ABORTION, SENTIENCE AND MORAL STANDING:

A Neurophilosophical Appraisal

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DECLARATION

I, the undersigned, hereby declare that the work contained in this dissertation is my own original work and that I have not previously in its entirety or in part submitted it at any university for a degree.

Signature:

Date: ...01 October, 2002.....

ABSTRACT

Moral theories on abortion are often regarded as mutually exclusive. On the one hand, pro-life advocates maintain that abortion is always morally wrong, for life is sacred from its very beginning. On the other hand, the extreme liberal view advocated by the absolute pro-choicers claims that the unborn is not a person and has no moral standing. On this view there is no conflict of rights; women have the right to dispose of their body as they wish. Therefore, killing a non-person is always permissible. In between the two extreme views, some moral philosophers argue that a 'pre-sentient' embryo or fetus cannot be harmed because it lacks the ability to feel pain or pleasure, for it is 'sentience' that endows a living entity (human and non-human) with moral considerability. Therefore, abortion of a pre-sentient embryo or fetus is permissible.

Neurophilosophy rests a philosophical conclusion on neurological premises. In other words, to be tenable sentientism – the claim that sentience endows an entity with moral standing - needs robust neurobiological evidence. The question is, then: What is the basic neuroanatomical and neurophysiological apparatus required to be sentient? The answer to that question requires a fair understanding of the evolution, anatomy and function of the brain. The exploration thereof shows quite convincingly that the advocates of sentientism do not provide convincing arguments to root their theory in neurobiological facts. Their claims rest rather on emotions and on behaviours that look like a reaction to pain. The other shortcoming of sentientism is that it fails to distinguish pain from suffering, and that as a utilitarian moral theory it considers only the alleged pain of the aborted sentient fetus and disregards the pregnant woman's pain and suffering. And, finally, sentientism leaves out of our moral consideration living and non-living entities that deserve moral respect.

The main thrust of the dissertation is that the argument of sentience as its advocates present it has no neurophilosophical grounds. Therefore, the argument from sentience is not a convincing argument in favour or against abortion.

OPSOMMING

Morele teorieë wat handel oor aborsie word dikwels as wedersyds uitsluitend beskou. "Pro-life" kampvegters hou oor die algemeen vol dat aborsie onder alle omstandighede moreel veroordeelbaar is, omdat die lewe van meet af heilig is. Daarteenoor hou die ekstreem-liberale oogpunt, wat deur "Pro-choice" voorstaanders ingeneem word, vol dat die ongeborene nie 'n persson is nie, en as sulks geen morele status het nie. Volgens hierdie standpunt is daar geen konflik van regte hier ter sprake nie; vroue het uitsluitelike beskikkingsreg oor hulle eie liggame. Dus is dit toelaatbaar om onder hierdie omstandighede 'n "nie-persoon" om die lewe te bring. Tussen hierdie twee ekstreme standpunte argumenteer party morele filosowe dat die voor-bewuste embrio of fetus nie skade berokken kan word nie, omdat dit nie oor die vermoë beskik om pyn of plesier te voel nie. Dit is juis bewussyn en die vermoë om waar te neem wat morele status aan 'n entiteit (hetsy menslik of nie-menslik) verleen. Dus is dit toelaatbaar om 'n voorbewustw embrio of fetus te aborteer.

Neurofilosofie basseer filosofiese gevolgtrekkinge op neurolgiese beginsels. Met andere woorde, so 'n standpunt sal eis dat 'n argument oor bewustheid op betroubare neurologiese feite gebasseer word, om sodoende met sekerheid morele status, al dan nie, aan de fetus of embrio toe te ken. Die vraag is dan: Wat is die basiese neuro-anatomiese en neurofiologiese apparatuur waaroor 'n entiteit moet beskik om as bewus beskou te word? Die antwoord op hierdie vraag vereis dan ook 'n redelik grondige kennis van die evolusie, anatomie en funksie van die brein. Wanneer die vraagstuk van naderby beskou word, word dit duidelik dat voorstaanders van die bewustheids-argument oor die algemeen nie hulle standpunte op oortuigende, neurologiese feite berus nie. Hulle beweringe rus dan eerder op emosie en op waargenome optredes wat *voorkom* asof dit 'n reaksie op pyn is. Nog 'n tekortkoming van die bewustheids-argument is dat dit nie 'n onderskeid tref tussen die konsep van pyn en die van leiding nie, en dat dit as 'n utilitaristiese morele teorie slegs die beweerde pyn van die ge-aborteerde fetus in ag neem en nie die leiding van die swanger vrouw nie. Ten slotte neem die bewustheids-argument ook nie morele status van lewende en nie-lewende entiete, wat geregtig is op morele respek, in ag nie.

Die hoof uitgangspunt van hierdie dissertasie is dan dat die bewustheids-argument, soos wat dit tans deur voorstanders daarvan voorgehou word, *nie* neurofilosfies begrond kan word nie. Dus is die argument vanuit 'n bewustheids-standpunt nie 'n oortuigende argument hetsy vir of teen aborsie nie.

Dedication

To Donna

All our sorrow is real, but the atoms of which we are made are indifferent

George Santayana

The word 'pain' has its etymological home in 'poena' or 'punishment'

Elaine Scarry

Contents

1 Introduction

> *Whatever pain achieves, it achieves in part through its unsharability, and it ensures its unsharability through its resistance to language... The human attempt to reverse the de-objectifying work of pain by forcing pain itself into avenues of objectification is a project laden with practical and ethical consequences.*
>
> *Elaine Scarry (1985: 4, 6)*

The ethical dilemma of abortion hinges on two main issues: the moral standing of the unborn, and women's right to self-determination. Therefore, most moral theories on abortion usually take a stance only on either of the two. Pro-life advocates have a general tendency to dwell on the moral standing of the unborn. Said moral standing is claimed to result from the possession of personhood (actual or potential), or from the claim that a God-given soul inhabits the unborn from the time of conception. In either case, this moral standing ascribes an inalienable right to life. Pro-choice activists are more prone to insist on women's rights. The debate, then, is more about conflicting rights, personal character, embodiment, and situatedness. On these views, the moral standing of the unborn takes a backseat.

These are extreme positions on abortion. In reality, however, very few people do actually go along with a die-hard, rigid, dogmatic pro-choice or pro-life stance. The former would sound repulsive and at odds with common-sense morality, and the latter would appear too intolerant (*e.g.*, in the case of rape). The spectrum between the two antipodean positions comprises a series of "softer" views that make allowance for exceptions. One of these intermediate stances is the claim that *sentience* – the capacity to *feel* pain and pleasure – is *the* criterion of moral standing. A sentient entity has moral standing; a non-sentient or a pre-sentient (that has not yet acquired the capacity to feel) being has no moral considerability. In the context of moral standing of a sentient being, the main emphasis is placed on the sentient being's interest/right not to be inflicted pain. Opinions diverge whether it stops there, or whether sentience also ascribes a right to life.

The abortion issue is very sensitive and often extremely emotional. The legalisation of abortion has, in many countries, been received with mixed feelings. Matters of life and death capture the public's attention and stir up its emotions, often in opposite directions. The current debates on physician-assisted suicide are another testimony illustrating the potential conflict of opinions and emotions. We cannot escape from having emotions, but this should not preclude a careful analysis of the arguments pro or con an ethical dilemma. This is the scope of this essay. The thesis I wish to defend is that the argument from sentience, *as its advocates present it*, is not a convincing criterion for the ascription of moral standing. The arguments underpinning my position are the following: 1) the concept of sentience used by utilitarians in the sense of the ability to *sense* or to perceive a stimulus that produces *pain* or pleasure does not do justice to the concept of the ability to *suffer*, which needs no physical injury but the faculty of introspection, of self-consciousness; 2) mere sentience is possible with a *coarse* neural equipment (*e.g.*, nonhuman sentient animals, and perhaps human embryos or early fetuses), whereas suffering requires a much more elaborate nervous system (e.g. the paradigm person, and perhaps apes and cetaceans); and 3) first and foremost, premises 1) and 2) must rest on neuroscientifically convincing evidence. Neurophilosophy rests its philosophical case on substantiated neuroscientific evidence, and not on emotions.

Chapter 2 presents the historical background in which the abortion issue has evolved to what it is today. Most striking is the fact that a serious debate on abortion did start only with the beginning of the nineteenth-century. From the times of Western Antiquity until the eighteenth-century abortion was not seen as morally reprehensible or legally indictable; it was a private matter. It seems that various circumstances and events occurring during the nineteenth-century brought abortion to the attention of the Law, the medical profession, and the Church. Abortion came under control of these respective bodies, at the expense of women's former privacy and rights.

The Civil Rights movements in the United States and pro-choice feminism were instrumental in changing attitudes towards abortion in the second half of the twentieth-century. It was in that context that Judith Jarvis Thomson, Mary Anne Warren, Baruch Brody, L. Wayne Sumner, Michael Tooley, and later, Bonnie Steinbock - to mention only the most influential writers on abortion – wrote their papers (which became *classics* in the field). At the same time, Aldo Leopold and Peter

Singer brought environmental issues and animal rights to the fore. A link arose between animal rights and the argument from sentience against inflicting pain to sentient entities. Post-threshold fetuses – that is, sentient fetuses – should not be inflicted the pain that results from abortion. Conversely, it is claimed that pre-sentient embryos/fetuses and insensate living entities do not possess moral standing; nothing matters to them.

As could be expected, the revitalised awareness of matters of life and death, in its broadest sense, triggered off a multitude of often diverging ethical theories. For some nostalgic of the past, this appeared like a Tower of Babel of incomprehensible moral languages underscored by a loss of moral fibre. For others, it was a re-enchantment. The main point of this overview is to illustrate the complexity of ethics, and more specifically of the abortion debate. It will, hopefully, show that there is more to it than the feud between pro-lifers and pro-choicers.

Chapter 3 investigates the claims made by three moral philosophers (Brody, Sumner, and Steinbock) that neuroscientific evidence indicates that the embryo/fetus exhibits some brain function that endows it with moral standing and the right to life. This is in contrast with Tooley's claim that the unborn (and even the infant) does not possess any sufficient brain function that could ascribe a right to life; hence, even infanticide is permissible.

Brody's thesis is that the embryo's brain functions since brain waves can be recorded with an electroencephalograph (EEG). Since a functioning brain is what makes a human being *human* (with an inalienable right to life), it follows that an embryo with a functioning brain has a right to life. I will argue that the problem with Brody's argument is that the claimed brain function is unsubstantiated.

Sumner's argument states that sentience is *the* criterion of moral standing. All sentient beings (human and nonhuman) have a right to life. Pre-sentient beings – that is, the embryo/fetus in the first half of pregnancy (it is unsure how far down the animal kingdom sentience is possessed) – have no moral standing and no right to life. How do we know whether an entity is sentient or pre-sentient? It depends, says Sumner, on the structure of its brain. I will argue that, like with Brody's argument, Sumner's neuroscientific argument is scientifically weak.

Tooley acknowledges that a sentient being, human or non-human, has a right not to be inflicted pain. Sentience, however, does not, in his opinion, ascribe the right to life. To possess the right to life, or any right for that matter, one must be able to

desire the content of that right. This requires the possession of a concept of time, past and future – a concept of self as a continuing subject of experience. The unborn and the infant, he argues, lack this concept. It follows that they have no right to life. How do we know that unborn and infants lack this concept? Because neuroscientific data indicate that their brain has not acquired the needed connections. Although Tooley's neuroscientific argument, as it stands, is a bit thin, more recent neurobiological evidence shows that there is something valid in Tooley's claim.

Steinbock borrows from Brody the argument from brain waves, and from Sumner the argument from sentience. She tries to build an argument about what she calls "brain birth". The birth of the brain is, in her opinion, something that can be demonstrated scientifically (as opposed to sentience that is not a "marker event" since there is in the middle of pregnancy a gray-area, a transition period from pre-sentience to sentience). The fact is, however, that what we really do know so far about the antenatal structure and function of the brain does not indicate that there would be any marker event in the true sense - a sudden eruption of a fully structured and fully functioning brain. Although Steinbock does not really acknowledge these facts, she *assumes* that the brain is born when the fetus reaches the stage of viability.

What is common to these four moral philosophers on abortion is their ascription of moral standing to the possession of a neurobiological property: sentience. To posses the ability to feel one needs a certain neural equipment that perceives sensorily and triggers on a reaction. The onus is on them to prove their neurophilosophical argument. Or, conversely, the onus is on me to show the weaknesses of their arguments by showing that their alleged neuroscientific evidence is neurobiologically ill-informed.

Since they refer to alleged brain waves detectable on the EEG, we have to gain some insight and understanding of what brain imaging (that includes EEG) is about. What we currently know about human fetal brain imaging is rather limited. Concerning more specifically the fetal EEG, it is established that at thirty weeks non-REM (rapid eye movement) sleep patterns can be recorded, and that at thirty-six weeks a REM sleep pattern is present. This proves that the fetus has the ability to sleep (!). However, it does not indicate that the fetal brain is just hibernating; evidence suggests that fetal sleep does contribute to the preparation of the basic neural circuitry of the brain. The connections within the circuitry will have to await birth to be

switched-on and to increase gradually. This is very different from Brody's claim about brain waves.

Chapter 4 goes in more neurobiological details. First, some information is given about the brain of lower and higher vertebrates. This is followed by a survey of the main steps in the intrauterine development of the human brain. Then follows an overview of the main role players, structural and functional, of the mature human brain. Although this chapter is rather technical, it fits into the whole context of showing the complexity of embryogenesis and of brain function (against the background of an oversimplified concept of sentience).

Having made some preliminary inroads into the neurosciences to refute the arguments presented by the moral philosophers, we need to become better acquainted with brain structure and function, and how this has been shaped by evolution. This is the topic of Chapter 5. The nineteenth-century witnessed the birth of theories of evolution, of genetics and heredity, of clinical neurology and neuroanatomy. An attempt to integrate all these important acquisitions gave rise to the neurosciences.

Chapter 5 takes us through the evolution of the brain, a short overview of the two main theories of the mind (functionalism and connectionism), basic neuroanatomy and neurophysiology, and the concept of brain maps. The aim of what might appear too technical is to provide a glimpse on the complexity of the brain. Neurophilosophy is about making a philosophical argument based on neuroscientific premises. If the neuroscientific premises are shaky and unsubstantiated, the philosophical conclusion does not follow. Chapter 3 has shown that no robust evidence does substantiate the claimed moral considerability attributed to the presence of an allegedly functioning brain. The argument from sentience suffers from the same shortcomings.

Chapter 6 explores the moral philosophical argument from sentience. Sumner sees sentience as a matter of degree: a primitive sentience and a developed sentience (although he attributes the same moral considerability to both). The former would seem to be equivalent to Edelman's concept of "primary consciousness" (or awareness), and the latter equivalent to his concept of "higher-order consciousness" (or self-awareness). The distinction between the two rests on neurobiological facts, and the evidence presented by Sumner is unconvincing. The problem is that Sumner seems to fail to see that primitive sentience (the mere ability to feel) is something very different from developed sentience – that is, the ability of introspecting one's mental

states (to possess qualia). It might not really matter as a purely philosophical argument to ascribe a right to life to all sentient beings; in practice, however, it leads to the challenge of the commandment thou shalt not kill, ever. The best alternative, in my view, to the untenable principle of sanctity of life seems to be the principle of respect for life, as Albert Schweitzer proposed it. There are unavoidable and inescapable limits to the principle of sanctity of life; it may happen that death will be the best option.

Peter Singer's sentientism – the ascription of moral standing to sentience – unlike Sumner, does not link sentience and the right to life. It ascribes only the right not to be inflicted pain. As a utilitarian, he claims that it is a sentient being's interest to experience pleasure and to avoid pain. To be sentient, he claims, is roughly equivalent to being "self-conscious". Now, one may argue (with Edelman) that consciousness (primary consciousness) is not the same as self-consciousness or self-awareness (higher-order consciousness, with a concept of time, past and present, the ability to introspect, etc.), and that the structure and function of the brain that allows the former does not allow the latter. Although Singer does not dwell on neuroscientific facts, he does make questionable arguments from analogy between the brains of birds, cetaceans, apes, and humans.

Steinbock claims that what matters to sentient beings is how you treat them. She does acknowledge that the ability to feel pain is something different from highly developed cognitive states (higher-order consciousness/self-awareness) such as emotions. There is, however, an inconsistency in her thesis. Remember her view about brain birth (not so different from sentience but happening a little later, roughly when the fetus becomes viable, i.e. able to survive outside the uterus). Later on, she states that late fetuses (i.e., having reached the stage of viability) are perhaps able to have pleasurable sensory experiences. It makes one wonder what finally is Steinbock's criterion of moral standing: sentience or brain birth? If it is sentience, when is it acquired? Is it in the middle or at the end of intrauterine life (not to mention the question of what is the meaning of perhaps)?

Chapter 7 looks at the roots of utilitarianism in order to understand the current arguments on sentientism. The quest for pleasure and the avoidance of pain are two inherent facets of life. The concepts of pain and pleasure have been interpreted in very different ways by Epicureans, stoicists, classical and latter-day utilitarians. Two

aspects of utilitarianism are striking. First, it seems that, in order to refute the objections to the theory, a large number of variations on the theme of utility/happiness/good/pleasure is needed to keep the principle afloat – act, rule, preference, restricted utilitarianism, and others. Second and more relevant to the topic of this essay, one might argue that utilitarianism is short of a sliding-scale for pain/suffering whereas it has one for pleasures (lower and higher).

The soft pro-choice moral theory on abortion states that the unborn moves from a pre-threshold (that is, prior to the acquisition of sentience) state (roughly from conception to around 18 weeks of gestational age), followed by a gray area of incertitude about the presence of sentience, to a post-threshold phase (starting around 22 to 24 weeks, that is, the stage of viability) where sentience is said to be acquired. On this view, it follows that abortion of the pre-threshold/insensate embryo/fetus is morally neutral and permissible. It equally follows that "abortion" (a misnomer after viability) of the post-threshold/sentient fetus is morally wrong. The theory qua theory (not to mention the lack of scientific base) raises two objections. One question is, How about the gray area? Another question is about the fact that a post-threshold fetus is viable (at least in proper medical and technological circumstances); this is no longer qualifiable as an abortion in the strict sense of the termination of pregnancy before viability. Therefore, the argument from sentience does not apply to the post-threshold fetus – this is no longer an abortion – but only to the pre-threshold or insensate embryo/fetus that can be aborted since it is not sentient.

It can be argued that the so-called "Third Way" is only a variation of the argument from potentiality advocated by some pro-lifers. One of the soft pro-life moral theories claims that during the pre-embryonic stage there is no defined individual because twinning is possible. If there is no individuality there is no personhood and thus no moral standing. Therefore, the abortion of the pre-embryo is morally neutral and permissible. From the embryonic stage on, there is an individual, a person – real or potential - with the right to life. The argument I present is that the two soft stances are not basically different. Both consider two stages of intrauterine life: 1) pre-sentience or pre-individuality; and 2) post-sentience or individuality/personhood. During phase 1 abortion is permissible, whereas during phase 2, abortion is impermissible. During the gray area of dubious sentience the

unborn is potentially sentient; after the pre-embryonic stage, the embryo/fetus is a potential person.

My central thesis is that the argument from sentience fails to be convincing, not only for the above mentioned reasons, but also because, like most moral theories on abortion, it leads to an either/or dead-end. Moreover, it excludes from our moral consideration a vast world of living and non-living entities that deserve respect. Is the final word really Jeremy Bentham's "What matters is not whether they can reason or talk, but whether they can suffer"? Or, should it be: What matters is respect.

Chapter 8, Post-structural Neurophilosphy, places the concept of sentience in the context of Complexity. The main argument is that sentientism is a functionalist approach to sentience. In other words, sentience is reduced to an input/output type of response. It (mis-)interprets a behavioural pattern as an indicator of an internal state or emotion. And behavioural evidence is by its very nature ambiguous. Sentientism, in other words, is rather "folk biology", to use Simon Baron-Cohen (1999: 22) words – our everyday way of understanding a system in terms of its physical makeup. The inroads made into the complexity of brain structure and function show that the ability to feel and the ability to suffer require a complex neural network, and that therefore the argument from sentience is biologically naïve.

2 Approaching the complexity of the abortion debate

Wishful thinking, without admitting it,
overpowered knowledge.

Albert Schweitzer (1987: 274)

Introduction

It seems to be part of human nature to avoid complexity instinctively in order to seek simplicity, and to give preference to wishful thinking that suits our intellectual comfort rather than to hard evidence that may disturb our coziness. We feel more comfortable with clear-cut positions and concepts than with less defined and fluctuant ideas. This is what contrasts modern from postmodern thinking. Albert Einstein's version of Ockham's Razor was:" Make things as simple as possible, but not simpler". In other words, we cannot avoid complexity without loosing much of the substance of our concepts, world-views, and moral theories (Bear & Cooper 1998: 132). It was one of the main aims of the Enlightenment to look for final answers and to come up with clear-cut moral imperatives that, hopefully, would solve ethical quandaries. It became clear, however, that strict deontological morality could not solve a great deal of genuine ethical conflicts. Consequentialism, on the other hand, proved to have to grapple with other types of genuine moral problems without solving them by means, for example, of the principle of the greatest utility for the greatest number. W. D. Ross (1930) tried to solve the dilemma with the concept of *prima facie* obligations. Principlism, as exemplified by Beauchamp and Childress' (1994) paradigm theory of biomedical ethics, a blend of deontology and consequentialism also fails in many respects. Alasdair MacIntyre (1984: 2) suggested a return to virtue ethics, claiming: "We have – very largely, if not entirely – lost our comprehension, both theoretical and practical, of morality". This sounds very similar to what Schweitzer wrote already in 1923:

> Our age is striking out unmeaningly in every direction like a fallen horse
> in the traces. It is trying with external measures and new organisation to
> solve the difficult problems with which it has to deal, but all in vain.
> The horse cannot get on its feet again till it is harnessed and allowed
> to get its head up. Our world will not get upon its feet again till it lets the truth

> come home to it that salvation is not to be found in active measures but in *new ways of thinking* (emphasis added) (1987: 271).

At variance with MacIntyre's pessimism and invitation to return to the past, Schweitzer seems to have believed in the future of morality provided new ways of thinking would be explored. New ways of thinking, which Thomas Kuhn (1996) has coined *paradigm shifts*, have proliferated over the last decades as much in the sciences as in philosophy, and in the philosophy of sciences. Wherever they may lead to – either ultimate pessimism and even nihilism, or naïve optimism or idealism – what paradigm shifts, however, have in common is that they challenge our ways of thinking. Socrates' dictum "the unexamined life is not worth living" remains a vital necessity. Another positive aspect of new ways of thinking is the clear tendency we are witnessing to build bridges between philosophy and the humanities. Philosophy is no longer isolated, or, at least, should not. Philosophy, now, welcomes the contributions of sociology, anthropology, psychology, and of the neurosciences, to mention only a few, to the world of "love of wisdom". This is particularly true concerning the topic of this essay.

Over the three last decades, the issue of abortion has attracted the interest of moral philosophers of all lines of thinking; sociologists, anthropologists, biologists, physicians, and political activists alike have challenged their mutual views. New technological developments made in reproductive technology and in genetic engineering have raised unprecedented moral problems related to issues such as cloning, stem-cell research, surrogacy, supernumerary embryos, fetal selection and fetal reduction, fetal tissue and organ transplants, etc. This is at the same time overwhelming, exciting, and frightening: from time immemorial and for the foreseeable future, Prometheus' and Frankenstein's specter has and will loom at the horizon. Our world-views are challenged. Shall we ever find a balance between the principle of the *Sanctity of Life* and the principle of *Reverence for Life*?

More specifically, in the South African context (although this is neither unique nor specific to South Africa), endeavours to implement and to be consequent with the Bill of Rights have led to the *Choice on Termination of Pregnancy Act No. 92* (1996). In a multicultural society, this Act forces us to think things through. A simple-minded attitude would be to take side with the extremists on either end of the spectrum: absolute "pro-life" (*viz.*, advocacy of the principle of the Sanctity of Life), or absolute

"pro-choice". In such a perspective, the absolute pro-lifer would simply ignore women's constitutional rights, and have no qualms with the death of about 600 women per year as a result of illegal abortions.[1] On the other hand, the Act imposes penalties on whoever obstructs the law, putting in jeopardy the right to conscientious objection and leading to conflicts of autonomy. Whose autonomy has precedence: the unborn, the pregnant woman, the health care provider?

It may come as a surprise to many people not so familiar with the intricacies and complexity of the abortion issue that roughly before the middle of the nineteenth century it was rather a non-issue. To understand the paradigm shift it is paramount to put the abortion debate in its historical context. Furthermore, the abortion debate cannot or should not be seen just as the clash between pro-lifers and pro-choicers. Therefore, I wish to outline briefly in the next section how from a common and private matter abortion became a complex and public hotly debated topic. An overview of the main ethical positions on abortion will follow.

Brief overview of abortion in Western history

A rarely quoted text in the Old Testament, namely Psalm 137, writes: "Happy shall be who takes and dashes your little ones against the rock". From various sources, it is well known that abortion and infanticide were practiced in the Ancient Mediterranean World. For example, the Spartans would dip the newborns in the icy waters of the Styx to test their strength, for only the strongest did stand a chance in life. Plato, in the *Republic* (Book 5, 460), had no objections against the killing of not only of handicapped newborns, but also of those who are the product of inferior parents or of individuals past the ideal childbearing age (quoted in Jones *et al.* 1969: 21). In the *Politics* (Book 7, chapter 16), Aristotle holds that deformed infants should not be allowed to live (quoted in Tooley 1983: 103). In *Peri psuchês*, later translated in Latin under the title *De anima*, Aristotle's theory of the distinction between living and non-living organisms was that the former did possess an animating principle – something that gives the ability to *move* – which he called *psuchê*, a principle of life (Laird 1970: 8). In the *Theory of Human Generation and Reproduction*, Aristotle claimed that the male human fetus becomes animated (*viz.*, starts moving) on day-40 after conception, and that it takes the female fetus 80 days to start moving (Ford 1991: 39). In line with this view, before the fetus starts moving, it is not alive; therefore,

abortion before 40 or 80 days is permissible. In the *Eudaimian Ethics* (1216 a 6-8), Aristotle wrote: "Just as we do not think a fetus, who lives a purely vegetative existence, without awareness, lives a full human life, so we are not going to be willing to praise and congratulate the life of this hopeless inactive adult". Matters of life and death at the two extremes of human life were already a matter of concern and debate; vegetative life at the two extremes of life was not worth the same attention as the life of adult rational persons.

The Stoics rejected Plato's theory of Forms. They had their own views on the *psuchê*, also called *pneuma*, as the principle of specifically animal life that allows *poioun*, action. The stoic soul is a corporeal entity; it penetrates the physical body, and leaves it after death (Long 1996: 233). Their concepts on human reproduction and embryology were written down by Hierocles in *Elementa ethica* (circa 200 C.E.), and by the Greek physician, anatomist and philosopher Galen of Pergamon (129- *circa* 199 C.E.) in *De foeto formatione*. On their view, throughout most of gestation the conceptus was just a growing thing, not really different from a growing plant. Progressively, the pure *phusis* (growth) becomes inhabited by the *pneuma*, the fiery breath, the intelligent fire. On their view, it was only at the moment of birth that, through an instantly hardening by contact with the cold air outside, the *pneuma* became *psuchê*. The stoic *psuchê* was together the rational component necessary for thought, language, and decision-making, as well as the instrument for sensation and movement. The *psuchê* was what allows us to lead an intelligent life within the boundaries of the body (Long 1996: 226). Like Aristotle, the Stoics saw the fetus as an almost purely vegetative entity.

It is quite clear that the concept of *psuchê* in the classical Hellenic world had nothing in common with the later Christian concept of *soul*, which is the cornerstone of the Roman Catholic pro-life position. The misinterpretation of the Greek concept of *psuchê* is attributable to what is commonly called the problem of the *tradutore traditore* (the so-called treason committed by translators): *psuchê* was translated *anima*, and *anima* was (mis-) translated *soul* (Rothman 1997: 104)! The roots of this interpretation are found in Augustine's adoption of Plotinus' theory of emanation that said that the Creation issues from God's thought, something like a composite of rationality and something celestial. On Plotinus' view, contrary to Plato's concept of the body as the dungeon of the soul, body and soul were supposed to live in harmony (Solomon & Higgins 1996: 12). For Augustine, God created the human soul in His

image. Our soul shares with the divine mind; our body is only a repository for the soul (123).

Aquinas shared Aristotle's view on the spark of life, the principle of motion that makes a living being alive (Ford 1991: 39). A fetus starts moving 40 days after conception – that is, when it starts to exhibit human features (Tivnan 1995: 34). This became the official position of the Church at the Council of Vienna in 1312 (Rachels 1993: 59); it remained as such until 1869 when Pope Pius IX repealed it. Early abortion was thus not morally forbidden until the second half of the nineteenth century neither by the Church nor by the common law (Rachels 1989: 115).

The thirteenth century's debates opposed the Augustinian-cum-Neoplatonist Franciscan friars to the Thomist-cum-Aristotelian Dominicans. Applied ethics was not a major concern in their debates; abortion was definitely not a matter of enquiry. In Medieval times, philosophy had not yet acquired its own status as a discipline independent from theology, but neither did sciences (then called natural philosophy). It was not until the Reformation initiated by Augustinian friar, Martin Luther (1483-1546), that theology was set on a course independent from philosophy; the final separation is attributed to René Descartes (1569-1650) (Jones *et al* 1969). With Descartes, philosophy and sciences also became "unnaturally separated" (Jonas 1996: 59). William of Ockham's (c.1280-1349) writings are representative of a transition from medieval thinking to a growing interest in *Man* (as essentially an individual) and in nature that would reach its acme with the Renaissance. Natural philosophy had also to be set on a course independent from theology. The Renaissance undertook this task.

Renaissance anatomist Andreas Vesalius (1514-1564) bravely debunked Galen's medical teaching that had prevailed for as long as ten centuries discovering that the sons of Adam have no missing rib (Gordon 1993: 9). This was evidence that Eve must have come from elsewhere! Not only for this unholy finding but also for having located the soul in the brain, Vesalius got under attack by the theologians of the Catholic University of Louvain where he was teaching anatomy. Indeed, the hard facts of early scientific discoveries and thinking were clearly not welcomed by the ecclesiastic establishment of the time.

It was not until the first half of the seventeenth-century that Aristotle's theory, formerly supported by Aquinas and confirmed by the Council of Vienna, became discredited by Flemish physician Thomas Feyens, alias Fienus. As a professor on the faculty of medicine at the Catholic University of Louvain, he published, in 1620, a

treatise entitled *De formatione foetus, in quo ostenditur animam rationalem infundi tertia die.* Fienus' thesis was that human semen needs only three days to "coagulate the menstrual blood" so that it can receive a rational soul that will take care of the further organisation of the embryo and fetus (Ford 1991: 47; Shannon & Wolter 1993: 41). The credit of the claim, made in Rome in 1621, that ensoulment does occur at the time of conception is to be attributed to the Italian physician Paolo Zacchias. In 1644, Pope Innocent X rewarded him for this brilliant achievement bestowing on him the title of General Proto-Physician of the Whole Roman Ecclesiastic State (Ford 1991: 48). However, this did not affect the well-established and traditional view on abortion before quickening. Abortion remained still rather a sin against marriage since, following Augustine's teaching sexual intercourse was only permissible in married couples and with the sole intention of procreating (Pence 1995: 147; Shannon & Wolter 1993: 47-48). This remains the current official teaching of the Roman Catholic Church.

During the seventeenth-century, European Common Law did not consider that abortion was an indictable offence. It was only in 1803 that an English statute made abortion of a quickened fetus a criminal offence. From the seventeenth through the nineteenth centuries, American law followed the English Common Law (Pence 1995: 148). Neither the English nor the American Common Law, prior to the nineteenth century, did recognise the existence of a fetus before quickening. And because quickening was *the* criterion to determine the presence of a fetus, pregnancy was a condition that only the pregnant woman could sense and make public, if so she wished (Duden 1993: 82). In the early nineteenth century, in the United States, abortion before quickening was legal and only a misdemeanor after quickening. Abortifacients were freely advertised, privately procured, and self-administered (Luker 1984). Eve's herbs such as pennyroyal and silphium have been known and used from times immemorial as "emmenagogues" – "to bring down the courses", to free the "suppressed menses" (Bilger 1998: 38). In 1847, however, things started to change with the creation of the American Medical Association (AMA).

The AMA is said to have been created to oppose the rising success of homeopathy, and to retain the power, control, and authority of the traditional Western medicine. This included control over abortion. There is some controversy surrounding the real motivation of the antiabortion lobbying by the AMA that started in 1857. For some, the intention was to protect women from health hazards by medicalising

abortion. Rachels (1989: 115), however, is of the opinion that the real motives were the prevailing Victorian mentality about illicit sex (that is, extramarital), and a feeling among the medical profession that there was something morally wrong about killing fetuses. On the other hand, Feinberg and Levenbook (1993: 195) attribute the AMA's position to a desire to control and contain abortion practices. Duden (1993: 82) adopts a similar view, namely that the medical profession wished to promote itself as the experts in charge of the procedure and decision about abortion.

Whatever the deep motives inspiring the AMA, it is quite clear that the medical profession initiated the opposition to abortion, and that the theologians only followed suit (Tivnan 1995: 12). In 1869, Pope Pius IX declared the excommunication for the sin of abortion, and, in 1870, at the First Vatican Council, he declared the Sovereign Pontiff's *ex cathedra* pronouncements infallible. From 1895, abortion became permissible only in the context of self-defence, as ruled by the doctrine of double effect (Rachels 1989: 122) – that is, in case of ectopic pregnancy, and of cancer of the uterine cervix in pregnancy.

It was not until 1967 that abortion became decriminalised in Britain (Oakley 1997: 364-396). In fact, it took Britain 29 years after the *Bourne case* to reach this decision. On June 14th 1938, well-respected British gynaecologist Aleck William Bourne (1886-1974) aborted a fourteen-year old girl at St Mary's Hospital in Paddington. She was six-weeks pregnant after having been gang-raped. On July 18, Bourne was indicted at the Old Bailey for "using an instrument to procure a miscarriage", but was later acquitted by the jury (Gordon 1993: 151). The United States followed the British move on abortion in 1973 with the famous or infamous *Roe v Wade.*

At stake in the *Roe v Wade* 410US113 was a State of Texas statute making it a crime to "procure an abortion" or even to attempt it, unless it was to save a pregnant woman's life. Norma McCorvey, alias Jane Roe, was a single pregnant woman living in Dallas. She wanted a safe and legal abortion to be performed by a physician. To obtain it she challenged the constitutionality of the Texas law. Henry Wade was Dallas County's district attorney. Justice Harry Blackmun and the US Supreme Court ruled that the "right of privacy" was guaranteed by the 14th Amendment's concept of personal liberty, and that the right of personal liberty and of privacy was "broad enough to encompass a woman's decision whether or not to terminate her pregnancy" (Annas 1988: 144). The decision held that laws prohibiting abortion violate women's

constitutionally protected right to privacy. The Court also held the view that a fetus is not a person in the legal sense, and so has no constitutionally protected right of its own (Rachels 1989: 115). The Court, however, recognised that the State has a right to limit abortion in the interest of either the woman's health or the fetus' life.

In 1973, an abortion procured after the first trimester was considered medically dangerous for a woman's life.[3] On the other hand, during that era, the viability of the fetus was set at twenty-eight weeks, the onset of the third trimester of pregnancy. Therefore, in line with the medical practice and technology of the time, the Court decided that a first trimester abortion is a woman's decision and right; that a second trimester abortion should be regulated by the Court; and that a third-trimester termination of pregnancy would be permissible only if the woman's health or life is at stake (Annas 1988: 145).

The salient points in the *Roe v Wade* Supreme Court decision were: (1) a first trimester abortion is a woman's *right*; (2) the unborn has no constitutionally recognised rights; and (3) the "viable" fetus has a "potential life" (potentiality being here interpreted as the ability to survive outside of the uterus). These points are important indicators of a paradigm shift. There is no mention of the intrinsic value of the unborn in any moral sense. There is strong emphasis on women's rights with no right of any sort attributed to the unborn (hence, no conflict between the woman and the fetus). The State and the medical profession through the Court, however, retain the right of decision-making after the first trimester. This has been seen "as much a reaffirmation of the rights of physicians to practice as they see fit as it has been an affirmation of women's right to control their reproduction" (Rothman 1997:108). Finally, the mention of "potential life" has given rise to the argument from potentiality in moral philosophy on abortion, although the argument as it stands in bioethics has little if anything in common with what it meant for the Court.

Still in the historical context of abortion, and with due respect for the advocates of the argument from potentiality, one cannot but think that the argument is inspired by Marcello Malpighi, a professor of anatomy at Bologna. In his treatise, *De formatione pulli in ovo* (1673), he published his theory of ontogenesis ,ontogeny[4] or preformationism– that is, that the whole future organism is already present in a miniature state either in the egg (ovism), or in the sperm cell (spermism or animalculism). Malpighi was not sure which of either was right: ovism or spermism. It was only later that Dutchman Anthonie van Leeuwenhoek (1632-1723), the

designer of the first microscope, found the answer to Malpighi's query: under the microscope he managed to see *homunculi* in human sperm cells (Ford 1991: 48)! Ontogenesis, however, was proven wrong by embryologist Caspar Frederich Wolff (1733-1794). Ontogenesis was replaced by the theory of epigenesis – that is, specific events have to occur before the next can appear (a position still held in embryology as will be shown). None the less, the spectrum of the *homunculus* is still roaming (Rachels 1995: 70). Another, perhaps more respectable, view on the origin of the argument from potentiality is suggested by Kristin Luker (1984: 11). She believes that the argument can be found among the Pythagoreans for whom the embryo was the equivalent of the child it will become.

Roe v Wade, however, was not the end of the story of the abortion debate in the US. In 1989, Chief Justice William Rehnquist (the 'loser' in *R v W*) made a significant retreat from the abortion rights that had followed from *R v W*. In *Webster v Reproductive Health Services*, he made it clear that the State has an interest in protecting life, not just after viability, but throughout pregnancy because, he claimed, life begins with conception (Tivnan 1995: 16). This fueled the debate about the beginning of life and the sanctity of life even outside of the courts. In 1992, *Planned Parenthood v Casey* reaffirmed the essential holding of *R v W* (Pence 1995: 172).

In 1987, RU-486 (mifepristone), an anti-progestagen prescribed for various endocrinological conditions as well as for use as an early abortifaciant, was approved in France (169). The American Food and Drug Administration (FDA) did not approve its circulation saying: "It would decentralise the role of the medical profession in abortion and remove them from public scrutiny" (Feinberg & Levenbook 1993: 196). In other words, it would take us back to the era before 1857 when abortion was a private matter practiced by women themselves; and that would be problematic (mifepristone was finally approved by the FDA in the year 2000). It is not evident from what follows, however, that the legalisation of abortifaciant drugs would really remove abortion from public scrutiny.

A prostaglandin analog, misoprostol, was marketed in the eighties to treat peptic ulcer. A number of pregnant women taking the drug for the prescribed indication happened to abort. In the late eighties, misoprostol started to be used to induce labour in case of intra-uterine fetal death. It is now widely used to induce labour with a normal alive and term fetus, as well as to terminate a pregnancy at any stage. It is a prescription drug, and, hence under medical control. In South Africa, the

use of misoprostol for the purpose of termination of pregnancy (TOP) is restricted to facilities designated, authorised, and registered for TOP by the National Department of Health. Every effort seems to be made to keep abortion under public scrutiny and under control of the health professionals and of the public authority.

The media have also been instrumental in this regard. As Rothman (1997: 111) put it, the fetus has become the subject of a "cultural creation" that fascinates the general public. On her view, this started with *The Silent Cry* and with *Miracle in the Womb*, picturing the "pain" endured by aborted fetuses. Rothman also claims that the mediatisation of the fetus gave birth to the so-called "fetal medicine".[5] And this, says Susan Sherwin (1999: 492, 496) has resulted in viewing pregnant women as "generic female wombs, anti-mothers", and the fetus as a "third-party".

This overview shows that the history of abortion as a moral and a legal issue is relatively recent. It also shows that the problematisation of abortion was initially a matter of power; the Church authorities considered the moral aspect only eventually. This is not to deny the moral dimensions of abortion. On the contrary, the debates, be they legal, political, theological, or philosophical, have all shed a different and new light on what was for centuries a non-issue. Abortion is undoubtedly a moral issue.

The ideal solution to the problem of abortion would be to create the necessary conditions to avoid unwanted pregnancies. At first glance, this should be possible if all sexually active people would use a safe contraceptive method when a pregnancy is not desirable. However, this would not be enough. With the increasing incidence of involuntary sterility, worldwide but much more in the developed world, recourse to reproductive technologies is also on the increase.[6] Unless technology comes up with new methods, the problem of supernumerary embryos and of selective fetal reduction will remain.[7] In some developing countries, where culturally and traditionally male offspring is mandatory or at least highly desirable and praised, the abortion of female fetuses will remain widely practiced.

Unlike MacIntyre's pessimism, it seems that Schweitzer's view on new ways of thinking has prevailed. The abortion issue forces us to think things through: the beginning and the end of life, the value and meaning of life, personhood and lack thereof, rights and their conflicts. Each of the facets of the problem has been the subject matter of moral theories and speculation. This is not to say that a final answer has been given. No *final* answer will ever solve ethical conflicts. What could be seen as a tower of Babel of moral relativism should perhaps rather be seen in the

perspective suggested by Iris Murdoch: What is important is to raise moral questions because it creates moral awareness. Ethical consciousness and ethical practice are two distinct things (Taylor 1995: 126). The answers to the moral dilemmas and conflicts are many, as we shall see in the following section.

Prevailing moral theories on abortion

In broad and general terms, one could arguably subdivide the moral theories on abortion according to the principle of right/wrong, permissible/impermissible, and pro-life/pro-choice. Indeed, these strong views do exist and have their advocates. The dogmatic and fundamental pro-life activists admit of no exception to the principle of *Sanctity of Life* (PSL). On the other hand, the liberal pro-choice advocates claim that not only abortion but also infanticide is permissible. Whereas it is practically impossible to follow strictly the PSL, it is counterintuitive and repulsive to be an absolute pro-choicer. Therefore, there must be room for softening at both ends of these antipodean extreme positions: soft pro-life and soft pro-choice stances both admit exceptions to their general principle. In what follows, I will present the basic arguments of the hard and soft views at each end of the spectrum, as well as the views of those who are discontent with the polar positions, hard or soft.

Strong pro-life morality

The PSL is at the heart of the conflict between staunch pro-lifers and liberal pro-choicers. The reason of the conflict, says Ronald Dworkin (1997: 131), is that for the pro-lifers abortion violates the PSL – this is what he calls the *detached objection* to abortion. Life is sacrosanct. End of the discussion. There are two different arguments supporting the PSL: the argument from association and the argument from history. An example of the PSL by association would be that of the sacred cows in India; they are valued because they are associated with certain divinities. The argument from history would derive either from the Divine Command theory or from the Natural Law theory.

The hard pro-life conservative position has its roots either in the Divine Command theory or in the Natural Law theory. The basic claim of the Divine Command theorists is that a soul is infused at the time of conception; therefore,

human life is sacrosanct from the time of conception. No exception should ever be tolerated. This is the expression of God's will. The position of the Natural Law theorists is a secular variation on the PSL: *Thou shalt not kill.* What nature has endowed with life is to be respected and allowed to follow its course. Natural Law stands above and apart from the activities of human lawmakers; it constitutes an objective set of principles that can be discovered by the use of reason (Blackburn 1996: 256).

One of the main difficulties with the Divine Command position is the fact that a theological premise (the infusion of a soul) is supposed to lead to a general moral conclusion (an ensouled entity is sacrosanct). The validity of an argument depends on whether the premise(s) is/are true. Since, as Curzer (1999: 435) writes, "we have nothing like a soul detector", without a leap of faith the premise cannot be substantiated. Although there should be room, understanding, and tolerance for theologically inspired worldviews, the Divine Command theory is convincing only for those who believe in the existence of the God given soul. Nevertheless, even among those who believe in the soul new perspectives are currently defended.

The current official position and teaching of the Roman Catholic Church still sticks strictly to the Divine Command theory. Progressive theologians like Joseph Donceel (1970), however, support the view of the so-called delayed *animation* (as opposed to the doctrine of *immediate animation*). Donceel's argument rests on the relatively new concept of the pre-embryo (or pro-embryo).[8] Advances in embryology have shown that during the first fourteen days of development a pre-embryo can split and produce identical twins; conversely (although very rarely) twin embryos can fuse (producing a chimera). In other words, before day fourteen the identity or the individuality of the pre-embryo is not definitely established; after the fourteenth day there is an individual. Donceel's point is that a soul cannot be infused before the individuality of the embryo is firmly established. In line with the embryological facts, he concludes that early abortion – that is, of a pre-embryo – is not immoral. The spin-offs of this view are that there should be nothing morally wrong with intra-uterine contraceptive devices (IUD) or with the so-called "morning-after pill".[9]

Natural Law theorists are mainly concerned with the sanctity of *human* life. Some of their arguments are, for instance, that a fertilised human egg is human because it has a complete and specifically human genetic equipment, or that since the time of conception the fertilised egg is alive (Noonan 1989). No one would really

argue seriously against the claim that a human embryo (or zygote for that matter) is both human and alive, and that it has a human genome. These are plain biological facts. Conversely one could, however, argue (for argument sake) whether chromosomal abnormalities (missing or additional chromosomes) deprives an entity from *humanity* in the same way as we deny apes humanity (their genetic equipment is extremely close to that of humans).[10] What really matters is, first, whether to be a zygote/pre-embryo/embryo is enough to possess moral standing, and, second, whether one should ascribe moral standing only to the species *Homo sapiens.* Animal rights activists have a serious moral objection against speciesism. The moral considerability of a zygote remains a matter of ongoing debate (van Niekerk & van Zyl 1996). The last word has not yet been said in reproductive technology, and the related moral issues surrounding it are cropping up every day. A clear example of the complexity of the ethics of reproduction and of the ascription of a clear-cut moral weight to a pre-embryo is that moral philosophers with a more or less strong pro-life inclination choose the middle-of-the-road argument from potentiality to ascribe moral standing to the "unborn". It is not in virtue of what the zygote/pre-embryo/embryo proper/fetus *is now* (because at the early stages it is just a cell or a cluster of cells that, if circumstances permit, will one day become a person) that it deserves moral consideration, but rather in virtue of what it has the potential to become. For instance, one could argue whether a frozen human embryo has a potential unless it is implanted in a woman's uterus; if not implanted a frozen embryo will ultimately be discarded, unless its stem cells are utilised (the only alternative potentiality).

The principle of *Reverence for Life* (PRL) has been mainly advocated by Albert Schweitzer. He states the following:

> However seriously man undertakes to abstain from killing and damaging, he cannot entirely avoid it. He is under the law of necessity, which compels him to kill and to damage both with and without his knowledge. In many ways it may happen that by slavish adherence to the commandment not to kill, compassion is less served than by breaking it. When the suffering of a living creature cannot be alleviated, it is more ethical to end its life by killing it mercifully than it is to stand aloof...The principle of not killing and not-harming must not aim at being independent, but must be the servant of, and subordinated itself to, compassion. It must therefore enter into practical discussion with reality. True reverence for morality is shown by readiness

> to face the difficulties contained in it (quoted in Marshall 1966: 88).

Schweitzer's PRL, also called his "biotic egalitarianism" (Jonas 1996: 17) (as much as his personal character) has been often misunderstood and misinterpreted. In the movie *Lambarene*, he is shown putting a toad back into the shade and keeping some sugar on his desk to feed the ants. On the other hand, Schweitzer was not a vegetarian. What he advocated was respect for all kind of life, animal and vegetal. At variance with the PSL, he acknowledged that death is part of nature and of life, and that we cannot do away with it. This is not, as claimed by Bonnie Steinbock (1992:12), that Schweitzer's concept of RFL is no more than "a well-intentioned confusion of distinct moral principles" and not different from the PSL. Mary Anne Warren (1991: 307) is of the opinion (which I share) that it does not follow from Schweitzer's ethic of RFL that abortion is morally wrong. Many abortions, she says, "may be defended as killing 'under the compulsion of necessity' ". Contrary to Steinbock's interpretation that "if the ethics of RFL implies that it is seriously wrong to destroy any living thing, it is implausible", the above quote clearly shows that the ethics of RFL is something very different from the ethics of PSL. Although it is not clear whether Schweitzer would have accepted the permissibility of mercy killing (*e.g.*, physician-assisted suicide) of human beings and of abortion, the logic of his argument would imply it. Schweitzer died in 1965, before the emergence of postmodern ethics. The last sentence of the quote – "True reverence for morality is shown by readiness to face the difficulties contained in it" – has a very postmodern flavour and reflects the position of many pro-choicers.[11]

Strong pro-choice morality

The strongest liberal pro-choice stance is undoubtedly epitomised by Michael Tooley's (1972) extreme position. Briefly, it states that abortion and infanticide are morally permissible. This position may sound *prima facie* repulsive to most of us but would have met mainstream thinking and practice in the era before the middle of the nineteenth-century. The main argument Tooley is making to underpin his thesis is the lack of personhood not only of the unborn but also of the infant during the first months after birth. If rationality is what characterises a person, he says, and if to be a person is what ascribes moral standing and the right to life, then abortion and

infanticide are morally permissible. What is morally impermissible, he claims, is to inflict pain even to an animal (but this does not mean that an animal has a right to life).

Mary Anne Warren (1973) holds a similar view on the lack of personhood of the unborn and the permissibility of abortion. Her emphasis, however, is on women's right to decide on what is happening in and to their body. She does not see any conflict between the unborn's right to life (since it does not possess a right to life) and the decision to abort (a mere right to decide to remove something like a nuisance from the body).[12] One should recall that the strong pro-choice and pro-life stances were voiced in the early seventies, mainly in the United States and in the context of the *Roe v Wade* controversy, that followed the Civil Rights crusade of the sixties. These were the times when major emphasis was placed on *rights* (and rights rhetoric).

Judith Jarvis Thomson (1971) is less adamant than Warren concerning an unequivocal right to abort. Her famous *Gedankenexperiment* of the violinist who is hooked to a woman's body during her sleep in order to survive is analogous, says Thomson, to the situation of the unborn who needs a pregnant woman's body to survive. The moral question is: Does a woman have the right to unhook the life-support system, or, conversely what is her moral obligation to provide and maintain life-support? The analogy with the violinist, however, would work only if the pregnancy resulted from rape or incest (a pregnancy forced upon a woman). In any other case, she says – that is, voluntary but unprotected sex – to maintain the life-support is a charitable thing to do like "a minimally decent Good Samaritan" would. To abort for reasons of personal convenience, says Thomson, would be callous. The problem with Thomson's argument is that it is unconvincing. First, there is no much more to her argument than to say that abortion is permissible in case of rape and incest. Simple common sense morality (and even conservative pro-lifers) would have no qualms with it. Second, it is not clear to me whether Thomson is arguing as a virtue ethicist or in the context of conflicting rights. Callousness and Good Samaritanism point at the morality of the agent rather than of the act. Keeping or unhooking life-support points at a conflict of rights. To make things even more confused, Thomson introduces in her argument the problem of the unborn as an aggressor and the right to self-defence. It would be extremely difficult to argue convincingly that the embryo/fetus could be an "innocent aggressor" (but an aggressor none the less).

Soft pro-life morality

Two mainstream doctrines are referred to in soft pro-life morality: the Doctrine of Double Effect (DDE), and the Doctrine of Self-Defence (DSD). It is mainly the Roman Catholic Church that holds the DDE. It states that when an intended action has two foreseeable effects, a good one and a bad one, the action should not be wrong in itself, the foreseeable wrong should not be intended, and the good should not be itself the result of the bad consequence. Traditionally, there are four situations related to pregnancy where a specific medical intervention on either the pregnant woman or on the embryo/fetus will have a "good" and a "bad" effect: 1) ectopic pregnancy; 2) cancer of the cervix in pregnancy; 3) a woman's medical condition worsened by pregnancy that threatens her health or her life; and 4) an obstetrical condition where a woman's life can be saved only by a fetal destructive procedure.[13]

According to the Roman Catholic interpretation of the DDE, only in conditions 1) and 2) is a medical intervention that results in the end of pregnancy morally permissible. In other words, the excision of a Fallopian tube containing a pregnancy (*viz.*, an ectopic pregnancy) and the excision of a pregnant uterus with a cervical cancer is permissible. The threat to the health or even to the life of a pregnant woman is no excuse for abortion. A lot could be said against the DDE as understood in this way. First, it is based on simplistic, biologically ill-informed and erroneous interpretation of medical conditions. Second, common sense morality in medical practice is clearly offended by the DDE.

Very similar to the DDE, though not inspired by religious motives, is the DSD and the morality of abortion. The basic tenet of the DSD is that one has the right to kill an unjust aggressor. The difficulty with the doctrine, when used to justify abortion as attempted by Thomson (with rape and incest), is the concept of the unjust aggressor. Is the embryo/fetus not innocent by definition? If this is agreed upon, the DSD collapses. Whatever the case may be (deliberate but unprotected sex, failure of a contraceptive method), the pregnancy could or should have been prevented (unless it resulted from rape). It would be hard to prove convincingly that any embryo/fetus could ever be an aggressor in the usual sense of the word.[14] In fact, what can be a threat to a woman's health or life in the real sense is the *pregnant condition.* In the

case of an ectopic pregnancy, it is the placenta that erodes the tube and causes the internal bleeding (the embryo as such is no threat). With cervical cancer neither the placenta nor the fetus are a threat. With obstructed labour, it is the fetus' inability to make its way through the pelvis that threatens the woman's life (if the fetus was in a different *position* or if it were lighter, there would be no problem). And, finally, when a medical condition is worsened by pregnancy it is the whole of the pathophysiologic changes accompanying pregnancy that affect the woman's health (again it is the placenta and the placental hormones that cause the problem and not the fetus). This takes us back to a similar sophistry as with the DDE. In medical practice, then, when these situations do arise, neither the DDE nor the DSD are really of any use to handle the conflict but rather the paradigm theory of medical ethics based on the principles of autonomy, beneficence, non-maleficence, and justice.

Soft pro-choice morality

The soft pro-choice morality states that there is room for abortion in certain conditions. What soft pro-choicers basically claim is that early abortion is permissible, but that it is morally wrong to terminate an advanced pregnancy. What is the criterion of moral considerability that tips the balance? Two schools of thought are representing the soft pro-choice position. One follows the recommendations of the Warnock commission[15] and the concept of the pre-embryo (or pro-embryo) alluded to with Joseph Donceel's position on delayed animation. On this view, the abortion of a pre-embryo is morally neutral. It follows from this argument that contraceptive' methods such as the intra-uterine contraceptive device (IUD), the so-called morning after pill, and mifepristone[9] are also morally neutral. The same argument would allow the disposal of supernumerary embryos produced with in vitro fertilization (IVF), as well as so-called embryo experimentation.[16] But these are spin-offs that Donceel might not have expected and might well disagree with. The other main soft pro-choice position's thesis is that the acquisition of *sentience* is the criterion of moral considerability. The main advocate of sentience as the criterion of moral standing is L.Wayne Sumner, who claims that a pre-sentient embryo/fetus has no right to life and can thus be aborted. The concept of sentience is also used by Peter Singer as a criterion of moral standing of nonhuman animals. The validity of the argument of

sentience is the topic of this essay and will be elaborated upon in the following chapters. Let us now turn to other views on the morality of abortion.

Other views on the morality of abortion

The antipodean pro-life and pro-choice positions, be it in their hard or soft versions, do not represent the whole spectrum of the current moral views on abortion. This is mainly because they focus too specifically and too exclusively on autonomy and rights. Furthermore, they are criticised for being gender-neutral and for emphasising the presence or absence of a single criterion, actual or potential: 1) the right to life deriving from either ensoulment, humanity (genetic), rationality (personhood), sentience, viability (need for life-support or not), or potentiality (for instance, Marquis' concept of "future-like-ours") (1997: 26); or, conversely, 2) women's right to self-determination. In these perspectives of maternal-fetal conflict, however, all other aspects of a pregnant woman's identity are erased (Roth 2000: 6).

Virtue ethics, ethics of care, feminist ethics, microethics, and postmodern ethics have all added their voice to the philosophical conversation. What they have mostly and mainly in common is that they set the problem of abortion in context rather than to argue in favour of an overarching principle in favour or against abortion. Pro-life and pro-choice are, in Roth's (16) words, "dead-end arguments", and in Curzer's (1999: 435) vocabulary, "line-drawing or gender-neutral approaches". Understandingly, women appear to be more "vocal" about contextualising abortion. After all, women are the ones who have a live-experience of the burdens of pregnancy as well as of most if not all the rewards of a planned and welcomed pregnancy. Therefore, it is only fair to listen to what they have to say.

As stated by virtue ethicist Rosalind Hursthouse (1997: 153): "current philosophical literature [on abortion and moral theory] has got badly out of touch with reality". What Hursthouse is saying is that it is one thing to argue about the ontology of the unborn (*e.g.*, personhood), which is a metaphysical debate, but that the life-experience of a person with the right mind-set who ponders the decision to abort, which is a personal ethical dilemma, is altogether another thing. Aretaic ethics focus on the character of the agent rather than on the consequences of his or her acts. If a woman decides, after thorough consideration of her act and with the right motives, to

terminate a pregnancy, abortion should be morally permissible. This is not to say that abortion is not a serious matter or that it is always callous.

Feminist ethics *per se* has no specific position on abortion. There is probably as many pro-choice as there are pro-life feminists. However, it can be said safely that many a pro-choice feminist is a women's right advocate and as such is likely to join the camp of the pro-choicers and their emphasis on the right to decide about their body. What is more specific to feminist ethicists is the attempt to articulate the feminine voice in moral reasoning through insistence on interconnectedness. In this perspective, abortion becomes more of a decision about severing or not a relationship (Wolf-Devine 1997: 160). This is not to say that abortion is permissible. For Celia Wolf-Devine (1999: 442), abortion is wrong because it severs a relationship irremediably. Susan Sherwin's (1999: 442) position is less clear. On the one hand, she claims that to have a right to life one must fit into a network of relationships. She denies that the fetus does possess the "network criterion". On the other hand, she contends that the effects of an unwanted pregnancy on the lives of women should be seen individually and collectively (*viz.*, women do possess the network criterion). In other words, what is important is that women fit into a network (but to which fetuses do not participate). It would thus follow that there is no moral dilemma involved in abortion. Surprisingly, however, Sherwin then writes: "the moral status of fetuses is determined by the nature of their primary relationship and the value that is created here" (497). Therefore, it should follow that the fetus does possess the network criterion and that abortion is morally wrong because it severs the relationship.

The thesis of the ethics of care, promoted by Carol Gilligan (1982), holds that people must balance conflicting responsibilities that arise from different relationships. The care approach rests on five central values: moral attention, sympathetic understanding, relationship awareness, accommodation, and response (Steinbock 1998: 142). Ethics of care accommodates abortion as a self-caring act, because care for oneself is a *prima facie* duty (Curzer 1999: 442).

Catriona Mackenzie (1997: 175-186) gives a phenomenological account of pregnant embodiment insisting on the fact that "in pregnancy, questions about the fate of the fetus cannot be separated out from the issue of a woman's right to self-determination". This is, she says, because of the psychic and somatic connectedness that is so peculiar to pregnancy; conscious experience is structured by our bodily situations. The problem of abortion is not, she claims, a question of women's rights

overriding fetal rights. Like Steven Ross (1982), she opts in favour of the view that abortion is rather "choosing that there be no being at all in relation to whom she is in a situation of such responsibility". This is a decision-responsibility – the decision that one is not prepared to bring such a child into existence. One may agree that the physical and psychological experience of pregnancy is something singular that an outsider can hardly understand (something similar to a *quale*). Nevertheless, to argue that a *quale* justifies abortion is rather controversial. Where Mackenzie makes a point is when she complains that men's responsibility is almost never touched upon (178).

Among feminists are also women like Sally Markowitz (1997: 198), who justify abortion on demand "because the society is sexist". Allison Jaggar's feminism aims at combating male biased normative dualism and its excessive focus on rationality. According to her Personal Control Principle, women should control abortion decisions (Wolf-Devine 1997: 160). This is no different from Mary Anne Warren's position on the right to dispose of the body. Against the thesis held by a number of advocates of women's right to bodily autonomy (and its conflicts with the unborn's right to life), Christine Overall (1987) argues that abortion could, with the advancing state of technology, become two separate events: 1) the evacuation of the fetus (morally permissible); and 2) the destruction of the fetus (morally impermissible). This is a way of reconstructing the conflict of rights into a situation where rights are absent. The traditional view is that of a conflict between the pregnant woman who has no right to kill, and the embryo/fetus that has no right to occupancy of the uterus. Overall's solution is to extract the fetus alive and to place it in the uterus of a surrogate, or, when technology will permit, in an incubator. This contentious view makes morality contingent on technology (Mackenzie 1997: 190-191).

The rights rhetoric still heavily permeates the abortion debate. It seems unlikely that a satisfactory solution will ever be reached by keeping the conflict of rights going. It seems equally doubtful that one of the contemporary mainstream bioethical theories, promoted *inter alia* by Beauchamp and Childress (1994), will be in a better position in this regard.[17] If respect for autonomy is a basic tenet or is *the* basic tenet of principlism (and there is no reason to disagree with the importance of autonomy), it does not solve anything in the abortion debate. If the embryo/fetus is autonomous and has an inalienable right to life, the pregnant woman equally possesses inalienable autonomy and the right to life. Since abortion has been medicalised, it can also conflict with the health care provider's autonomy (*viz.*,

conscientious objection). Since men are responsible for impregnating women, they should be part of the decision-making process and share the responsibility. This adds up to four autonomies to be reconciled, or, at least, to be taken into consideration. This is a conundrum that principlism cannot solve (and is hardly addressed by Beauchamp and Childress).

The paradigm theory of biomedical ethics, says Winkler (1993: 352-353), conflicts with contextualism, for it has "oversimplified an inadequate conception of moral reasoning as the application of principles to concrete issues of practice". In addition and specifically concerning the abortion debate where the concept of moral status is central, Winkler claims that the paradigm theory "is useless" for it "is silent on the question of moral standing". Following the same line of thinking, Barry Hoffmaster (1993: 372) lists four reasons why the paradigm theory cannot succeed on its own terms (internal criticism), neither account for the phenomena of morality (external criticism): 1) autonomy is a contested concept; 2) the paradigm theory provides no weighting when principles conflict; 3) it does not consider the issue of moral standing; and 4) it is blind to actual moral principles and new moral situations.

Because of the dissatisfaction and the frustrations resulting from principlism microethics or contextualism is gaining momentum. The focus is on rootedness: What, in the specific circumstances, should guide the ethical decision? Contextualism possesses a "greater sensitivity and realism" about the general conception of the process of moral reasoning, but without denying the normative force of moral principles (Winkler 1993: 362). For Hoffmaster (1993: 376), "moral decision-making is more a matter of coming up with creative, responsive solutions than it is trying to apply a philosophical formula". Concerning abortion, he writes (373): "Even the abortion controversy – perhaps the most intractable of moral disputes – can be illuminated by locating it culturally and historically".

Concluding remarks

It has been the two main purposes of this approach to the complexity of the abortion debate, first, to situate the topic in its historical context, and, second, to illustrate the various perspectives in which the moral issue can be viewed. It is not because abortion was not of any great moral concern until relatively recently that it should not be seen as a serious moral problem. So did it happen with slavery, sexism,

and racism. Even if racism, sexism, and (to a lesser extent) slavery still do prevail widely what has changed is that from a non-issue they have become a matter of serious moral enquiry and concern. What distinguishes the abortion issue from these three morally reprehensible attitudes is that it is less certain that abortion is *always* morally wrong. Furthermore, it is not because there are many views on the morality of abortion that one should conclude with MacIntyre that we have lost our comprehension of morality. It rather shows that the complexity of the ethical debate is such that it needs, as suggested by Schweitzer (in a broader perspective), new ways of thinking. And new ways of thinking there are. This is not moral impoverishment, but rather heightened moral awareness.

Life and death, pleasure and pain, are issues that arouse our emotions. Gut feelings can easily blur our rationality. Some feel that life is sacrosanct; to be strictly and absolutely consistent with this principle, whether inspired by Divine or by Natural law, is a challenge that can hardly be met in real life. Suffering and death are an integral and inescapable component of life. The difficulty is to accept it, as J. Baird Callicott writes:

> Death and often pain are at the heart of nature's economy...[even those who] recognise this implication inconsistently turn aside from it...Sudden, untimely death and often pain are fundamental and intractable ecological facts (1993: 352,373).

Many pro-life anti-abortion activists have rallied, and still rally, behind the question: When does life begin? Alternatively, abortion advocates with a moderate pro-choice leaning rally behind the banner of sentience. The latter position on abortion (as well as on animal rights) could be translated into the question: When does pain begin? It is noteworthy that both positions base their respective argument on a biological fact – that is, being alive or feeling pain. In other words, one could say that both moral stances on abortion rest their case on the possession of a biological feature: life (vegetative or mental), or a neurological property (the ability to perceive noxious stimuli).

To the first question – When does life begin? – moral philosophers who support the principle of the sanctity of life have an easy answer: From the time of conception (*viz.*, the so-called genetic view). Although it appears irrefutable that life begins with conception, some argue that not only zygotes are alive, but also gametes

(*viz.*, the so-called metabolic view). On this view, life is a continuum with neither a beginning nor an end. Others argue against the PSL asking whether it is life *per se* that is sacrosanct, or rather the quality of life of a living entity. Furthermore, they would argue that if it is life *qua* life (rather than its quality) that is sacrosanct, then every single living being across the border merits to be preserved. The PSL, as it stands for the die-hard contenders, is thus untenable. In reality, it has to be watered down either to the principle of reverence for life (including all living entities), or to the infamous speciesist position on the sanctity of *human* life.

To the second question – When does pain begin? – there is no easy answer. Pain is one of the so-called *qualia*, as well as the opposite of pleasure. Utilitarians see pain as something negative, bad, wrong, to be avoided at all cost. Surely, the wanton infliction of pain is morally wrong. However, it is simplistic to see pain as a purely negative thing. From a biological point of view, pain is a warning, a defence mechanism. According to neurophysiologist and Nobel prize laureate Lord Sherrington's (1857-1952) "utility-of-pain" concept, the value of pain is to function as an alarm signal; pain has the utility of a self-protection mechanism and of inducing physical strengthening as a result of pain (Rey 1995: 284).If direct contact, say, with fire were not painful we would not withdraw and we would be burned. What do we really know about the ability of an embryo/fetus to feel pain (*viz.*, its sentience)? Paraphrasing Thomas Nagel's famous "What is it like to be a bat?" (*viz.*, the difficulty if not the impossibility to know and to understand what other people's qualia really feel like), one may ask the question: "What is it like to be an embryo or a fetus? "What is the evidence that a fetus (and a lower animal for that matter) is not a kind of "someone floating in a tank as an indeterminate blob", to paraphrase Robert Nozick (1994). Is the concept of sentience something more than folk psychology or folk biology?

The morality of abortion based on sentience not only assumes that from a certain stage, the fetus is sentient, but also that abortion inflicts pain to the fetus. This might well be a mere assumption, in need of scientific backup. Who of us recalls how painful it was to be squeezed through our mother's birth canal? If birth were so painful for the fetus (we surely know that it is for women), and if infliction of pain is always morally wrong, would there not be a moral obligation to deliver all fetuses by Caesarean section? But that would sound not only impossible but also outrageous. Similarly labour wards where pain relief is not administered systematically to all

parturients would be staffed by immoral midwifes and obstetricians. For utilitarians, pleasure has to be maximised and suffering has to be minimised; and, every one counts for one and the same in the hedonic calculus. One might wonder why, in the utilitarian morality of abortion, only the fetus' pain (whatever that could be) seems to count in the hedonic calculus.

If sentience is to be *the* criterion of moral standing of the unborn, one has to prove beyond reasonable doubt that the ability to feel pain and pleasure is present at some stage of intra-uterine life. This needs reliable neuroscientific evidence and not mere assumptions. Sentience needs a certain neural equipment. As we will see later, sentience requires more than a "primitive" brain. The nervous system relays messages either chemically (by neurotransmitters) or electrically (by action potentials).

In the next chapter, I will examine what four moral philosophers have claimed about a basic neurobiological feature, the so-called "firing" of neurons (*i.e.* the presence of an action potential) in the brain of the embryo and of the fetus that, in their view, endows the embryo/fetus with "humanity".

3 Four moral philosophers on alleged brain function of the unborn

> *The core of myself is my functioning brain. I am not just my brain. But the brain is the only part of me whose destruction I could not possibly survive. The brain, but not the rest of the animal, is essential to the self.*
>
> Thomas Nagel (1986: 40)

Introduction

Brain death, defined as the absence of detectable brain waves on the electroencephalogram (EEG), is a clear marker of the cessation of function of both the brain stem and the cerebral cortex (Boyd *et al* 1997: 27). Most, if not all, of us would agree that brain death marks the end of a person's terrestrial life. Whereas we are quite clear about *brain death*, matters are less clear about *brain birth*. Does the birth of the brain coincide with the birth of the body, that is, on average 280 days after conception? Alternatively, as some writers claim, one should ask the question: Does the birth of the brain antedate the birth of the body?

The question is not trivial. If, as suggested in Nagel's quote, the core of my self is my *functioning* brain, and if the brain birth happened to occur somewhere during intra-uterine life, it is important to know if and when the alleged brain birth might occur. If the functioning brain is the core of the self, of the person, and if the brain of the fetus[1] *is* functional in the sense alluded to by Nagel, it follows that the fetus is a person and that abortion is morally wrong. On the other hand, if the fetal brain is only fully structured but *not fully functional*, the embryo/fetus' moral standing deriving from brain function cannot be grounded.

The question then is to find out: What is meant by *functioning* brain, and what brain structure is not only sufficient but also necessary in order to *function*? The importance of answering these questions relates to the fact that some moral philosophers claim that the unborn[2], at some (variable) stage, exhibits signs of *brain activity*. On this view, the (often unspecified) nervous system activity is claimed to endow the unborn entity with an inalienable right to life. Not so, others argue. It does

not follow from the presence of an anatomically completely structured brain (provided that this were the case) that it is well functional - that is, capable of consciousness/awareness (even in the most basic sense).

At this preliminary stage, it is already clear that the *neurological criterion* of personhood (that a person is a human being with detectable brain waves) (Pence 1995: 159) is used to tip the balance against or in favour of abortion. The argument in favour of a neurological criterion of personhood possessed by the unborn runs as follows (or vice versa) (161):

(1) An embryo/fetus has brain waves after *n* weeks of gestation.
(2) A conscious adult (the paradigm person) has brain waves.
(3) Therefore, killing an embryo/fetus after *n* weeks of gestation is as wrong as killing a conscious adult.

In the following sections, I shall present the respective arguments put forward by Brody, Sumner, Tooley, and Steinbock. The choice of these moral philosophers' views on abortion relates to the fact that all of them refer to alleged neurobiological data to underpin their argument. Brody founds his antiabortion position on brain waves allegedly emitted by the embryo. Sumner bases his middle of the road pro-life stance on the criterion of sentience, which needs some degree of development of the brain. Tooley's extreme pro-abortion and pro-infanticide stance claims that the brain structures of the fetus and of the infant are unable to sustain any type of rationality and self-consciousness needed to possess moral standing. Finally, Steinbock argues in favour of what she calls "the interest view" – that is, that the possession of interests is both necessary and sufficient for the possession of a moral status (and nothing matters to a pre-sentient fetus because it is non-conscious). Since a good deal of their *neurophilosophical* argument (although none of them claims to practice neurophilosophy) refers to neurobiology, mainly brain waves allegedly detectable on the EEG, some neurophysiological evidence will be discussed to see whether the arguments are sound or not.

Baruch Brody's argument

In 1975, Brody wrote: "the fetus [sic] has a functioning brain about the end of the sixth week of development".[3] The evidence that the brain is functioning, he says, derives from the fact that brain waves are detectable with an EEG. Although no reference was provided in support of this statement, he concluded that, from this stage onwards, there is a human person with a right to life.

A note of caution is in order. First, one should be clear about the vocabulary and terminology to avoid confusions. In medical terms, the various stages of intra-uterine development are called respectively: pre-embryo[4], embryo proper, and fetus. The term pre-embryo refers to a conceptus[5] of 1 to 14 days of age from the time of conception; the term embryo proper refers to a conceptus aged 3 to 8 weeks after conception. Between 9 and 40 weeks after conception, one speaks of a fetus. Hence, there is no *fetus* yet in the true sense at the end of the sixth week of development, that is, six weeks since conception. Second, the sonographic diagnosis of pregnancy is only possible at 6 to 7 weeks of gestation with an abdominal probe, and about one week earlier with a vaginal probe. At 6 weeks, the gestational sac[6] measures between 1.0 and 1.5 cm, and the embryo measures about 4.0 mm (it can hardly be seen!). At this stage, the embryo's heartbeats are mostly not visible and body movements are seen only very uncommonly (Jeanty & Romero 1986: 39). In view of these facts, it is hardly conceivable that one could place a EEG electrode on the scalp of a 4-mm embryo since there is not even a scalp to speak of and that, as will be shown, the "brain" at this stage is not yet formed. It consists of "brain vesicles" (hollow sacs lined by undifferentiated nerve cells or neuroblasts).

In spite of the very implausibility of such a technical prowess (*i.e.*, to record the EEG of a human embryo), a number of writers do refer to these unsubstantiated brain waves allegedly detected at six (Feinberg & Levenbook 1993: 197), seven (Flower 1985: 237; Wennberg 1985: 27), eight (Olen & Barry 1996: 170), ten (Thomson 1971: 48), or thirteen weeks of gestation (Sumner 1997: 111). It is quite surprising that none of these writers (with the exception of Thomson's reference to Daniel Callahan, 1970) ever provides a reference to the medical or scientific literature to substantiate their claim. In addition, contemporary scientific evidence from human embryology shows that at six weeks the embryonic brain consists only of three dilatations of the cephalic end of the neural tube called respectively forebrain, mid-brain and hindbrain, or prosencephalon, mesencephalon, and rhombencephalon (from

the Greek ενκεφαλον, literally, what is inside of the head). These structures are vesicles with no brain matter as such, in the sense of grey and white matter (Sadler 2000: 426); these structures are not functioning, but only potentially functioning since (*i.e.*, at some stage, they will evolve into the different brain structures of an adult paradigm person). But no argument from potentiality could even apply when the argument is about (even if they are alleged) biological facts –that is, the presence of brain waves detectable by EEG. It would be inconsequent to use the argument from potentiality when the moral argument rests (or should rest) on biological *facts*.

Brody's (1997: 95) argument runs as follows:

(1) A functioning brain (or at least, a brain that, if not functioning, is susceptible of function) is a property that every human being must have because it is essential for being human.
(2) By the time an entity acquires that property, it has all the other properties for being human.
(3) Therefore, when the fetus acquires that property it becomes a human being.

Let us unravel Brody's argument. Premise (1) looks like an *ignoratio elenchi*, a circular argument: it is essential to have a functioning brain to be a human being; therefore, one cannot be a human being if one does not possess a functioning brain. This is question begging. Moreover, the condition put between brackets introduces the argument from potentiality, and jumps the fact-value gap (i.e. it commits the naturalistic fallacy). Furthermore, it is not clearly defined what is meant by "functioning brain". Does it refer to the neurovegetative functions located in the brain stem (regulating the basic vital functions such as breathing and cardio-vascular function), or does it refer to the higher cortical brain functions of higher-consciousness? Actually, Brody does not explain what could possibly be the significance of the alleged brain waves; he merely states that they are emitted. It can be surmised that the brain function Brody refers to must be the "brain waves" allegedly detected by EEG.

More details about the intra-uterine brain waves will follow. What can be said at this stage is that the only electrical activity existing in a seven-week's embryo arises

in the brain stem (Flower 1985). This means that the embryo is alive and that it exhibits neurovegetative functions (a rudimentary cardio-vascular and gastro-intestinal system is present and functional). But this has nothing to do with the *cortical* brain waves detectable on EEG.

Premise (2) is also problematic for it is not clear what "property" it refers to. Is it an established or a potential brain function? The way the premise is phrased suggests that Brody refers to a *potentially* functioning brain, or, at least, wishes to include it to make the argument work. Now, if the premises are not valid (they are mere assumptions we have no reason to take for granted) the conclusion does not follow. The conclusion does not follow in the sense Brody wishes - that is, as an argument against abortion. That the zygote[7], the pre-embryo, the embryo proper, and the fetus are human in the genetic sense of belonging to the species *Homo sapiens* is beyond any doubt. That the same entities are beings, in the sense of living entities, is a truism. It is altogether another thing to claim that they have a fully functional brain and that they are rational beings like a paradigm adult person. Finally, if the presence of brain waves (whatever this could mean) is the indicator of humanity, as Brody claims, one could take his argument at face value and conclude that before 6 weeks the embryo is not human since it does not yet emit "brain waves", and that, therefore, early abortion is morally neutral. But that would be against Brody's antiabortion position. Hence, Brody's argument is unsound.

L. Wayne Sumner's argument

What is central in the debate on abortion is the ascription of moral standing to the unborn entity (Steinbock 1992: 4), be it personhood (actual or potential), ensoulment, or sentience. Women's right to bodily integrity is a very different approach that does not take into consideration the moral standing of the embryo/fetus. As we have seen with Brody's argument the ascription of moral standing on the basis of an ill-defined and unsubstantiated brain activity is problematic and unconvincing, to say the least. Let us now investigate whether Sumner's argument from sentience fares better.

Sumner's (1997: 100) "Third Way" is a quest for a more satisfactory and plausible criterion of moral standing that would ascribe the right to life to any entity possessing

said moral standing.[8] In order to be satisfactory, he says, that criterion must meet the following conditions: (1) it must be general (not only applicable to human fetuses); (2) it must root moral standing in empirical properties of the entities to which it applies; and (3) it must be grounded in a moral theory to be morally relevant. Sumner's position thus differs from Brody with respect to the first and third condition. Brody's moral theory rests on the principle of sanctity of *human* life; Sumner rejects *speciesism*[9] and advocates utilitarianism (all sentient beings have a moral standing).

In addition to the three above mentioned conditions, says Sumner, the following is *assumed*: (1) to have a moral standing is to have some right to life (101); (2) the paradigm bearer of moral standing is an adult human being with normal capacities of intellect (*viz.*, rationality), emotion, perception, sensation, and the like (101); and (3) a criterion of moral standing must rest on something whose presence or absence can be shown objectively (this condition is applicable to life, *sentience*, and rationality)(102). Like Brody, Sumner wants to found his moral theory on a scientifically provable fact – that is, the presence of the ability to feel pain and pleasure. The challenge, now, is to prove scientifically the possession of sentience.

In order to meet the first criterion of moral standing (*viz.*, to be general - that is, to avoid the charge of speciesism), Sumner has to modify the second assumption that includes rationality. This reduction is required, first, to avoid the exclusion of non-rational beings – that is, in his terms, "the mongoloids, the psychotics, the autistic, the senile, and the profoundly retarded" (107). A second reason for the reduction is that otherwise some non-human animal species (apes, cetaceans) as well as fetuses and infants would not be included, for none of these beings possesses all of the "higher-order cognitive processes typically owned as a bundle by rational beings"(106). Finally, the third reason for the reduction relates to the necessity to dissociate moral rights from moral duties, for one has to be rational to be a bearer of rights and duties (sentience without rationality can only ascribe moral rights). For all these reasons Sumner suggests: "something less demanding [than rationality] (such as *sentience*) is better suited to the latter [*viz.*, the possession of moral rights]". A criterion of sentience (or consciousness), he argues, "is a promising middle path" (108).

Concerning Sumner's second satisfaction criterion (*viz.*, that moral standing must have an empirically objectifiable evidence), it is simply assumed (see the third

assumption) that sentience is a property that can be measured empirically with scientific tools. In order to make his point in this regard, Sumner presents a neuroanatomical and neurophysiological expose of what is roughly needed in terms of brain development to possess sentience (111-112) (the complex issue of sentience as such will receive more attention later). The only mentioned "quantifiable data" indicative of the presence of sentience presented by Sumner in a non-referenced footnote are the presence of two neurotransmitters, dopamine and endorphin, qualified by him as the "pleasure-inducing chemicals", that can be found in sentient beings. (More will be said later about neurotransmitters.) Strange enough, however, he then concludes: "The possession of particular neural structures cannot serve as a criterion of moral standing, for we cannot rule out encounters with sentient beings whose structures are quite different from ours" (a reference to possible extra-terrestrials). This contradicts an earlier statement that "the capacity for sentience is present only when the necessary physiological structures [sic[10]] are present". Thus, on the one hand, Sumner suggests that the capacity of sentience is a minimum but necessary requirement to possess moral standing and the attached right to life, and that the ability of sentience requires basic neurological equipment that might be species-specific. On the other hand, he wants to avoid the charge of speciesism while making the point that some sentient beings may have structures quite different from ours. One should be clear about those anatomical structures and distinguish sentience from what in non-human animals *resembles* the paradigm human reaction to pain. Furthermore, similar structures may have different functions. As already mentioned, the similarity in gene structure, embryology, and neuroanatomy between humans and chimpanzees is such that they are almost indistinguishable (Miklos 1998: 203). Nonetheless, the paradigm adult rational person seems to function differently from a chimpanzee (Baron-Cohen 1999: 127; Mitchell 1997: 35).

Finally, with regards to Sumner's third satisfaction criterion – that is, that the argument must be supported by a moral theory – it is quite clear that the use of sentience (*viz.*, the ability to feel pleasure and pain) as *the* criterion of moral standing is rooted in classical Benthamite hedonistic utilitarianism: "the greatest happiness for the greatest number", and what matters is can they feel. The problem is not whether one adopts utilitarianism or not. The question is rather: Is the argument sound? In other words, is sentience *as defined by utilitarians* – that is, the ability to suffer and to

enjoy - a convincing moral argument against abortion? For it is not enough to state that they do suffer and enjoy; the onus is on the utilitarians to prove beyond any reasonable doubt that these living entities have the necessary neural equipment to actually suffer and enjoy in a meaningful sense rather than behave as though they were able to feel.

In summary, the only convincing point made by Sumner is the linkage between sentience as a criterion of moral standing and utilitarian morality. As Eric Katz (1993: 856) and Raanan Gillon (1996: 43) argue: moral standing derived from sentience is a "highly counterintuitive" and "a pure outgrowth of classical Benthamite utilitarianism". One could also argue about the meaning of *feeling* as it is used by Sumner to define sentience. Is feeling merely the ability of sensory perception? Is what is observed as a reaction to pain more than a behavioural response to a noxious stimulus? As Konrad Lorenz (1979: 93, 187) pointed out, "behaviour is determined by the play of multiple interactions between the different automatic instincts (hunger, fear, sex)...every one of these behaviour patterns is the function of a corresponding special physical organisation of the nervous system, sense organs, etc.". How do we really know whether, say, a lower non-human animal really feels pain? Or are we talking about *qualia*? Sumner argues in favour of the extension of sentience to all nonhuman animals, possibly including the so-called lower animals, on mere assumptions; his alleged neuroscientific argument, however, is thin and unconvincing. We would all agree that a sensible human being is (or should be) normally and spontaneously prone to avoid pain as well as to refrain from inflicting pain. In that respect, we may agree with Sumner's intuitions. It needs, however, more scientific evidence, than the alleged "empirically provable basis" provided by Sumner, to conclude that a fetus has the ability to experience pain rather than that it just exhibits reflex arcs (automatisms).

Having analysed and refuted Brody's (a self-confessed moderate conservative pro-life advocate)[11] and Sumner's (a moderate utilitarian pro-choice advocate) arguments, let us now turn to Tooley's (a radical pro-choice advocate) position.

Michael Tooley's argument

According to Jonathan Glover (1990: 127), Tooley's discussion on abortion seems to be "the most unconventional and at the same time the most convincingly argued in the literature". Two things are unconventional in Tooley's book, *Abortion and Infanticide*: (1) the mere logic of the argument leads to the inescapable (but intuitively repulsive) conclusion that not only abortion (or the termination of pregnancy at any stage) but also infanticide are permissible and morally neutral; and (2) that it is morally wrong to torture a kitten whereas it is permissible to kill it.

Like Sumner and Singer, Tooley argues against the permissibility of inflicting pain to sentient beings (the example of the kitten). Like Sumner, Tooley (1997: 57) agrees that "a desire not to suffer pain can be ascribed to something without assuming that it has any concept of a continuing self" (for instance the kitten). Contrary to Sumner, however, Tooley (and Singer, as will be discussed) claims that it does not follow from the right not to be tortured that one has a right to life. His main thesis is that one needs a concept of "continuing self" to have a right to life (neither the kitten nor the fetus/infant do possess that concept). Glover, however, disagrees with Tooley by arguing that it is inadequate to set sharp boundaries in order to try to answer the question: "What sorts of killings are directly wrong?" This is, he says, "because there is some arbitrariness in stipulating that 'person' is a purely moral term, roughly equivalent to 'bearer of rights' ".

Tooley's argument is basically that to be a bearer of rights – in this case, the bearer of right has the right to life – one must have at least the capacity to desire what one has a right to. Moreover, to have this capacity, one must possess the idea of oneself as a continuing subject of experience. Because an infant (and a fetus, for that matter) does not possess an idea of self as a continuing subject of experience, it cannot have a desire to life. Therefore, neither a fetus nor an infant has a right to life. At a later stage, Tooley (1997: 40-58) modified his argument by changing the link between rights and desires to a link between rights and interests. In other words, to have a right to life one must have an interest in having one's life continued. That interest, however, should not be something momentary. In addition, to have a "non-momentary interest" one needs a concept of a "continuing mental substance".

Now, what are the conditions or what is necessary for having a non-momentary interest? Tooley (1983: 303) says: "What makes an individual a person... is the property of being an enduring subject of non-momentary interests". He

argues that at least three conditions must be met to qualify as an enduring subject of non-momentary interests: (1) one must have the ability of having desires, i.e. states that can be represented in consciousness (not merely behaviour); (2) one must possess the ability of having thoughts about time other than the present; and (3) one must possess and have exercised in relevant ways the concept of self as a continuing subject of mental states. Neither kittens nor fetuses/infants meet these conditions. Therefore, they have no right to life.

In the conclusion of the chapter entitled *The Scientific Evidence: Human Neuro-physiological Development* (372-407), Tooley concludes that newborns (and a fortiori fetuses) are no "human persons" because: (1) they show no evidence for a capacity for thought, self-consciousness or rational deliberation; (2) the networks located in the upper layers of the cerebral cortex, that are thought to underlie higher mental functions are not present at birth; and (3) the bioelectrical changes [necessary for (2)] take place after birth. The main neuroscientific arguments Tooley refers to in order to substantiate claims (2) and (3) are two articles (quoted in Tooley 1983). One, by Dreyfus-Brissac (1966), is about the fact that the electro-encephalic difference between wakefulness and sleep appears only at 36-37 weeks of gestation. The other, by Yakovlev and Lecours (1967), reports that at birth only 60 percent of "what is characteristically human in the brain" shows myelination. The two issues (sleep and wakefulness EEG, and myelination of the nervous system will be considered later).

It is quite clear to any one that a newborn shows no evidence of rational deliberation. No one would argue against this statement. The question, however, is then that if one denies personhood to any being devoid of rational deliberation, one may easily get rid of a sizable proportion of humankind (remember the examples given by Sumner). As far as the neuroscientific arguments are concerned, it might be unwise to reach dramatic conclusion based on a limited number of outdated data. Daily experience with what is called "evidence-based medicine" amply shows that a number of concepts and practices considered being self-evident and unshakable in the past have no valid scientific or clinical grounds. The question of electrical brain waves evidenced by EEG deserves further attention; and the question of myelinisation refers to the insulation coating of some nerve fibers that affects the speed of action potentials. The peripheral nervous system is composed of motor and sensory nerves. The sensory peripheral system comprises two sorts of nerves: myelinated and

unmyelinated. The unmyelinated or poorly myelinated sensory nerves convey impulses concerned with pain and cold. The myelinated nerves are larger, conduct their impulses faster (because myelin sheaths act as insulators). They originate in the skin as well as in the muscles and tendon receptors. Myelinisation of nerve fibers in the spinal cord begins in the fourth month of intrauterine life. Some of the motor fibers descending from higher brain centres to the spinal cord do not become myelinated until the first year of postnatal life. Tracts in the nervous system become myelinated at about the time they start to function (Sadler 2000: 421). In the present context, however, what is relevant is the fact that the unmyelinated or poorly myelinated nerve fibers are those conducting pain and temperature stimuli. In other words, there is no need for myelinisation in order to feel pain (Cole & Paillard 1998: 245; Lazorthes 1999: 298). Accordingly, the issue of myelinisation taken in isolation would indicate that a fetus might possibly be able to feel pain, but it does not as such prove or disprove this possibility. Concerning EEG sleep patterns, current evidence indicates that the first REM sleep is detectable at 30 weeks of gestational age (Lazorthes 1999:111). More details will be discussed on this issue later.

Finally, Tooley (163) states: "Once one introduces reference to specific [brain] functions, one is confronted with the very difficult question of which functions are the morally relevant ones". And: "Purely biological concepts cannot enter into right-making or wrong-making characteristics" (313). Unless I did misread Tooley, it appears that this is precisely what he has been arguing for: no (fully functional) brain, no mind. No mind, no personhood. No personhood (i.e. no property of being an enduring subject of non-momentary interest), no right to life.

What is common to Brody, Sumner, and Tooley is that they refer to brain structure and brain functions either to support or to reject a moral standing of the unborn (or even newborn). Brody is quite adamant that even at six weeks the embryo has a fully functional brain (brain waves are emitted!). Sumner takes an intermediate position: the fetal brain starts functioning (allowing for sentience) somewhere in the middle of intra-uterine life (a mere assumption though). Tooley denies any brain function to speak of until a couple of months after birth. Both Sumner and Tooley are, however, ambiguous about the weight that can be assigned to neuroscientific data to support an ethical argument. In other words, they appeal to neuroscientific data of the time to ground their argument while they reject the idea that biological facts could

support ethical and philosophical conclusions. This link was established by Patricia Churchland in her book *Neurophilosophy* (1986).

Bonnie Steinbock's argument

From the outset, Steinbock (1992: 48) accepts the premise that "brain waves are detectable at about 8 weeks". However, she rather advocates the argument from "brain birth", and, therefore, she argues: "the emergence of brain waves is only a necessary, not a sufficient, condition of conscious experience" (49), for

> Pain perception requires more than brain waves. It involves the development of neural pathways and particular cortical and subcortical centres, as well as neurochemical systems associated with pain transmission (189).

Now this sounds reasonable and prudent enough, and, broadly speaking, in line with the neurosciences. If brain death is manifested by the disappearance of brain waves detectable on the EEG, it is also a fact that an irreversible comatose person's brain does emit electrical waves (Carpenter 1996: 284). Hence, consciousness requires more than the presence of electrical activity in the central nervous system, and the presence of some electrical activity in the brain is no indicator of the ability to be conscious. Where the argument becomes confused is when Steinbock makes either bold or contradictory statements about the intra-uterine development and function of the brain. She writes:

> Painful sensations are transmitted on [sic] nerve fibers and interpreted in the cerebral cortex. Development of the fetal neocortex begins at 8 weeks of gestation, and by twenty weeks each cortex has a normal complement of 109 [sic] neurons (49).

Unless *on* should be seen as a typographic error, it makes no sense to claim that the transmission of any neural in- or out-put occurs *on* a neuron. Furthermore, while it is true that painful sensations are "interpreted" in the cerebral cortex, Steinbock seems to

ignore that between the peripheral nerve that transmits the sensation and the cortex (that interprets) there is a very complex thalamo-limbic system, which permits full integration of the nervous system (Grobstein 1988: 48) and plays an essential role in the projection of sensory stimuli to the prefrontal cortex (Changeux 1998: 159). Quoting Grobstein (1988: 48), Steinbock states that the development of the thalamus starts around the twentieth week. As it will be shown in Chapter 4, the primitive thalamus is already recognisable in an 8-weeks embryo (i.e. the primitive embryonic structure is present). What counts, however, is the establishment of the thalamo-cortical connections. In addition, it should be said that the neocortex is the fully developed mature part of the brain (the outer layer of gray matter) with its six layers of neurons (Kahle *et al.* 1996: 226), that appears only late in the fetal development of the brain (194). The cortex and the neocortex are not the same thing, neither are the global cortex and the prefrontal cortex. The prefrontal cortex is not a general "central executive" but a set of control systems, each with its separate targets (Kinsbourne 1998: 238). The prefrontal cortex, says Kinsbourne, "enables the individual to overcome primitive preprogrammed responding when that would be maladaptative". Furthermore, the left prefrontal cortex regulates planning and the right prefrontal cortex the interpersonal relations (239). There is more to the cortex than just *cortex*. Finally, the claim that not only a twenty-week fetus has a normal (i.e. full) complement of neurons and that this consists of 109 neurons is appalling. In fact, the neocortex contains 28 billion neurons and one to ten trillion synapses (Edelman 1998: 38; Mountcastle 1998: 5).

On the other hand, Steinbock writes (in contradiction with the above quote):

> The neural pathways are not sufficiently developed to transmit pain messages to the fetal cortex until 22 to 24 weeks of gestation (50)...Before 8 weeks of gestational age sentience is not possible; after 28 weeks, it is very likely... Brain birth is when neocortical brain activity begins. The neocortex first begins producing EEG waves between the twenty-second and twenty-fourth weeks of gestation (85).

If one would accept the unsubstantiated claim that by twenty weeks the brain has a full complement of neurons, one might then wonder why it is still not fully functioning (she claims that the first EEG waves are detected at 22 to 24 weeks, and sentience only after 28 weeks). In addition, the statement is in contradiction with the

earlier claim (48) that brain waves are detectable at about 8 weeks (which waves, and how are they detected?). Finally, Steinbock claims that "sentience appears roughly to coincide with brain birth" (87) - that is, a 4 to 6 weeks gap in between the two alleged events (in obstetrics this represents a huge gap that makes the difference between potential life and certain death, between possible viability and non-viability).

Her closing argument is the following:

> The brain-birth standard has the advantage of being objective (unlike sentience) and unaffected by developments in medical technology (unlike viability)(86)... It is sentience rather than brain birth that marks a qualitative difference in the life of the unborn. However, sentience appears roughly to coincide with brain birth (87).

It is difficult to see what is "objective" in Steinbock's argument. In addition, it is not clear whether she advocates "brain-birth" rather than "sentience" as the criterion of moral standing. The claim that sentience and brain birth coincide roughly is highly questionable since, as Steinbock states, there is a four-week gap in between. Moreover, as already mentioned, four weeks more or less of intra-uterine life constitutes a significant time span; it cannot be ignored or minimised.

The four authors refer to brain waves. Let us now find out what these brain waves are in reality and if they can be used (as they are) in a moral argument about abortion.

Electroencephalography and allied brain imaging procedures

In order to gain access to and insight into the structural and, much more importantly, the functional properties of the brain we need *in vivo* imaging methods. The oldest one is electroencephalography (EEG), and the latest one is functional magnetic resonance imaging (*f*MRI). In between, we have a series of brain imaging techniques such as event-related potentials (ERP), magnetoencephalography (MEG), computerised tomography (CT), full-body scan or electron-beam computerised tomography, low-dose CAT scan, positron emission tomography (PET), and single photon emission computed tomography (SPECT). In Raichle's (1999: 109) words, as

opposed to PET and MRI that allow to make a connection between what is *seen* and what the brain *does*, EEG, ERP, and MEG are "venerable electrical tools".[11]

Brain Imaging

Hans Berger pioneered EEG as early as 1924. This was followed about 50 years later, in the 70s, by the realisation of computerised tomography (CT) (or computer assisted tomography, CAT scan) by Hounsfield and McCormack. The CT scan is a method using X-radiation to generate separate images of consecutive slices of the body (as opposed to a plain X-ray that shows the superposition of planes). The same year, 1972, Lauterbur and Damadian realised magnetic resonance imaging (MRI); the method has the dual advantage of providing better images than the CT scan but without the use of ionising radiation. MRI discerns the behaviour of molecules and atoms in high magnetic fields. CT-scans and MRI, however, give static images of the brain – that is, information on the brain *structure* and alterations thereof. Neuroscientists are rather interested in brain *function.*

The newer techniques, positron emission tomography (PET) and *f*MRI provide information on the *functional* aspects of the brain. PET, a derivative of autoradiography, uses the injection of radioactive water to identify changes in the blood circulation. The concept of PET is based on the principle that the activity of nerve cells is an energy-dependent process. The oxygen carried in the blood supplies this energy to the brain by the blood flow. The detection of changes in blood flow and oxygenation allow co-localising any increase in neuronal activity as an index of local firing cells. In this manner, PET provides an anatomical and functional map of the brain. Data obtained with PET suggest that we possess an *automatic* and a *non-automatic* brain system. The automatic system operates for familiar tasks and for stressful situations, where we are acting in a reflexive way. The non-automatic system, subserved largely by the frontal cortex, operates in the processing of novel tasks. The latter area of the brain develops fully only some time after birth (Raichle 1999: 115). This is relevant to our topic since it indicates that even though there may be some non-automatic brain activity before birth, the unborn's brain activity is mainly automatic.

The limitation of PET, however, is related to its power of resolution of a sphere of 6 to 10 mm in diameter, whereas one needs a much higher resolution of a sphere of one cubic mm to gain enough insight into the functional anatomy of the cortex (Frackowiak 1998: 109). This is the advantage of BOLD-*f*MRI, a variant of *f*MRI that is based on the detection of local brain oxygen levels; it provides a better but not yet ideal resolution of 3 cubic mm. Event-related potential (ERP) mapping integrates the information that is obtained from PET and MRI, thus providing more detailed information than EEG. Another combination, called magneto-encephalography (MEG), integrates the information from the EEG and ERP-mapping (Raichle 1999: 115). At variance with conventional EEG that records largely the cerebral voltages occurring in the surface gyri (the convolutions, bulges) of the cerebral cortex, MEG goes down to the banks of the sulci (the fissures). It must, however, be said that these techniques (with the exception of a recent report on *f*MRI) have not yet been used to investigate the functional anatomy of the human fetal brain. The first report on *f*MRI in the human fetus was published in the year 2000 (Vadeyar *et al.* 2000: 28). In this study, auditory stimuli applied to the abdominal wall of 16 pregnant women between 36 and 41 weeks of pregnancy elicited temporal lobe activation in the fetal brain. This was interpreted as an indication that there is sensory competence in mature fetuses, in other words, that the mature fetus has the ability to hear sounds. Three-dimensional trans-abdominal ultrasound to study the possible structural anomalies of the fetal brain is still in its infancy; at any rate, it helps in the diagnosis of structural anomalies but says nothing about the function of the fetal brain (Cohen *et al.* 2001: 145).

Electroencephalography

Hans Berger is credited for having described the α-waves of the resting brain, as well as their block by the onset of alertness. The work of H. Blake and R.W. Gerard, in 1937, and of E.D. Adrian, in 1944, provided more information about the nature and disorders of sleep, as well as of epilepsy (Sournia 1992: 494). Although the functional significance of the various EEG waves remains largely to be elucidated (Lazorthes 1999: 81), there is general agreement that the EEG is basically a marker of

sleep intensity.[13] The two types of alternating waves, indicating respectively the so-called REM (rapid eye movement) sleep and the non-REM sleep were described in 1953. The non-REM sleep, also called "orthodox", "quiet", or "deep" sleep is characterised by *slow* waves: the SW-sleep. It constitutes 75 to 80 percent of the sleep and reaches its maximum within the first hour after the onset of sleep. The highest threshold to sensory stimuli is reached at the same time. The EEG slow waves indicate decreases in metabolic activity (Kinsbourne 1998: 249). The non-REM sleep is interrupted periodically (more or less every 2 hours) by periods of REM sleep. The EEG waves of non-REM sleep have a high voltage and a low frequency. Thus, paradoxically, the largest potentials are recorded when the brain is at rest. When brain activity is "disturbed" as it is in schizophrenia, the dimension of the resting scalp EEG is higher due to the less organised, less coherent and less stable dynamics (Globus 1995: 98). REM sleep, also called "active" or "paradoxical" sleep, characterises the EEG of dreaming adults; it resembles closely what is recorded in the waking state. REM sleep occupies proportionally much longer of babies and children's sleep. The same has been observed in the fetus, which spends most of its time in states of active sleep that resembles REM sleep (Carpenter 1996: 284; Borbély & Tononi 1998: 186).

Although most of what we know about the fetal EEG results from observations made in fetal lambs (Nathanielsz 1992: 127), there is some indication that in the human fetus the first non-REM waves of deep sleep are detectable around the 30th week after conception, and that the first REM waves of active sleep are detectable around the 36th week of intra-uterine life. In early extra-uterine life, REM of active sleep is the predominant EEG pattern (Lazorthes 1999: 111). This does not mean that the fetal brain is in a dormant state of hibernation. According to Borbély and Tononi:

> Activity-dependent processes are essential for axonal growth, synaptic remodeling, and the refinement of connectivity. In the absence of extrinsic stimulation, the intrinsically generated activity of sleep, which is often oscillatory in nature, might promote the growth and maturation of neuronal circuits (1998: 187).

In other words, it is likely that fetal sleep is preparing the basic neural circuitry that will be switched-on after birth when extrinsic stimulation will establish the needed connections between the circuits.

It should also be noted that during the state of coma large amplitude EEG waves are recordable and that they resemble the SW-sleep (Carpenter 1996: 284). A technical point is equally in order at this stage. In adults, the recording of the EEG is carried out with up to 120 scalp electrodes (the size of the head is the limiting factor to the number of electrodes) in order to compensate as much as possible for the poor localisation of the number and of the origin of signals (Mountcastle 1998: 20; Frackowiak 1998: 111). As already mentioned, it is hardly conceivable how one could record the EEG of a 6-weeks human embryo (Brody's unsubstantiated claim) when the length of the body is between 10 and 14 mm! Andy Clark (1998: 275) recently reported on a kind of world *première* where some scanty neural recordings from a locust in free flight have been obtained through tiny radiotransmitters. With progress in technology, more neurobiological knowledge will undoubtedly be acquired. Whether this technology will be applicable to and morally permissible in human embryology and fetus research remains an open question.

The main problem related to techniques like EEG is that they are "secondary signs of neural activity", but "say nothing about how neuronal activity generates the secondary signs" (Mountcastle 1998: 24). To know how the secondary signs are generated, one needs chronically implanted microelectrodes in relevant neurons (ibid.). While this appears possible in locusts, it would be ethically questionable in human embryos or fetuses.

Concluding remarks

It can be said with confidence that there is no scientific evidence supporting Brody's and others' claim concerning brain waves emitted by the embryonic and early fetal brain. When EEG waves start appearing (and this happens rather late during intra-uterine life, the earliest around the thirtieth week) they merely indicate that the fetus has the ability to sleep. Although fetal sleep might activate the brain and prepare it to extra-uterine life, this is far from saying that its brain is fully structured and fully functional. Hence, the ethical arguments based on the alleged presence of brain

electrical activity, have no solid neuroscientific, hence no neurophilosophical grounds.

Currently available scientific evidence on the intra-uterine development and function of the embryonic and fetal nervous system are still very limited. Embryologic data, information gathered from autopsies, ultra-sonographic imaging of the fetus and clinical data from severely premature newborns give the information listed in Table 1.[14] It is important to note that fetal "behaviour" should be seen merely as a "conservatory automatism" rather than an adaptation to variable conditions (we know little about the fetus' perception of environmental changes except the faculty of hearing sounds). Even the anencephalic newborn sleeps, yawns, cries, and sucks its thumb (Lazorthes 1999: 30). Also of note is the presence of the Babinski sign (the upgoing big toe when the foot sole is stimulated) in all newborns, indicating dissociation between the brain and the spinal cord (as it can be observed with central nervous system damage) (Carpenter 1996: 196).

The newborn has a full complement of neurons. However, "the fact that a neural system is in place does not guarantee that it will participate in the control of behaviour; it needs to be switched on, or activated" (Kinsbourne 1998: 252). During intra-uterine life, says Edelman:

> Cells divide, migrate, die, stick to each other, send out processes, and form synapses. This dynamic series of events depends quite sensitively on place (which other cells are around), time, and correlated activity (whether cells fire together or change together chemically over a period of time) (1992: 22).

These facts should be understood in the perspective of a brain that is ever changing, against the simplistic and static view that the brain is born somewhere in early embryonic life and just grows bigger with time. There is no *homunculus* in the brain.

4 Approaching the complexity of the brain

What peculiar privilege has this little agitation of the brain which we call thought, that we must make it the model of the whole universe?

David Hume

Introduction

The aim of the present chapter is to introduce the reader to the complexity of the brain – its evolution, basic embryogenesis, and function. The main thrust could be said the refutation of the seventeenth-century theory of preformationism – that is, that all future generations were already present in Eve's ovaries like dolls within dolls – which still remains in the back of some people's mind (Rachels 1995: 70). As Edelman writes (1992), the spectrum of the *homunculus* is still with us. In other words, those less (or not at all) familiar with the intricacies of phylogenesis and organogenesis might, as in the past, have the idea that the human embryo has miniature organs that just grow larger during intra-uterine development. If this can be said to some extent for some of our body parts, it surely does not apply to the brain. Moreover, although the human brain reaches a more or less complete structure by the onset of the third trimester of gestation, there is sufficient evidence that indicates that it is unable to function like the brain of a paradigm mature rational person. The other vital organs (lungs, heart, intestines, kidneys, liver) are structurally and functionally ready at birth. They will grow larger with the growth of the body. Not so for the brain.

There is also a misconception about the nervous system that needs to be dispelled. Advocates of sentientism rest their case on the claim that non-human animals possess a brain that is similar to the human brain. Humans have the ability to feel pain and pleasure. Since animals (at least the higher animals) have the same brain they feel the same. Therefore, they demand the same respect.

In order to refute these two misconceptions it is imperative to have a minimum of insight into the evolution and the basic functioning and structure of the brain in animals and in humans. In the present chapter, the anatomic aspects of the brain and its evolution will be addressed. This is the task we are now turning to.

The phylogenesis of the central nervous system: nonhuman animals

It would be far beyond the scope of this essay to survey in any depth the anatomy and physiology of the nervous system of all animal species.[1] First, it would not be relevant. Second, even the most radical sentientists have doubts about the capacity of sentience of molluscs, arthropods, and microbes. Arguably, perhaps, they limit sentience to the world of vertebrates, and even only the higher mammals – the limitation of moral consideration to the so-called "mammalian ethics".

The animal kingdom can be subdivided into two major classes: those with no brain so to speak (hyponeureans) and those with a brain (epineureans), as summarised in the following table.

1. **Hyponeureans**: 1.1. worms
   1.2. molluscs: 1.2.1. gastropods (e.g. snails)
   1.2.2. bivalves (e.g. oysters)
   1.2.3. cephalopods (e.g. octopus)
   1.3. arthropods: 1.3.1. crustaceans (with neural ganglia above and below the oesophagus)
   1.3.2. insects (with a network of metameric ganglia)
2. **Epineureans**: the phylum Chordata (vertebrates):
   2.1. agnathes (primitive fish)
   2.2. cartilaginous fish (e.g. sharks)
   2.3. lower vertebrates: 2.3.1. osseous fish
   2.3.2. amphibians
   2.3.3. reptiles
   2.4. birds
   2.5. mammals: 2.5.1. lower (or primitive): - monotremes (egg-laying)
   - marsupials (e.g. kangaroo)
   - placentals: 18 orders →
   2.5.2.higher: - cetaceans (e.g. whales, dolphins)
   -primates: lemurs, monkeys, apes, and humans

Lower vertebrates (fish, amphibians, reptiles) possess a rhombencephalon (hindbrain), a midbrain (archencephalon or reptilian brain), and a forebrain consisting mainly of a sizeable olfactory bulb (*bulbus olfactorius*). The telencephalon (the cerebral hemispheres) is limited to a small appendage situated in front of the olfactory bulb. Their archicortex is limited to the hippocampus (a component of the limbic brain). This means that lower vertebrates possess the neural equipment needed for automatisms and reflexes, a potent organ of smell, and an integration system.

Higher vertebrates comprise the class of mammals, lower and higher. The lower (or primitive) mammals are characterised by a progressive increase in the development of the forebrain, or telencephalisation. The increase in size of the neoencephalon (forebrain) leads to the burrowing of the diencephalon and of the midbrain (mesencephalon). The burrowed portions of the brain, called centrencephalon, comprise the archencephalon or reptilian brain and the paleoencephalon. The reptilian brain is constituted by the reticular formation, the hypothalamus, and the archicortex. The reticular formation, situated in the *truncus cerebri* (hindbrain), regulates the sleep/wake tonus. The hypothalamus regulates the basic biological needs (hunger, thirst, reproduction), emotions (fight/flight), and the internal milieu. The most ancient component of the cerebral hemispheres, the paleopallium, situated at the lowest part of the brain, is predominantly composed of the olfactory bulb and the rhinencephalon (the adjacent paleocortex). Because of the importance of the organ of scent, Lorenz (1979: 27) says that animals "think through their noses". The archicortex is composed mainly of the hippocampus, a portion of the limbic brain. Lower mammals, then, possess the necessary brain equipment for basic emotions (fight/flight) as well as for a rudimentary memory.

It can be said, as a rule, that during phylogenesis (the evolution of species) as well as during embryogenesis (the coming into being of an individual member of a species) what appears first is the centrencephalon and the paleocortex. The centrencephalon has two components: 1) the paleoencephalon or limbic brain; and 2) the archencephalon, the hindbrain or brain stem and the hypothalamus (a component of the limbic brain). The only cortical structure at this stage is the paleocortex (rhinencephalon), an outgrowth of the diencephalon: the olfactory system. The neoencephalon or forebrain appears last both in phylogenesis and in embryogenesis. If one considers the brain of a primitive rodent (e.g. the porcupine), of a primitive primate (e.g. the tupaja), and of a primitive lemur (e.g. the maki) one can see the

transition between a brain anatomy where the cerebellum is respectively free (not burrowed underneath the forebrain), one-third, and half-covered by the expansion of the neopallium (cerebral cortex). In these animals, the surface of the brain is smooth; there are no sulci (small groves) or gyri (bulges).

In higher mammals, the telencephalon (brain hemispheres) reaches its highest development. The neocortex (cerebral cortex), now called gyrencencephalon, exhibits sulci and gyri. It is the organ of relationship with the outside world. The centrencephalon, which is covered by the telencephalon, is in charge of the maintenance of the internal milieu. According to the phylogenetic ancienty of the species, the centrencephalon comprises: 1) the reptilian brain (the reticular formation, the hypothalamus, and a portion of the fronto-temporal archicortex); and 2) the limbic brain. According to Lazorthes (1999: 99), the importance in size of the frontal lobes and their late appearance towards the end of intra-uterine life, argue in favour of the idea that they are the sites of intelligence although they are not totally conditioning the ability to think. The same is said from higher mammals, and more specifically the apes:

> Animals have clever brains, but blank minds. They receive sensory inputs but their minds are not conscious of any accompanying sensation. They go about their lives deeply ignorant of an inner explanation for their own behaviour (Baron-Cohen 1999: 6).

These rudimentary data on the evolution of the brain are enough to show that so-called primitive or lower animals (a "naïve value-judgement" says Lorenz), mainly the primitive vertebrates (fish, reptiles, and amphibians), possess the basic neural substrate to cope with biological life and reproduction. Their forebrain is mainly structured at providing a potent ability to smell (to compensate for the limited potency of the other sensory systems – vision and hearing). They have the ability to experience *emotions* – that is, to react to visceral sensations required to survive. But as Mayerfeld (1999: 59) writes: "To understand the feelings of animals attention must be paid to the organisation of the nervous system". If this is true about non-human animals, there can be no reason why it should not be true about human animals, including the embryo and fetus. Let us now turn to the genesis of the human brain.

The organogenesis of the nervous system: human animals

In this section, I will present some of the main steps in the organogenesis of the human brain. I will try to illustrate them, although in a rudimentary manner, by a series of pictorials.

The very first steps of development of the pre-embryo (day 1 to 14 after fertilisation) and embryo proper (third through eighth week of intrauterine life) have been described in Chapter 3. In the present section, I wish to focus again on the early development of the central nervous system – that is, the brain and the medulla spinalis.

The central nervous system arises from the neural groove of the embryonic disc. By day-14, the neural tube is formed. Two weeks later, the cephalic or rostral end of the tube starts dilating and flexing (Fig.1).[2] The wall of the "brain vesicles" is lined by undifferentiated neural cells (neuroblasts). The process of dilatation and flexion of the brain vesicles intensifies gradually. At day-32, the roof of the 4th ventricle starts thickening (Fig.2).[3] A sketchy diencephalon (the caudal part of the forebrain) is recognisable by day-49; it contains the rudimentary elements of the thalamus and of the hypothalamus (Fig.3).[4] During the last week of the embryo proper stage the three components of the brain (forebrain, midbrain, and hindbrain) are well individualised. The relative size of each is roughly similar (Fig. 4).[5] At this stage of embryogenesis, the hypophysis and the epiphysis (pineal gland) make their appearance at the lower rostral and upper caudal end of the diencephalon respectively.

We now enter the fetal stage of development. During the tenth week, the diencephalon undergoes major modifications. In addition to the thalamus and the hypothalamus, two new structures make their appearance: the neostriatum (the caudate nucleus, the lentiform nucleus, and the putamen) and the paleostriatum (the globus pallidus). The pallium, the future cerebral cortex, is represented by three structures: 1) the paleocortex at the lower part of the diencephalon (the future olfactory lobes); 2) the archicortex at the inner aspect of the telencephalic vesicle (the future hippocampus); and 3) the neocortex on top of the future cerebral hemispheres (the future cerebral cortex)(Fig. 5).[6] The corpus striatum connects the extrapyramidal nervous motor system to the brain; but its precise function remains unknown. Its experimental destruction does not produce motor dysfunction; its stimulation is

followed by circular movements of the head (Kahle *et al.* 1996: 222). At this stage, then, the central nervous system starts establishing its internal connections. The basic elements from which the future brain components will arise are in place. By the third month of fetal life, more rudimentary structures become visible (Fig.6).[7]

Eight weeks later, by the end of the fourth month of gestation, the cerebral hemispheres have expanded considerably and the diencephalon has become partly burrowed under the overlying telencephalon. The olfactory bulbs are well visible. The hypophysis starts its expansion. The rostral part of the corpus callosum, a connection between the two brain hemispheres, is present. The cerebellum, pons cerebelli, and medulla oblongata are recognisable. The surface of the cerebral cortex is still flat (Fig. 7).[8] The most advanced development is at the level of the midbrain (mesencephalon and pedonculi cerebri) and hindbrain (pons and medulla oblongata), the parts involved in the vegetative functions of the body. It has been suggested that by the twenty-second week (end of the fourth month) of gestation the connections between the thalamus and the cortex are in place (*i.e.* the cortico-thalamic connections) (Flower 1985). Based on this suggestion it has been inferred that from that stage on the fetus has the ability to feel pain. It is true that the thalamus possesses sensory relay nuclei that project to the sensory cortex of the brain, more specifically the SII area (Carpenter 1996: 85). The cortical sensory areas receive projections from two spinothalamic pathways: an anterior (more highly developed in higher animals) and a lateral pathway. The anterior spinothalamic tract projects to regions that are not wholly somatosensory; the lateral spinothalamic (older) is more concerned with pain (77-78). It cannot be ruled out nor can it be proven that the fetus has the ability to feel pain. Carpenter reminds us: "the central pathways for pain are in fact rather complex and poorly understood, partly because the sensation of pain is itself very complex" (85).

It is not before the seventh month of gestation that the various layers of neurons in the brain cortex become clearly individualised. They reach their ultimate outlook during the eighth month (Lazorthes 1999: 108). By the time of birth, the brain is a bulk of neurons and of circuitry, says Lazorthes (109). It is by practice that triage is achieved. The circuitry is put in place by establishing new connections as well as by neuronal death resulting in disconnections. The initial phase of synaptogenesis is genetically induced; fine-tuning results from the interaction with the environment

(110). Therefore, the fact that the spinothalamic tract is in place does not prove that the cortical structures are able to process the nociceptive input.

In order to make sense of the preceding, it seems that an outlook on the structure and the function of the adult brain is in order. This is the topic of the next section.

The major role players in the central nervous system

As we have seen earlier, the brain (encephalon, cerebrum) refers to the parts derived from the forebrain – that is, the cerebral hemispheres (telencephalon, or anterior portion of the prosencephalon) and the diencephalon (posterior part of the prosencephalon). The brainstem refers to the unpaired parts derived from the midbrain and the hindbrain – that is, the truncus cerebri, which comprises the mesencephalon (with the pedunculi cerebri) and the pons (a midbrain derivative), and the medulla oblongata (a hindbrain derivative). Let us now consider the components of the brain that are viewed as the major role-players in the processes of thought, memory, and sentience (in its broadest sense).

The frontal lobes

The brain hemispheres are subdivided into four lobes: frontal, parietal, temporal, and occipital (Fig. 8).[9] The frontal lobe extends from the frontal pole (*viz.*, the most anterior part that corresponds to the forehead) to the sulcus centralis of Rolando (or central sulcus). The cortex of the anterior and lower part of the frontal lobe is called the prefrontal cortex. It is noteworthy that only human animals do possess a prefrontal cortex (Lazorthes 1999). It is composed of associative neurons – that is, neurons that are neither motor nor sensory but that have the function of establishing links between all the areas of the brain. It receives input from the thalamus, and sends output back to the thalamus and to the limbic system (Lazorthes 1999: 102). Therefore, the prefrontal cortex is not a "general executive" (Kinsbourne 1998: 238), but rather what I would call a "public relations officer". The left prefrontal cortex is involved in planning; the right prefrontal cortex is involved in interpersonal relations. It enables the individual "to overcome primitive pre-programmed responding when that would be maladaptative" (ibid.). Between the

prefrontal cortex and the central sulcus, there is a premotor area and a somatomotor area. The frontal lobe is undoubtedly a major role-player in the process of thinking. One of the hypotheses suggesting how mental activity is brought about has been suggested by Luria (1973 quoted in Lazorthes 1999: 101) (Fig. 9).[10]

A major part of our understanding of the function of the central nervous system is the result of neurological diseases and accidents. With regard to the role of the frontal lobe, the famous case of American mining engineer is worth recalling. J.M. Harlow in the Bulletin of the Massachusetts Medical Society published it in 1868. Working with dynamite sticks in a mine in 1848, Phineas Gage suffered from an accidental perforation of the skull by a crowbar that destroyed his prefrontal cortex. The most remarkable consequence of this accidental leucotomy (severance of the white brain matter, also called lobotomy or section of the frontal lobe) was that Gage became totally indifferent, mainly to pain. A similar case was that of Elliot V.R., who underwent an excision of the ventromedial frontal lobes. This was followed by the incapacity of long-term planning, a lack of sense of what is socially appropriate, and an inability to defer instant gratification (Changeux & Ricoeur 2000: 196).

Gage's accident was at the origin of what became known as frontal lobotomy, which was initially performed surgically, but eventually became possible through pharmacological means. The procedure is used in patients suffering from intractable pain. The interesting thing is that it does not result in the disappearance of pain. The pain is there and the subject is aware of it. What disappears is the emotional quality of pain. Cambridge University neurophysiologist R.H.S. Carpenter has suggested that an explanation of this dissociation between the feeling of pain and the pain-affect might be that "by stripping the pain of its meaning for the future, we also relieve its emotional threat" (1996: 250). In experimental so-called "frontal" animals – that is, having undergone a frontal lobotomy (they possess a frontal lobe but no prefrontal cortex)– the ability to store a program of action for deferred use is lost (ibid.). This suggests two things. One, that the frontal lobe (and more specifically the prefrontal cortex) needs to be connected with the rest of the brain to be able to memorise and to have a concept of time, present, past, and future. And two, that without a concept of time pain looses its emotional overtone. If this hypothesis were valid, it would mean that suffering requires a fully structured and fully functional brain. Therefore, the unborn (and lower animals) may possibly feel pain but not suffer.

Another part of the frontal lobe, the orbito-frontal cortex (locus of the amygdala), plays an important role. It is connected to the superior temporal sulcus. This orbito-frontal cortex/superior temporal sulcus has been studied by single photon computed tomography. It suggests that it plays a major role in our mental states (think, imagine, hope, fear, remember, plan)(Baron-Cohen 1999: 92). A damage to the amygdala or a disconnection between the two areas results in abnormal social perception, failure to attach emotional significance to stimuli, diminution of aggression, and affiliative behaviour (95).

Since the topic of discussion is the neurophysiology of pain perception, the other cerebral lobes will not be considered. Suffice to say that sensory inputs to the brain are directed to the sensory cortex located in the temporal lobe behind the sulcus centralis (Fig. 8).[9] It is worth noting that the electrical stimulation of the somatosensory cortex in conscious human subjects rarely produces a pain sensation (Carpenter 1996: 84). More relevant to the discussion are the functions of the thalamus and hypothalamus.

The Thalamus

The thalamus (from the Greek *thalamos*, bedroom) is one of the four components of the diencephalon. In other words, the diencephalon is composed of four areas lying on top of each other: the epithalamus, the dorsal thalamus, the subthalamus, and the hypothalamus. The hypothalamus will be considered in the next section.

The epithalamus is a relay between the olfactory centre and the truncus cerebri. It is also connected to the epiphysis (pineal gland). The dorsal thalamus receives sensory inputs from the skin, the eyes, the ears, and the taste buds. It has two-way connections with the cerebral cortex. The subthalamus is the motor-zone of the diencephalon. As a whole, the thalamus is a relay for sensory and motor afferents to the cortex. It also exhibits connections with the associative cortex and with the limbic brain.

The thalamus is composed of a number of nuclei. The anterior and dorsolateral nuclei connect with the limbic brain. The median nuclei connect with the frontal cortex. The lateral nuclei connect with the parietal lobe. The ventral nuclei connect either with the motor and the sensory cortex or with the visual and the auditory cortex.

It is through the ventral thalamic fibres that somatic inputs are integrated and transmitted to the frontal cortex. This is the pathway through which unconscious stimuli originating from the visceral and somatic spheres of the body reach the frontal cortex to affect our moods and to become conscious of our moods (Kahle *et al.* 1996: 170). Remember the corticothalamic and spinothalamic tracts referred to by Flower (1985) in support of the possibility for the fetus to feel pain.

Once again, we have to refer to experimental data and other procedures that may help the understanding of the role of this part of the brain. During some neurosurgical procedures on the brain patients are kept awake and conscious. This has the advantage that specific areas can be stimulated and that the patient can report what he or she experiences. The electrical stimulation of the ventrobasal thalamus provokes a pricking pain (also called first pain). The stimulation of the central thalamus is followed by a sensation of intense unpleasantness (Carpenter 1996: 85). Thalamotomy – the stereotaxic destruction of selected portions of the thalamus – is practiced for the relief of pain, for the arrest of involuntary movements, and for the treatment of emotional disturbances (Stedman 1997: 876). This is not to say that the thalamus is the "pain centre" of the brain (as opposed to the alleged "pleasure centre" located in the hypothalamus). It means that the thalamus *participates* in the chain of events leading to the perception of pain. Once the communication between the sensory input and the higher cortical areas has been severed, the processing procedure is hampered.

The Hypothalamus

The hypothalamus is the fourth component of the diencephalon (Fig. 10).[11] It is in close relationship with the underlying hypophysis. Like the thalamus, the hypothalamus is composed of nuclei: the nucleus supraopticus, the nucleus paraventricularis, the tuber cinereum (itself composed of the nucleus ventromedialis, dorsomedialis, and infundibularis), and the mamillary bodies. The hypothalamus has two-way connections with the cerebellum, the thalamus, the limbic system, and the hypophysis.

In Carpenter's words, "the hypothalamus determines all what we do"; it is a "need detector and a response generator" (1996: 278). In Kahle *et al.* view, the hypothalamic centres influence all the phenomena that play a role in the homeostasis

of the internal milieu. They adapt the function of the organs to the needs of the body: energy supply and consumption, water and minerals supply and consumption, cardio-vascular and respiratory function, and circadian rhythm (biological clock). It processes the instinctual body requirements perceived as hunger, thirst, sexual pulsions, and all the conservatory mechanisms which most of the time have emotional overtones such as refusal, pleasure, fear or anger (1996: 186).

In human pathology, according to the site of damage there will be either gonadal atrophy or precocious puberty. Other sites of damage result in either cachexy or obesity. In animals, experimental stimulation or destruction of hypothalamic nuclei have similar results.

The Limbic system

In evolutionary terms, the limbic brain is the so-called paleoencephalon (the ancient brain). Together with the archencephalon (the initial brain) – that is, the hypothalamus and the hindbrain – the limbic brain belongs to the centrencephalon (burrowed underneath the cerebral hemispheres, in the centre of the brain). Remember the reptilian brain or midbrain common to the lower vertebrates (fish, amphibians, reptiles), and the limbic brain (composed only of the hippocampus in lower vertebrates). Likewise, recall the fact that lower mammals have a more complex limbic brain, a less developed olfactory brain system, and a more developed archicortex than the lower vertebrates (Lazorthes 1999: 65).

The limbic system (from the Latin *limbus*, edge) was identified as a specific system only in 1953 (Rey 1995: 328). It has since received a number of nicknames such as visceral brain, affective brain, and emotive brain. All names point to the view that this part of the brain plays a special role in animal behaviour loaded with emotional overtones. It is composed of a heterogeneous array of nuclei, fibre tracts, and cortical areas at the edge of the medial wall of the cerebral hemispheres (Fig. 10 & 11).[11-12] It has telencephalic (brain hemispheres) and diencephalic components.

The limbic nuclei comprise the amygdala (corpora amygdaloidea), the septal nuclei (the so-called "pleasure centre"), the mamillary bodies, and the hypothalamus. The limbic cortical areas are: the hippocampus (from the Greek *hippocampus*, seahorse) (or hippocampal gyrus), the cingulum (from the Latin *cingulum*, girdle) (cingulate gyrus, or limbic convolution), and some parts of the olfactory cortex. The

limbic nuclei and the limbic cortical areas are connected by fibre tracts (Carpenter 1996: 258). The limbic convolution is composed of associative cortex that links up different parts of the brain: the hypothalamus (the fornix to the preoptic area and tuber cinereum, the stria terminalis to the tuber cinereum, and the ventral fibres to the corpora amygdaloidea), the thalamus, the mamillary bodies, and the frontal cortex (through the hippocampus) (Fig. 10).[11]

Because of its hypothalamic component, the limbic system is involved in all the functions mentioned earlier about the hypothalamus. The limbic projections from the amygdala and the information received by the hippocampus (an important contributor to the faculty of memory) contribute to the limbic processing of emotional reactions, motivation, and accompanying the vital processes involved in conservation (survival) (Carpenter 1996: 259; Lazorthes 1999: 259).

In animals, the selective electrical stimulation of specific areas of the hippocampus produces anger, hyperphagia, defecation, micturition, or retreat. In humans, it produces relaxation. The selective stimulation of the septal nuclei (the so-called pleasure centre) produces euphoria. The electrical stimulation of some areas of the dorsomedial thalamus, of the hypothalamus, or of the amygdala produces reactions of avoidance and of withdrawal. It is not clear whether the latter reaction results from the production of pain (Carpenter 1996: 282). Cingulectomy (the removal or destruction of the cingulum or hippocampus) significantly decreases aggressive behaviour; like frontal leucotomy, it produces indifference to intractable pain (Kahle *et al.* 1996: 306).

From the above data, we can build a kind of map of the various loci of the central nervous system that are involved in the processing of pain and emotions.

Mapping the "pain centres"

It would be contrary to the connectionist view on brain function to retain the idea of centre(s) since the processing of pain is not performed by any centre so to speak but by the loops and feedbacks between a large number of loci scattered through the entire central nervous system. Nonetheless, as it can be seen from animal experiments as well as from stereotaxic electrical stimulation or destruction of specific areas of the brain, the thalamus plays a central role in the process of pain sensation.

The thalamus is the only central nervous component whose electrical stimulation provokes a feeling of pain. On the other hand, the perception of pain can be altered by interventions at levels other than the thalamus.

Starting from the prefrontal cortex, we have seen that prefrontal lobotomy or leucotomy in humans suffering from intractable pain results in indifference to pain. Pain is still perceived but its "unpleasantness" (its emotional, psychological, temporal overtones) so to say, disappears. The same result is obtained through cingulectomy (the destruction of the limbic convolution) for intractable pain. A third locus in the brain hemispheres (although they are a component of the limbic system that has also components within the diencephalon), the corpora amydaloidea of the temporal lobes, plays a less defined role; their stimulation results either in anxiety or relaxation, depending on the mood of the subject at the time of the stimulation.

Moving down to the diencephalon – the limbic system, the thalamus, and the hypothalamus – we find two major role players in the perception of pain and pleasure (the hypothalamus does not seem to play a role in this regard). As we have mentioned, stimulation of the ventral thalamus evokes "first pain" (pricking pain). Stimulation of the central thalamus evokes a feeling of intense unpleasantness. Stimulation of the dorsomedial thalamus evokes "second pain" (withdrawal). The section of the spinothalamic tract (that is, in the medulla dorsalis), or mesencephalotomy, relieves intractable pain. This is different from frontal lobotomy and from cingulectomy in the sense that the section of the spinothalamic tract results in the disappearance of the sensation of pain and not only of the emotional aspect of pain. In other words, the pain-affect requires the connections between the thalamus, the limbic convolution and/or the frontal cortex. Pain sensation requires the connections between the peripheral pain receptors and the thalamus through the spinothalamic tracts (Fig. 12).[13]

What about the pleasure centres? The main central nervous system loci of pleasure are the septal nuclei and amygdala. These have been called pleasure centres in the sense that if an electrode is implanted and connected up so that when an animal presses a lever in its cage it receives a pulse of electrical stimulation. Then, as soon as the animal discovers what the lever does, it will go on pressing it repeatedly, often in preference to other pleasant stimuli such as food and sex. As Carpenter (1996: 282) comments: "Of course, one cannot tell whether it is *feeling* pleasure as a result; but it is clear that the electrode must in a sense be by-passing the normal motivational

mechanisms of the hypothalamus and in some way activating the tropistic input to the motor system directly". In other words, we are interpreting a behaviour without knowing exactly what the animal really *feels*.

Having gained some insight into the main sites involved in the transmission of nociceptive stimuli inside of the central nervous system, we have to turn to the peripheral sensory systems and to the neurochemical function of the nervous system.

Sensory modalities and sensory systems

In order to adapt to the external world and to react in an adequate manner to the sensory inputs, living entities possess a vast array of sensors for light, sound, temperature, pressure, vibration, taste, pain, pleasure, etc. These sensors are located in the skin, tendons, muscles, ears, eyes, nose, tongue, etc. The exteroceptive sense relates to the perception of stimulation by external agents. The proprioceptors perceive the movements and positions of the body. The nociceptors perceive the painful or noxious stimuli.

The skin contains a variety of sensory receptors. The Pacinian corpuscles perceive deformation and pressure. The Meissner's corpuscles respond to mechanical stimuli. The Merckel's discs respond to light touch; they are the first skin sensors that appear during intrauterine life (approximately at 20 weeks of gestation). Ruffini's endings are proprioceptors. The encapsulated endings are sensitive to cold, and the free endings are sensitive to warmth, pain, and mechanical stimuli (Carpenter 1996: 75). This is a kind of rough taxonomy of the peripheral sensors, which do not reflect the vast richness of our sensory perceptions (74).

The sensory input reaching any of these sensors travels to the spinal cord through nerve fibres of different types: poorly or richly myelinated, large or small. Myelin is an insulation coat around nerve fibres that speeds up the conduction of action potentials. The gauge of nerve fibres also influences the speed of transmission of inputs.

Myelination of the nerve fibres in the spinal cord begins in approximately the fourth month of intrauterine life. Some of the motor fibres descending from the higher brain centres to the spinal cord do not become myelinated until the first year of postnatal life. Tracts in the nervous system become myelinated at about the time they start to function (Sadler 2000: 421).

The nociceptor system belongs to the poorly myelinated protopathic sensory system; the proprioceptor system belongs to the heavily myelinated epicritical system.

The size of nerve fibres also plays a role, not only in the speed of transmission, but also in the nature of the stimuli. Mechanical and proprioceptive stimuli travel to the spinal cord through large fibres called Aβ. Nociceptive stimuli travel to the spinal cord through Aδ and C fibres. First pain (pricking pain or immediate feeling) travels through the large and fast Aδ fibres. Second pain (including visceral pain), which induces withdrawal, travels through slow C fibres (Carpenter 1996: 84).

One should keep in mind that the sensation of pain may result from tissue damage – that is, a noxious stimulus sensed by nociceptors- yet, many kinds of pain are not associated with tissue damage at all. As Carpenter (85) reminds us:

> The sensation of pain is itself very complex... the degree of pain that is felt depends to a large extent on the emotional state and on the meaning that pain may have (e.g. frontal leucotomy). Sensing the pain is not the same as feeling the pain.

According to the above data, it can be said that the human fetus acquires the faculty of sensing light touch around the twentieth week of gestation. Around the same time, the process of myelination starts. We now turn to the complex issue of the neurotransmitters.

The Neurotransmitters

The coordination of a single-celled organism such as an amoeba is essentially chemical. As Carpenter (1996: 3) puts it: "its brain is its nucleus, acting in conjunction with its other organelles". In multicellular organisms, however, there is a need for communication between different cell types with specialised functions in order to coordinate the entire system in an adaptative manner. Where the system is small and able to function properly albeit in slow motion, a chemical communication is still possible. The larger the system the more speedy communication gains importance. This is where the electrical transmission of in- and out-puts (the action potentials) is crucial. In complex nervous systems (*e.g.* the human nervous system),

the two modes of transmission of messages are operating in conjunction: electrical and chemical. The latter is the matter of the neurotransmitters.

About fifty neurotransmitters and cotransmitters have been identified in the human brain; some are inhibitory and others are excitatory (Changeux 1998: 148). The main neurotransmitters are: acetylcholine, the monoamines, the neuropeptides, and some amino acids. The monoamines comprise dopamine, noradrenaline (or epinephrine), and serotonine (or 5-hydroxy-tryptamine). They activate the monoaminergic (cholinergic, or adrenergic) receptors of the sympathetic nervous system – that is, the autonomous nervous system, the regulator of the basic vital systems (respiration, circulation, digestion, etc.). The main neuropeptides are the β-endorphins and enkephalins, the so-called natural opiates. Although the neuropeptides might be involved in the transmission of pain messages, (some of the opiate receptors are located in areas related to pain such as the centromedial nucleus, while others are located in the striatum which is not involved in the pain processes) their role is far from being fully understood (Carpenter 1996: 87). Finally, the amino acid gamma-aminobutyric acid (GABA) is an inhibitory neurotransmitter (its decrease is linked to the pathophysiology of epilepsy).

Each of the main neurotransmitters acts on a system called the diffuse modulatory system (or DMS) – that is, acts preferentially and predominantly upon an area of the central nervous system (there are areas of overlap). In other words, neurotransmitters exert stimulatory and inhibitory action on a brain map located mainly in the midbrain from where their influence fans in to and out of the forebrain (Changeux 1998)(Fig.8).[9] Since there are basically four main categories of neurotransmitters, the DMS comprises four corresponding maps.

The dopaminergic DMS is located in the substantia nigra and in the ventral tegmental area (*viz.*, in the truncus cerebri, at the junction between the pons and the pedunculi cerebri). It fans out to the frontal cortex, the limbic cortex, and the corpus striatum (*viz.*, the nucleus locus caudatus and putamen of the telencephalon). The noradrenergic DMS is situated in the nucleus locus ceruleus of the mesencephalon (midbrain). It fans out to the entire cerebral cortex, to the thalamus, the cerebellum, and the spinal cord. The serotonergic DMS is located in the medulla oblongata (hindbrain), more specifically in the raphe nuclei; it fans out to the entire central nervous system. Finally, the cholinergic DMS, located in the brain stem (hindbrain)

and at the base of the forebrain, fans out to the entire cortex, the hippocampus, and the thalamus (Changeux 1998; Kahle *et al.* 1996).

As emphasised by Carpenter (1996: 238), these are complex structures whose functions are uncertain. As with other parts of the central nervous system, the meagre information we have about the functions are mostly derived from clinical observations of the effects of damage in humans (239-240). A number of neurological and psychiatric diseases have been linked to dysfunctions in neurotransmission in the form of hyperactivity or hypoactivity. For instance, schizophrenia is attributed to an overactivity of the dopaminergic system; it can be improved by antipsychotic drugs that decrease the levels of dopamine in the brain. Parkinson's disease, on the contrary, is a condition of hypoactivity of the dopaminergic DMS; it responds to drugs that stimulate the production of dopamine (Globus 1995: 97). Alzheimer's disease is a condition of cholinergic hypoactivity. Serotonergic hypoactivity results in depression and sleep disturbances, whereas serotonergic hyperactivity might possibly be involved in autism (Berkow *et al.* 1992: 2656; Lazorthes 1999: 157).

Catecholaminergic neurons within this aminergic system (the dopamine mesocorticolimbic neurons of the ventral tegmental area of the midbrain) project in the prefrontal cortex and the nucleus accumbens of the limbic system. They constitute what Changeux (1998: 159) calls the "reward circuits in the brain". The former (*viz.*, the projections to the prefrontal cortex) contribute to motivation, planning, temporal organisation of behaviour, attention, and social behaviour; the latter (*viz.*, the projections to the limbic system) contribute to emotion, hedonic pleasure, and memory (ibid.).

An illustration of Carpenter's warning (*i.e.* that our knowledge of brain functions is incomplete and fragmented) is Lazorthes' (1999: 159) view on Changeux's reward circuits of the brain, which Lazorthes calls the "mesencephalic dopaminergic pathways" (situated in the archencephalon). It comprises the following pathways: 1) the mesocortical (from the locus niger to the prefrontal cortex) participates to arousal, decision-making, and behavioural patterns; 2) the nigrostriatum (from the locus niger to the nucleus caudatus and from the nucleus lenticularis of the thalamus to the corpus striatum) "controls" (sic) the initiation and the tone of movements; and 3) the mesolimbic (from the ventrotegmental area to the nucleus accumbens and the olfactory bulb) "controls" our moods. The same system, called by Carpenter (1996: 283) the "reticular activating system", has thalamic relays

that influence the neural circuits of the cerebral cortex, altering the level of activity by controlling the inflow. It also may prevent cortical activity from getting out of hand.

Concluding remarks

As mentioned in the introduction, this sketchy overview of very rough data on the evolution of the brain among animal species, the intrauterine development of the human brain, and some functional aspects of the mature human brain can only give us a faint idea of the intricacies of the matter of the brain. Knowledge of the function of the brain is still largely incomplete. Most of what we know about the structure and function of the brain of the unborn is extrapolated from information gathered from fetal lambs – the most utilised experimental model to study fetal physiology (Nathanielsz 1992). It would be very contentious to draw firm conclusions about the alleged presence or absence of such an elusive thing as sentience and to draw a moral theory from it. If one only thing should appear clearly from the above is the fact that the biologically well-informed would shy away from the biologically ill-informed deductions made by some moral philosophers about sentience.

There seems to be no clear evidence to support Peter Singer's claim (1995: 54) that animal behaviour is convincing evidence that they suffer (at least down to fish, reptiles and other vertebrates). First, contrary to the claim that human and nonhuman animal brains are similar (Singer 1993: 96) is the evidence that there is a great variety of vertebrates and a great variety of brain anatomy amongst them. Second, contrary to the claim that enkephalins and endorphins are present in the nervous system as a prove of sentience (Sumner 1997: 109), current neuroscientific evidence is far from having defined the function of these and other neurotransmitters. Third, to use pain and suffering synonymously, as Singer does, is arguable. Rachels (1995: 68) reminds us: "As Hume observed, normative conclusions cannot legitimately be derived from factual premises... for factual premises can never by themselves entail evaluations". In this case, the alleged facts presented by Singer and others are not substantiated by scientific evidence. Even if they were, would it follow that sentience qua sentience endows an entity with rights? My claim is not that nonhuman animals (and embryos and fetuses for that matter) do not deserve moral respect. On the contrary, my claim is that moral consideration should even extend beyond the world of sentient beings and include so-called insensate beings. The thing is that the concept of sentience and what

it entails (the concepts of pain and pleasure) might need to be placed in a wider perspective as, for instance, in *Animal Liberation: A Triangular Affair*, where J. Baird Callicott writes:

> Pain and pleasure seem to have nothing at all to do with good and evil if our appraisal is taken from the vantage point of ecological biology. Pain is primarily information...Pleasure appears to be, for the most part (unfortunately it is not always so) a reward accompanying those activities which contribute to organic maintenance...or to social solidarity...or to the continuation of the species...The idea that pain is evil is a primitive notion. To live is to be anxious about life, to feel pain and pleasure in a fitting mixture, and sooner or later to die (1995: 247).

Something similar might be said about the insistence on the concept of rights, a point made by Val Plumwood (1995: 200-201):

> Rights seem to have acquired an exaggerate importance as part of the prestige of the public sphere and the masculine, and the emphasis on separation and autonomy, on reason and abstraction. A more promising approach...would be to remove rights from the centre of the moral stage and pay more attention to some other less dualistic, moral concepts such as respect, sympathy, care, concern ,compassion, gratitude, friendship, and responsibility.

The point I am trying to make is this. Even if or when neurobiologists or neuroscientists manage to unravel the complexities of brain function and provide a final prove that this animal species *is* sentient, or that at a specific stage of intrauterine development the human embryo/fetus *is* sentient, it should not make a difference in the way it should be treated. One can argue at length whether sentience entails rights, intrinsic values, preferences, or interests (as animal liberationists do). Paraphrasing Tom Regan (1995: 74), "Many people who perform abortions are not cruel, sadistic people. But that fact about their character and motivation does not settle the terribly difficult question about the morality of abortion", one could say: many people who work on cattle farms, abattoirs, fisheries, animal experience laboratories, etc. are not cruel, sadistic people. This, however, does not settle the morality of animal rights, moral humanism, and exemptionalism. Equally, it would not settle Steinbock's (1992) controversial stance that nothing matters to insensate entities. As stated by Harley

Cahen (1995: 300), "Nonsentient organisms – those not capable of consciously taking interest in anything – have interests [and thus are candidates for moral considerability] in achieving their biological goals". This view is echoed by Paul Taylor (1996: 127), who writes: "We can act in a being's interest without it being interested in what we are doing to it in the sense of wanting or not wanting us to do it". Neither would it settle Aldo Leopold's (quoted in Baird Callicott 1995: 241) position: "A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise". By biotic community Leopold refers to individual animals and plants, and the whole ecosystem that sustains them.

Where should we stand amongst all these ethical claims? Can mere rationality reach a consensus amongst so many conflicting claims? Is sentience the last word? Or shall we conclude with Taylor (1995: 127): " the concept of a being's good is not coextensive with sentience".

5 The birth of the brain

Science without philosophy is blind, and philosophy without science is paralysed.

Paul Cilliers (1998: 13)

Introduction

Nothing is more complex than the brain. In the past, ratiocination about what is called higher-brain functions – that is, perception, reasoning, emotion, aesthetic preferences, planning, decision-making – was part of the realm of theology and philosophy (Rakic 1999: 90). With the "birth of the clinic", to use Michel Foucault's vocabulary, or the implementation of empirical sciences to the understanding of diseases as well as of physiology, our "gaze" into brain function is becoming less and less blurred. This is not to say that the complexity of the functions of the brain is now fully understood. On the contrary, the more we know about it the more complex it appears to be, and even more complex than one ever imagined.

Brain sciences now involve at least 18 disciplines (Mountcastle 1998: 3). Amongst them is what is called *neurophilosophy*, "a loose term for attempts to formulate ideas about our humanity by reconciling biological facts about the brain with abstract and historical concepts about behaviour" (Frackowiak 1998: 105). It provides an alternative vision of human moral and social nature through "carving and recarving world and mind into new categories" (Paul Churchland quoted in Sutton 1999) using *meta-neuroanatomy* (Sutton 1999). This is not without the risk of giving in into new "exuberant neuromythologies", or "misplaced physics-envy of overzealous reductionism" (Sutton 1999). On the other hand, the temptation to reject new paradigm shifts and new ways of thinking should equally be seen as a real risk to be avoided.

Thus, the quest is now for a balance between the hard empiricist view of the brain as a *tabula rasa*, and the hard nativist view of the brain, also called *Platonic neuralism* (Gazzaniga 1998). The hard empiricist view claims that neural activation is a necessary condition for the proper development of the brain in terms of both its

structure and of its function. The hard nativist view, inspired by Plato's theory of recollection or doctrine of anamnesis in the *Meno*, claims that we do not learn but merely recollect the knowledge already present in the brain (Knowles 1988: 36). A similar innatism was advocated by Gottfried Leibniz in *Nouveaux essays sur l'entendement humain* (1704). He compared the mind to a block of marble; the sculptor's work is to uncover a shape that is already present in the structure of the stone. On this view, the newborn is said to be armed with established brain circuits already able to process the necessary information enabling it to function in the physical world. In other words, the hard wiring of the brain is genetically encoded and regulated, leaving only a limited plasticity within the boundaries set by the constraints of genetic development (Gazzaniga & Gallagher 1998).

In between the two antipodean positions many contemporary neuroscientists have rather adopted the view that the way the brain operates borrows from both genetic factors originating from the process of evolution, and from sensory experience. Synaptic plasticity is the buzzword. Thus, to a large extent, many neuroscientists (and neurophilosophers alike) are moving away from the computer analogy (Mountcastle 1998: 29) in the direction of a "complex selectional system" (Edelman 1999: 50), or of "biologically realistic nets" (Globus 1995: 64).

The fundamental question is to try to unravel what it is to have a mind – that is, to be (self-) aware, to be (self-) conscious – and what type of brain structure and function is necessary for these high-level activities to take place (Edelman 1992: 4-7). The manner in which neurosciences have so far shed some light on these questions will be useful to understand the neurological development of the human embryo, fetus, and infant. We need a grasp of basic evolutionary, embryological, and neurological data to understand neurophilosophical arguments, since, by definition, neurophilosophy bases its arguments on neuroscientific data.

The evolutionary development of the brain

The first attempt at understanding the evolution of species is credited to French naturalist Jean-Baptiste Pierre Antoine de Monet, chevalier de Lamarck (1744-1829). In order to explain the evolution from simple to complex organisms,

Lamarck suggested his theory of transformation or of descent. His main thesis was that evolution is an adaptative process. Lamarck's motto was "la fonction crée l'organe" – that is, a specialised organ results from a protracted specific use thereof to accomplish a specific function. Two of Lamarck's well-known examples were the growth of webs between the toes of ducks resulting from swimming, and the elongation of the neck of the giraffe from grazing the leaves from the top of the trees. Lamarck's theory was "the first important rupture with the previous idyllic conception of a finished world of a great chain of being with man on top" (Changeux & Ricoeur 2000: 178). Although we may smile at the naiveté of the Lamarckian examples, the concept behind his theory has been vindicated by contemporary neurobiology, that is, that the use of the brain strengthens its connections (Hebb's rule). There is thus still a trace of Lamarckism in contemporary neurosciences.

In 1859, English physician and naturalist, Charles Robert Darwin (1809-1882) published his theory on the evolution of species based on the concept of natural selection: the fittest survive. His theory was that the central motor of evolution requires self-reproduction and heritable variation. Once these occur, natural selection will cull the fitter from the less fit (Kauffman 1995: 72). Although current views on the Darwinian theory of evolution suggest that the order of the biological world has evolved from natural selection sifting among random mutations is incomplete (vii), Edelman's *neural Darwinism* is part of the contemporary dominant views on the evolution of the brain. A few years later, in 1874, German naturalist Ernst Heinrich Haeckel proposed the theory of "basic biogenetic law" that embryogenesis is a short recapitulation of phylogenesis. In other words, during the development of the human embryo (embryogenesis) some stages of past evolutionary steps (mainly of the amphibians and fishes) are recapitulated. As a matter of fact, contemporary embryology shows that during the first five to six weeks after fertilisation the human embryo goes through morphological and structural changes common to fishes and amphibians; a rodent embryo also shows huge similarities with a human embryo (Sadler 2000: 415). During phylogenesis (the evolution of a specific species) and during ontogenesis (the development of an individual) the components necessary for the primary vital functions appear first (Kahle *et al.* 1996: 14). For instance, concerning the development of the embryonic brain, it is the function of the hindbrain (or rhombencephalon) and of the brain stem (the locus of the neurovegetative

automatic functions) that appears first. The full structure of the forebrain -the cerebral hemispheres and more specifically the future cortex - appears relatively late in pregnancy (during the second half of gestation). In other words, what appears first is the neural equipment needed for basic vegetative life; higher brain functions are not necessary (and arguably not even possible) during intra-uterine life (Lazorthes 1999). Interestingly, it is said that Ernst Haeckel inspired Frederick Engels' essay, *The Part Played by Labour in the Transition from Ape to Man* (Scarry 1985: 252). Engel's hypothesis was that it was not the size of the skull and of the brain that was crucial in the transition from ape to *Homo sapiens*, but rather the use of hands, the instrument to make tools.

The role played by heredity was unknown to Darwin. He was not and could not have been aware of the groundbreaking observations made by Brother Johann Gregor Mendel (1822-1884) crossing peas in a Moravian monastery. Darwin rebutted Lamarck, and Louis Bolk debunked Haeckel. Bolk's theory of neoteny (*i.e.*, the extension or retention of youth), presented in 1920, rejected Haeckel's theory of recapitulation in favour of the idea that some features of the young animal persist in the adult. For instance, humans share a list of features in common with young but not with adult chimpanzees. On this view, the young chimpanzee should be seen as a humanoid, or, conversely the adult human should be seen as a neotenic chimpanzee. Instead of having a fast recapitulation of the stages of evolution, neoteny claims that, on the contrary, the evolution of the individual is instead a slowing down process. In other words, the *higher* an animal is situated in terms of evolution, the slower its phylogenesis. For instance, in humans, gestation is longer and growth is slower than in chimpanzees. The newborn infant's brain is only a quarter of its final volume; at the age of six months, the infant's brain reaches the size of a newborn chimpanzee's brain. This would mean that, theoretically, humans should be born after 15 months of gestation if the intra-uterine development of the human brain were to be similar to that of the newborn chimpanzee. But that would be incompatible with the pelvic size of women (the fetal head would never be able to go through a woman's pelvis) (Lazorthes 1999: 194-195).

What we can see so far is that each of the scientific acquisitions or theories made independently during the eighteenth and nineteenth centuries by Lamarck, Darwin, Mendel, and Haeckel was a step in the right direction. The synthesis between

evolution and genetics (selection by mutation), "the two constructors of evolution" (Lorenz 1979: 73) had to wait for the end of the twentieth century to be made.

But let us go back to the facts and leave the theories on evolution momentarily aside. Somewhere in the evolution from protozoa (unicellular organisms without neural system, like the *amoeba*) to multicellular organisms, two types of living organisms did appear: the *hyponeureans* and the *epineureans*. The hyponeureans – that is, worms, mollusks, crustaceans, and insects – are characterised by the fact that their nervous system develops underneath (*hypo*) - that is, between the digestive tract and the abdominal wall. For this anatomic reason, the mouth becomes an obstacle to any possible cephalad (in the direction of the head) extension and development of the neural system. There is no brain because there is simply no space for it to develop. The hyponeureans possess only a diffuse network of sensory and motor nerves allowing only for basic reflex arcs, the simplest neuronal circuits linking a stimulus to a response (like a tendon-jerk) (Carpenter 1996: 206). The epineureans, on the other hand, the ancestors of the vertebrates, have their nervous system located above (*epi*) - that is, between the digestive tract and the back. Thanks to this feature, room becomes available for the primitive neuronal network to grow anteriorly and allows for a possible further development of the brain.

Amphioxus, the first known vertebrate, appeared 600 million years ago, the time of the Cambrian explosion. It is the ancestor of the so-called lower vertebrates: fishes, reptiles, and amphibians. Lower vertebrates posses what is called an archencephalon or rhombencephalon (hindbrain)[1] that allows them to process sensory data. Contrary to higher vertebrates that have both electrical and chemical (neurotransmitters) synapses, lower vertebrates possess only electrical synapses (Kahle *et al.* 1996: 24). Their behaviour is operated by a "fixed programme", that is purely reflex in nature (Lazorthes 1999: 24-29). In primitive single-celled organisms, the coordination is essentially chemical (Carpenter 1996: 3), and also purely reflex in nature.

The first mammals are said to have appeared 180 million years ago (about 65 million years after the Permian extinction of around 96 percent of all existing species that appeared with the Cambrian explosion). In addition to the lower vertebrate's hindbrain, these mammals possess a paleoencephalon or mesencephalon (limbic brain or midbrain). This important addition to the brain provides the ability to adapt to the

environment – that is, a minimal capacity of learning and of memory. The hippocampus, a component of the archicortex and of the limbic brain, is considered to play a role in the process of memory.

The first primates made their appearance 70 million years ago, a few million years before the extinction of the dinosaurs (estimated to have happened about 60 million years ago). With the first primates, appeared a second addition to the hindbrain: the neoencephalon or prosencephalon (forebrain). This forebrain has two components: the diencephalon (comprising the eyes, hypophysis, epiphysis, thalamus, and hypothalamus), and the telencephalon (the cerebral hemispheres). From now on, the stage is set for the possible appearance of higher brain functions. It will, however, take 62 million years before the *hominoidae* will evolve into *hominidae*, the precursors of the pre-human *Australopithecus* (the first to have adopted an upright stance) and of the *pongids* (apes and chimpanzees) (Mountcastle 1998: 9). The further steps will be from *Homo habilis* to *Homo erectus*, and finally to *Homo sapiens*. The latter is said to have appeared around 40 000 to 50 000 years ago. This slow process in the evolution of the brain through natural selection allowed the development of the frontal lobes of the brain, signaling "the birth of the mind" (Lazorthes 1999: 99).

Let us now briefly examine what are the current mainstream theories of the mind. A basic view on the two main tendencies in the field is helpful to understand to what extent the fetal brain might be able or not to function, or what kind of function might be possible.

Brain and mind

Sciences of the mind attempt to know how the brain enables the mind. Two major schools of thought have arisen in philosophy of the mind: *functionalism* (cognitivism), and *connectionism* (neural networks).

In the functionalist perspective initially pioneered by Hilary Putnam (but who no longer supports it, because psychological states cannot be described by the computational model) (Edelman 1992: 223; Cilliers 1998: 30), the brain operates like a Turing machine[2] (the computational theory of the mind). On this view, the brain (the physical substrate) constitutes the hardware, which can run different programs, the

software (the mind, the mental thing). The system follows pre-established rules or algorithms. On this view, mental states can be defined by three relations: 1) what typically causes them; 2) what effects they have on other mental states; and 3) what effects they have on behaviour (Blackburn 1996: 150-151). Functionalism, however, raises serious problems about representation, mainly the adequacy of a physical system to adapt to functional states, and the meaning-giving ability of a physical system (Cilliers 1998: 61). Because of the difficulties involved in functionalism, Paul Churchland (1989: 12-14) compared it to alchemy: "an outrage against reason and truth...a smoke screen for the preservation of error and confusion". Notwithstanding this reservation, he accepts functionalism while acknowledging its "methodological problems" (44); he strongly believes that neuroscience will come up with an explanation of how the brain functions (54). On Miklos' (1998: 207-208) view, the difficulty with the computer analogy is dual. First, in the computer-like view, a brain does not construct its world by interacting with it but "rather stamps itself on the brain". In reality, he says, "the world is 'unlabelled', changing and not prefigured". In other words, as expressed by Changeux (Changeux & Ricoeur 2000: 91), there is no Platonic world of pre-established Forms and Ideas, it is by a process of selection [by the brain] that the world comes to be labeled (117). Second, in view of the documented continuous loss of synapses (*e.g.*, 30 000 synapses are lost per second in the cortex of macaque monkeys), if it were a computer it would shutdown (Miklos 1998). Third, the nervous system is a parallel-processing device (whereas the conventional computer is serial). Signals are processed at the same time in different networks and interactions between neurons are non-linear and modifiable so that new properties emerge, and emergence is a central feature of complex systems (Lewin 1997: 164).

In the connectionist perspective, on the other hand, the neural network is constantly adjusting the weights of signals (input) to adjust the output to the circumstances. There is no hard wiring or pre-established programme to process information; the brain is a self-tuning net. According to this view, brain states "evolve under tunable constraints" (Globus 1995: x). The system operates through the interaction of its components. It is *distributed* – that is, there is no hierarchy, no *homunculus* or *femincula,* and no *pontifical cell* (in Jamesian vocabulary). The distributed functioning of the brain provides an "uncentered brain" (Kinsbourne 1998:

248). We have thus moved from *phrenology* (the attribution of functions to specific sites, or maps, in the brain) to *neophrenology* (brain maps are still there but they interact through what Edelman calls *reentry*). Churchland sees connectionism as follows:

> an approach to human cognitions that is at once naturalistic, reductionistic, and capable of explaining both the radical plasticity of human consciousness, and its intricate dependence on the extended cultural surround. It resides at the interface of computational neuroscience, cognitive psychology, and artificial intelligence (1989: 130).

What thus basically opposes the two views is that functionalism sees the brain operating in a linear fashion (the input is proportional to the output, like in a Turing machine); whereas connectionism views the brain within a non-linear perspective (a very small input can cause large changes in output, like the butterfly effect). The former operates in equilibrium conditions, and the latter is subject to complexity far from equilibrium (Cilliers 1998). The processing of information by the brain is thus radically different from the conventional digital computer (Churchland 1989: 156). To make matters even more complex, Globus (1995: 60) sees in connectionism two tendencies, which he calls conventional and radical connectionism. Conventional connectionism, he says, is still computational since it views information processing through representation (even if representation is *distributed*). Globus' radical connectionism claims to be non-computational because unlike with computation, the results are unpredictable, chaotic, non-representational (72, 99). Like Miklos, he claims that the outside is not re-presented inside. He goes even further saying that "it no longer makes sense even to talk of representation", for:

> The input influx (both from the environment and from the endosomatic instinctual and emotional sources) provides a shifting constraint on the self-organising process, together with other flowing constraints due to chemical modulation of connectivity, connection weights, transfer functions, parameters and neurotransmitter expression. The outside is not re-presented inside but participates on the inside as but one constraint on a self-organising process (67).

For Globus (101), "the brain is an autopoietic, autodynamic, self-organising, nonlinear dynamical, complex system". He strongly claims his affinity with continental philosophy, more specifically with Martin Heidegger and Jacques Derrida. From Heidegger he borrows the concept of *Dasein*, the way we are in the world: "no brain, no Da-Sein; no Da-sein, no brain" (36). From Derrida he borrows the concept of *différance*:

> The difference of *différance* is like the difference in neural nets: in both there are nodes, which are foci of relatedness embedded in a complex network of relationships. These nodes open two ways to the whole: the whole fans in on the node and the node fans out to the whole. *Différance* is not present meaning, the condition for the possibility of meaning. Connection weights are the conditions for the possibility of meaning in neural nets. The difference of *différance* can be found in neural nets, as a function of the connection weights (54)...The "postmodern brain" which meshes with Derrida's sheaf of *différance* is a connectionist system whose processes are spontaneous, unpredictable, non-logical, self-organising, self-tuning and holonomic (59).

The main focus of the present essay is to analyse the concept of sentience, to find out what neural equipment it requires, and to investigate it's appropriateness as a criterion of moral standing. Functionalism much more than connectionism can be traced in the views expressed on sentience in human and non-human animals. Sentience is not like an action-reaction formula, a binary phenomenon, on or off, a Skinner box. There are degrees of it. The behaviour of a rat (a sentient nonhuman animal) to external stimuli is predictable; to predict the behaviour of an ape (a sentient nonhuman animal) we need to have some insight into what it desires and thinks (Mitchell 1997: 16).If functionalism should be viewed as a rather simplistic explanation of the function of the nervous system, it can be said that the moral considerability attributed to the faculty of sentience (as presented by their advocates) is inspired by functionalism and is simplistic and naïve. The thesis presented in this essay is rather inspired by a connectionist view on the structure and function of the nervous system, including the complexity of qualia. The aim is to show that there is more to sentience than it might appear *prima facie*. Or, in Jean-Pierre Changeux's words:

A naïve neural model for the Epicurean position would thus be that we have in our brain "pleasure centers". The situation is not that simple (1998: 157). But let us once again consider what the advocates of sentience have to say. The argument is roughly as follows. A living entity that possesses the ability to feel is an entity that is able to suffer, to feel pain (and to enjoy, to feel good). It is wrong to inflict pain to any living being that is able to feel pain. Killing inflicts pain to a sentient being. Therefore, it is wrong to kill a sentient being (but, arguably, permissible to kill that same being before it has acquired sentience). This is, in a nutshell, the argument developed by L. Wayne Sumner in *The Morality of Abortion* (1983). In *Animal Rights* (1975), Peter Singer develops a similar argument but basically in favour of nonhuman animals. Human and nonhuman animals are sentient, able to experience pain and pleasure. It is in their interest to experience pleasure and to avoid pain. To inflict pain to a sentient being is acting against its interest. Therefore, it is wrong to inflict pain to nonhuman animals.

More will be said about the ethical argument. In this section I wish to focus on the neuroanatomical and neurofunctional requirements for sentience as an indicator of awareness (primary consciousness) or of self-awareness (higher-level consciousness). In other words, to feel pain requires a basic neural equipment needed for the awareness of that feeling. *To suffer or to feel pain as being mine* (self-awareness) needs more than a basic and coarse neural equipment. For it is one thing to *claim* that a living entity is sentient, but it is altogether another thing to *prove* beyond reasonable doubt that that being is sentient in the sense of suffering, of experiencing pain as its own suffering. The prove or disprove has to rest on proper neuroscientific evidence to be valid. If the claim about sentience cannot be substantiated the alleged neurophilosophical argument will collapse. In order to prove or disprove anything about sentience we need a minimum understanding of neurophysiology and neuroanatomy.

Basic neuroanatomy and neurophysiology

The neuron (nerve cell) is the basic unit that constitutes the entire nervous system, peripheral and central. The neuron consists of a cellular body (a cell membrane, a

nucleus, and a cytoplasm with its organelles) and its extensions. One pole of the neuron has dendrites (from the Greek *dendron*, tree) resembling the branches of a tree; the other pole has an axon. Peripheral nerve dendrites receive the inputs, and the axons transport the outputs in the form of action potentials to the central nervous system (i.e. the spinal cord and the brain).

Neurons communicate at the level of the synapses (a word coined by Sherrington, Nobel Prize laureate 1932) (or end-plates) through electrical signals (action potentials) or chemical signals (neurotransmitters). There are four classes of neurotransmitters and more than 50 known neurotransmitters and cotransmitters (Changeux 1998: 148). Only for a small proportion of synapses in the central nervous system, it is known which transmitter is doing exactly what (Carpenter 1996: 58). As a general rule, however, it is known that as a result of a transmitter release, electrical signaling not only takes place but also leads to changes in the biochemistry and even in the gene expression of target neurons (Edelman 1998: 41). Synapses do not only transmit messages, they also contribute to the maintenance of the cells they contact (Carpenter 1996: 67). In other words, only what functions persists (Lazorthes 1999: 109).

There are two types of neurons: the excitatory and the inhibitory neurons. The predominance of either of the two results in either the strengthening or the weakening of connections (synapses) during development and during the process of learning (Gazzaniga & Hutsler 1999: 131) – that is, Donald Hebb's rule[3] or "unsupervised learning rules" (Bear & Cooper 1998: 136). This synaptic plasticity is an important factor in the ontogenic development of neural circuits in the cerebral cortex; it is largely influenced by activity-dependent competition in all brains, young or old (Mountcastle 1998:7). The first stages of synaptogenesis during intra-uterine life are genetically encoded; the progressive attunement of synaptogenesis is conditioned by the interaction with the environment (Lazorthes 1999: 109-110). The level of activation of a neuron is thus a function of four factors: 1) the number of connections; 2) the weight of the connections; 3) their polarity (stimulatory or inhibitory); and 4) the strengths of incoming signals (Churchland 1998: 160).

The take home message, so far, is that one should beware of simplistic views on neurobiology. With the short overview given of some basic neurophysiological data it already appears that a morphologically similar looking cell, the neuron,

operates in a large variety of ways and under a wide spectrum of influences.[4] To see neurons as simple reflex arcs is simplistic, naïve, and ill-informed. There are some 28 billion neurons in the brain, and each one receives and gives an average of 10^4 synaptic connections. The brain contains one to ten trillion synapses (Edelman 1998: 38; Mountcastle 1998: 5). It is very unlikely, says Edelman, that the entire circuitry is encoded in the genes. According to Kauffman (1995), the linear sequence of genes in a genome does not specify the genesis of form in an embryo. The genes only produce component parts of the system, within a range of values. The next step is "dynamics generating geometry and geometry modifying dynamics"(Lewin 1997: 36). Furthermore, experiments in mammals show that connections can be altered by the pattern of neural activity resulting in the maintenance of useful connections and the loss of useless or unused connections – the prove that the brain is capable of self-organisation (Carpenter 1996: 66-67). And self-organisation, says Kauffman (1995: 185), "may be the *precondition* of evolvability itself", because "only those systems that are able to organise themselves spontaneously may be able to evolve further". In 1977, David H. Hubel and Torsten N. Wiesel showed that even when the genetically determined visual apparatus of the *Macaque* monkey is intact at birth, the organism must be exposed to visual stimuli after birth, after which visual education becomes less important. There is, in other words, a critical period for vision, says British professor of neurobiology Semir Zeki (1998: 81), "just as there appears to be for emotional development". He further argues: "The brain needs to be visually nourished at critical periods after birth so as not to remain almost indefinitely blind". One may wonder whether emotional development after birth needs equally to be nourished at critical periods to prevent the disappearance of emotions.

Another fascinating example of brain plasticity was shown by Sur *et al* (quoted in Churchland 1989: 267). They induced the axons in the optic nerve of neonate ferrets to project in the auditory pathway instead of leaving them in the visual pathway (where they normally belong). This resulted in the fact that the auditory cortex became driven exclusively by information sent from the eyes. These animals did nevertheless develop significant visual function. This shows, says Churchland, that "the processing features specific to our adult sensory systems are not endogenously specified, but rather are developed over time in a highly plastic system

that is shaped by the long-term characteristics of the sensory input they receive from the periphery".

Having now a basic idea about how neurons function and interconnect, let us now consider more specifically current views on how the brain neurons are interconnected. This is the topic of the so-called brain maps.

Brain maps

Franz-Joseph Gall (1758-1828), a neuroanatomist and the father of *phrenology* (etymologically, the science of the mind; from the Greek *phren*, mind), was the first to represent the human cerebral cortex as a geographical map. His idea was that bundles of nerve fibers unite on the surface of the brain; each area was supposed to function as a distinct organ representing each of the 30 human mental and moral faculties. While the concept of brain maps still remains, Gall's view was in William James words:

> Phrenology hardly does more than restate the problem. To answer the question, "Why do I like children?" by saying, "Because you have a large organ of philoprogenitiveness", but renames the phenomenon to be explained (1890: 28).

Pierre Flourens (1794-1867) debunked phrenology's concept of the brain as composed of independently functioning areas with specific functions; he was the first to claim that brain function is *distributed* throughout the cortex. The concept of distributedness of brain function still prevails. The true founder of cerebral localisation was French anthropologist and surgeon Pierre Paul Broca (1824-1880), who, in 1861, localised the cortical center of speech where it really is: the third convolution of the left frontal lobe. In his enthusiasm, Broca wrote: "if it is established that an intellectual faculty is located in a specific area of the cerebral hemispheres, it is highly likely, if not absolutely certain, that each convolution is involved in a specific function" (quoted in Lazorthes 1999: 77). It remains still true that the *Broca area* plays a fundamental role in speech. Also to Broca's credit is the concept of the dominance of one of the two cerebral hemispheres.

In the following years, interest and research in the anatomy of the brain and in the patho-physiology of brain diseases brought about a large amount of knowledge in the field of neurosciences. Not only were human neurological diseases the subject matter of extensive investigation; the most amazing, not to say appalling, experiments were run in animals (mainly frogs, dogs, cats, and monkeys), as vividly described by William James (1890). The concept of brain maps, suggested by Gall and confirmed by Broca (in a more scientific and more relevant sense), received a new impetus with German neurologist Korbinian Brodmann's preliminary descriptions, first published in 1909 (Rakic 1999: 90). His final "architectonic map", published in 1923, comprises 52 distinct areas. Brodmann's maps are still used and illustrated in contemporary textbooks of neuroanatomy. What has changed is the explanation of their origin and of their connections. Brain maps are no longer considered the exclusive site of the function of, say vision, audition, speech (as suggested by Gall's phrenology); maps interact and integrate various types of inputs to ensure the most adequate output or response (Edelman's concept of *reentry*). In Andy Clark's words:

> The concept of, for instance, the "somatotopic map" in which a dedicated neural subregion governed each individual digit....is a tidy, easily conceptualized solution to the problem of finger control. But it is the engineer's solution, not (it now seems) that of nature (1998: 260).

Gall's phrenology has been re-christened *neophrenology*: it emphasises, in Pasko Rakic's (1999: 90) words, "the importance of being well placed and having right connections". Rakic's interest, as a neurobiologist, is mainly the "*protomap* hypothesis of brain development". Let us now turn to the development of the fetal brain.

Fetal brain development

The protomap is the embryonic/fetal precursor of the cortical maps; the challenge is to find out how these maps come into existence. Are they purely genetically programmed (*viz.*, the nativist view), or are they also influenced by

external signals (*viz.*, the empiricist view)? Before answering these questions, we have to have a look at the intra-uterine development of the human brain. In what follows only a very general overview on brain development is presented. More details and pictorials are available (notes 2 to 12).

John L. Casti writes: "The greatest unsolved problem in biology, the real *terra incognita* of the field, is the enigma of embryology". The challenge is to find a rational explanation for "how the local genetic coding in individual cells could cause the global unfolding of the embryo"(1994: 69). Mathematical models have been proposed by René Thom (1972), the father of the catastrophe theory, and by Alan Turing (1952). Turing suggested the theory of *morphogens*, or chemical gradients to explain the interaction between cells in the growing embryo (69, 71). The fact is that from one single cell, the zygote, an estimated 256 different (that is, differentiated or specialised) cell types do arise, and that despite the fact that each single cell contains the same genome the specialised cells express some genes and suppress others. This can be explained only by a "spontaneous order that selection then goes on to mold...an emergent property of complex networks of genes controlling one another's activities", like in a Boolean network (Kauffman 1995: 18-19). The fitness is determined by the number of genes in the species (the elements of the network) and their interaction (the number of connections between the elements). By tuning the connectedness of the genes, the fitness of various combinations changes and produces a new "landscape" (Lewin 1993: 57).

The first evidence of the future central nervous system is the appearance of the primitive streak on day 15-to-16 after fertilisation (the embryo proper stage). It consists of a small depression bordered by ridges at the caudal end of the embryonic disk. Progressively this process of neurulation extends cephalad. At this stage, the neural groove deepens and the ridges approximate and fuse to produce a neural tube. The closure of the tube is complete at day-27 (4 weeks after fertilization, or 6 weeks after the last menstrual period), but there is no "brain" yet. The cephalic end of the neural tube dilates; although there is still no demarcation into distinguishable vesicles, it is theoretically already subdivided into three portions called respectively the forebrain (prosencephalon), the midbrain (mesencephalon), and the hindbrain (rhombencephalon)[5]. It is not before day-32 (4½ weeks, or one month after fertilization) that the dilatations exhibit incisures and three distinct dilatations, the

primary brain vesicles, can be observed.[6] At 8 weeks (56-day embryo), when the embryo measures 27 mm, the cerebral hemispheres exhibit a small protrusion, the olfactory bulb; the diencephalon (the future eyes, hypophysis, epiphysis, thalamus, and hypothalamus) starts taking shape.[7] Two distinct regions make their appearance in the hindbrain: the metencephalon (the future cerebellum and pons), and the myelencephalon (the future medulla oblongata).

So far, homeobox or HOX genes, determining the position and the identity of the neural structures, exclusively regulate the patterning of the central nervous system. Further differentiation will occur under the influence of growth factors, key-signaling molecules (Sadler 2000).

In a 10-week fetus, the cerebral hemispheres exhibit a flat surface.[8] It is only during the final part of fetal life (when it has grown up to a body length of more than 30 cm, i.e. during the sixth month (Kahle *et al.* 1996) or seventh month (Sadler 2000: 425) of intrauterine life, that the surface of the cerebral hemispheres grows so rapidly that a number of convolutions (gyri) separated by fissures (sulci) will start appearing on its surface (to accommodate with the size of the skull).

The cerebral cortex develops in waves of neuroblasts (immature and undifferentiated nerve cells) coming from the *pallium* (coat) located laterally to the primitive thalamus and primitive hippocampus of the 8-weeks embryo. The subsequent waves of neuroblasts migrating to the cortex cover the previous waves; the early-formed neuroblasts obtain a deep position in the cortex, and the later-formed neuroblasts migrate to a more superficial position. The final layout of the cortex is that of a sheet made up of six layers of cells and fibers. The main output (through the axons) from the cortex comes from the large pyramidal cells of layer V to their subcortical destinations (mainly the thalamus); the dendrites branch out in all directions to connect with the other layers (functional association) (Carpenter 1996:226-228). The thalamic fibers have been said to connect with the human neo-cortex at about 22-23 weeks of gestation (Flower 1985). According to Grobstein (1988: 55), "an adequate neural substrate for experienced pain does not exist until about 30 weeks". He, however, conceded that "a provisional boundary at about 26 weeks should provide safety against reasonable concerns" (130).

One should, however, take these statements with caution. Peripheral pain receptors have afferents through the spinothalamic tract. The ascending fibres concerned with first pain (pricking pain) go to the somatosensory thalamus and from there to the cortex, particularly the SII area of the somatosensory cortex. The pathways for second pain (burning pain) are older and more diffuse (Carpenter 2000: 85). Neurophysiologist RHS Carpenter writes:

> The relation between the type or intensity of a stimulus and the degree of pain that is felt is a highly variable one that depends to a large extent on the emotional state of the subject and on any implications or meaning that the pain may have... One of the clearest pieces of evidence that there is a degree of separation between peripheral neural discharges and the objective sense of the existence of a noxious stimulus on the one hand, and actually feeling pain on the other, comes from patients who have undergone frontal leucotomy to relieve intractable pain (85).The central pathways for pain are in fact rather complex and poorly understood, partly because the sensation of pain is itself very complex (85).

In other words, it is not enough to state that some connections between the thalamus and the cortex are established to conclude that the fetus is able to *feel* pain. Connections must be established with the prefrontal associative cortex to give pain a meaning. The "emotional" facet of sentience is to feel pain as my pain. Emotions are part of long-term memory. And long-term memory is located at the level of the various pathways that unite the frontal cortex with the limbic brain, and most especially the amygdala (Changeux & Ricoeur 2000: 140). The following important point is made by Changeux:

> Connections between nerve cells are gradually established over the course of development by a process of trial and error. The selection and elimination of such connections are regulated to a substantial degree by the newborn's interaction with the environment and with itself (6).

It can safely be said, I think, that the fetus' interaction with the environment must be rather limited. Some type of reaction has been observed when an intense light

or a noise is applied on a pregnant woman's abdomen. It is not clear whether this proves anything more than a certain ability to hear and to see. To quote Changeux again:

> The human child is born with a very immature brain, whose synaptic network is incompletely established and therefore ready to receive traces of the environment. At birth, his brain produces mental objects of a particular type that might be called prerepresentations (or preliminary representations) (112).

Rakic's protomap hypothesis of brain development states that in the phylogeny of the cerebral cortex some genes (the above mentioned HOX genes) are expressed in a region-specific manner prior to, or in the absence of, input from the periphery. In other words, the coarse mapping of the cerebral cortex is encoded in the genetic equipment; this general structure of the brain needs no input from the outside to get established. The function of the brain – that is, the determination of the size and of the synaptic characteristics of the cerebral cortex – needs afferent signals from extra-cortical sources. It has been shown that *after birth*, in humans, synaptic density increases rapidly until it reaches a peak in early childhood (Rakic 1999: 104). It is now quite well established that "genetic *and* environmental influences interact in defining the connectivity within and between cortical microcircuits and the specification of architectural fields" (Mountcastle 1998: 9). Now, part of the activity-dependent processes of axonal growth, synaptic remodeling, and refinement of connectivity, may occur in the absence of extrinsic stimulation – that is, during REM-sleep, active or paradoxical sleep (Borbély & Tononi 1999: 187). Knowing that the fetus spends most of its time in REM and non-REM sleep[9] (186), it may be hypothesised that some synaptic growth and maturation of neuronal circuits does occur in the fetal brain in the absence of extrinsic stimuli. The newborn, says Kinsbourne:

> has a full complement of neurons; further development proceeds by selective death and elimination of synaptic connections. The biological chisel prefigures the microgenesis of brain states....The fact that a neural system is in place does not guarantee that it will participate in the control of behaviour; it needs to be switched on, or activated (1999: 246, 252).

In addition to the above, one has also to distinguish automatic from non-automatic processing systems. According to Marcus Raichle:

> The non-automatic processing system [for more difficult and novel tasks] is subserved largely by the frontal cortex, and it takes that area of the brain some time to develop fully after birth....The child's immature brain finds it difficult to make an adaptation and to change a habitual response (1999: 115-116).

Let us now summarise what we have learned so far from developmental neurosciences. The embryonic/fetal brain acquires a coarse network of cerebral neural connections mainly under the influence of specific genes. The cortico-thalamic connections (which play a role in the ability to *feel*, in its broadest sense) have been said to start to be established the earliest around 22 weeks (Flower 1985). However, a structure might be in place without having yet the ability to function. Some fine-tuning of the neuronal network is likely to occur during fetal sleep without the intervention of external stimuli. The automatic processing system of the brain is ready to function at birth. The non-automatic processing system that allows adaptation to new situations is far from being ready. Sentience, in its broadest sense of the ability to feel, *may be* present the earliest at 22 weeks; qualia, the consciousness of feelings and emotions, are unlikely to be present in a fetus.

Concluding remarks

Heraclites of Ephesus (died after 480 BCE) is principally remembered for the doctrine of the "flux" of all things: παντα ρει - everything flows, nothing can be categorised, the wind cannot be caged. Even the flux cannot be captured in words. His follower, Cratylus (5th century BCE), reached the logical conclusion that the right course is just to stay silent and wag one's finger (Blackburn 1996: 87). Two and a half thousand years later, Heraclites has made a come back. The title of one of Gerald Edelman's books, *Bright Air, Brilliant Fire* (1992), is a reference to Heraclites' theory of the four elements: fire, air (breath, the stuff of which souls are composed), earth

and water. Gordon Globus, in *The Postmodern Brain* (1995), refers to Heraclites as "the progenitor of non-linear brain dynamics". Much water has flown under the bridges during the 2500 years from Heraclites to contemporary neurosciences. Many paradigm shifts have taken place.

Nicolaus Copernicus (1473-1543) dismissed the traditional Ptolemaic theory of geocentrism and replaced it with the theory of heliocentrism. Although not popular at first, heliocentrism was confirmed by Galileo Galilei (1564-1642), and later by Johannes Kepler (1571-1630). Both may be considered as the founders of proper scientific observation as the true source of knowledge of the physical world, as opposed to traditional authority, dogmatism, and speculation. Isaac Newton (1642-1727) followed in their footsteps, but with some restrictions though. In his opus magnum, the *Philosophiae Naturalis Principia Mathematica* (1687), he argued: "It is not to be conceived that mere mechanical causes could give birth to so many regular motions" (quoted in Blackburn 1996: 261). In other words, the laws of nature, the order of the universe, the causes of the law of gravity, cannot be explained without a Supreme Being, a Creator. This illustrates the difficulty people (even sometimes the authors of a paradigm shift) may experience in accepting all the consequences of a paradigm shift. The same applies to the ontologic problem of the mind. Is it a purely physical thing (*e.g.*, reductive materialism), or is there an essentially nonphysical thing, with no matter, shape, and position in space? Neither materialism nor dualism can yet explain all what has to be explained (Churchland 1999: 12, 18).

Darwin brought about another paradigm shift. As though it was not enough to have displaced the center of the universe from the planet earth to the planet sun, Darwin dethroned *Man* from *his* central place in the animal kingdom. The new horror provoked by Darwin was, in Mary Midgley's (1994) words, the question: "How can we, without degradation, suppose the more admirable features of human life to have arisen out of something that was not human?" Friends and foes of speciesism are still alive and well".

The twenty-first century is, in the eyes of neuroscientists, the century of the brain. The new paradigm shift is that modern linear, rule-governed, and logical thinking, with "hidden great wells of passion and spirit of domination" (Globus 1995: 122) is loosing terrain in favour of postmodern thinking. The *postmodern brain*, to use Globus' vocabulary, is plastic, constantly restructuring itself, in relentless flux. Is

there anything like a "brain birth", as suggested by Bonnie Steinbock (1992)? The answer seems to be no. There is, in the ontogenesis of the embryonic/fetal brain, no clear *marker event* that would indicate a time when the structure *and* the function of the brain have reached a kind of accomplishment that would be enough to say: yes, from this stage on the brain is born. The hard nativist view is very unlikely. The hard empiricist view has a better chance of being representative of how the brain really functions. The difficulty might be to accept facts as they are. Aren't we scared of reductionism? Can the mind be reduced to complex brain chemistry? Can we accept the idea that the embryonic and fetal brain is not a miniature adult brain? And yet, it surely isn't.

The greatest challenge to *man* is the proverbial "Know thyself"; and the aim of philosophy, said Wittgenstein, is to clarify our ideas. Konrad Lorenz (1979: 189-190) believes that there are three main obstacles to the command to "Know thyself": 1) our reluctance to accept our evolutionary origin (especially the close relationship to the chimpanzee); 2) our reluctance to accept the fact that our own behaviour obeys to laws of natural causation (for we tend rather to believe that we possess a free will); and 3) the heritage of Western idealistic philosophy that appeals to *man*'s spiritual pride. So, we are caught between *vitalism*, a mystically inclined observation of nature, which does not really explain the process in question (41), and *reductionism*, a reaction against ontological dualism (Changeux & Ricoeur 2000: 20). The contemporary neurosciences taken as a whole do raise the spectrum of a reduction of life processes to physico-chemical processes, which they undoubtedly are. It would, however, be wrong, said Lorenz (1979: 197), to assert that life is *essentially* only a physico-chemical process. Nonetheless, he adds: "to regard *man*...as the final and unsurpassable achievement of creation... is certainly the most arrogant and dangerous of all untenable doctrines".

This leaves us with the open question raised by Paul Ricoeur (Changeux & Ricoeur 2000: 8): "How can neuronal man be a moral subject?" (an allusion to Changeux's book, *Neuronal Man*). One may extrapolate the same question to the unborn: How can neuronal fetus be a moral subject?

6 Three moral philosophers on sentience

Nature has placed mankind under the governance of two sovereign masters, pain and pleasure.

Jeremy Bentham (1789)

Introduction

The thesis that an entity's ability to *feel* pain and pleasure must be taken into consideration in the moral deliberation about how that entity deserves to be treated, is a basic tenet of classical utilitarianism. The implications of this tenet on the morality of abortion and on the so-called animal rights started to be explored thoroughly only in the second half of the twentieth-century.

In Erwin Straus' (1963: 317) view, *sensing* is an all-inclusive road of access to the world in its generality. The fabric of *sentience*, said Straus, is this experience of generality or of signals, which points to a kind of *consciousness* "also to be found in animals". He further wrote (1966: 247): "Experiencing is synonymous with experiencing-the-world and with experiencing-oneself-in-the-world [it] cannot be translated into or replaced by the sequence 'stimulus and response' ".

These quotes are relevant to the topic of this chapter, which is mainly to explore the concept of sentience and its link with "a kind of consciousness", for it is used in the argumentation about the moral standing of the unborn by L. Wayne Sumner, and of the justification of animal rights by Peter Singer.

Sentience, as will be discussed, is part of the so-called *qualia*. Maurice Merleau-Ponty writes the following about the qualia:

> A certain form of external experience implies and produces a certain consciousness of one's own body...[perception presents itself] as a re-creation or re-constitution of the world at every moment...Sensations, 'sensible qualities' are then far from being reducible to a certain indescribable state or qualia...they are enveloped in a living significance (1999: 206-207).

Both views, as expressed by Straus and by Merleau-Ponty, see a link between sensation or sentience, and some kind of consciousness. In order to understand this link one has, first, to explore both concepts, and second, one has to investigate if and how they are linked. If this link can be established, it remains to be seen whether it can be used as an argument about the moral standing of beings endowed with sentience.

In this section, I will first explore the concept of qualia versus sentience. This will be followed by the analysis of Sumner, Singer, and Steinbock's views on sentience as a criterion of moral standing.

The 'qualia' conundrum

In Paul M. Churchland's words:

> 'Qualia' is a philosopher's term of art denoting those intrinsic or monadic properties of our sensations discriminated in introspection...Qualia are not an ineffable mystery... they are physical features of our psychological states...On the view argued here, the nature of specific qualia will be revealed by neurophysiology, neurochemistry, and neurophysics (1989: 23, 31).

Churchland's definition of qualia is somehow in line with Gerald Edelman's (1992: 114) view[1] that qualia are phenomenal or felt properties as "they constitute the collection of personal or subjective experiences, feelings, and sensations that accompany awareness". In other words, qualia refer to "how things seem to us" (ibid.). This implies that the understanding of the qualia experienced by another individual is limited by their subjective character *and* by the fact that the observer himself or herself is not qualia-free. However, since human beings are self-conscious animals (as opposed to non-human animals that are conscious but not self-conscious, as will be discussed later) the subjectivity of qualia does not preclude the scientific investigation of the phenomena of consciousness, of which qualia are part of (ibid.). What, in Edelman's view, is required for having qualia is the possession of higher-order consciousness (115), for to have qualia one needs higher-order categorisation[2] (116). To posses higher-order consciousness is "to be conscious of being conscious" – that is, to have a minimum of "an emerging consciousness of the distinction between

the self and other entities classified as non-self" (125). Higher-order consciousness, he claims, is more than the primary consciousness of biological identity (133). Finally, on Edelman's view, qualia do require the possession of the "appropriate morphology and experience" (135).[3] This, however, does not mean that non-human animals – that is, those with only primary consciousness – do not experience qualia. The difference between the qualia of entities with higher-order consciousness and the qualia of beings with primary consciousness only is that "if they [qualia] occur [in beings with only primary consciousness] they exist only for the duration of the remembered present of the scene" (135).[4] Our assumption that non-human animals with primary consciousness do experience qualia, says Edelman, derives from the observation of *behavioural responses* (ibid.). Those entities can neither report qualia nor reflect on them; they experience them (as we assume they do) "solely in the remembered present" (151) – that is, as an ongoing experience without awareness of past experience (167).

One may argue that Edelman's attribution of qualia to non-human animals confuses the issue. For he writes: "They [qualia] are phenomenal states – 'how things seem to us' as human beings" (114). And also: "The *qualia assumption* distinguishes between higher-order (i.e. direct awareness in a human being who has language and a reportable subjective life) and primary...consciousness". If qualia require the possession of a concept of time (past and future) and language, it follows that entities with primary consciousness must be qualia-free. And any living entity that does not possess qualia can only possess sentience in its primary sense of the ability to feel without being able to introspect on that feeling.

Paul Churchland (1989: 31), who believes that "qualia are not an ineffable mystery", claims that their nature "will be revealed by neurophysiology, neurochemistry, and neurophysics". He argues against Thomas Nagel's (1974) view that even if one would have total knowledge of a bat's neurophysiology and its interaction with the world, one could still not know nor imagine "What is it like to be a bat?". For Churchland (66), "the elusiveness of the bat's inner life stems not from the metaphysical *emergence* of its internal qualia, but only from the finite capacities of our idiosyncratically human brains". Recently, however, Nagel (1998) has conceded that it would be "overconfident to conclude, from one's inability to imagine how mental phenomena might turn out to have physical properties that the possibility can be ruled out in advance".

This is not the place to enter into the endless debate between dualism and monism. Nevertheless, we should acknowledge with Chuchland (1999: 21) that "We are creatures of matter and we should learn to live with that fact". This needs not to result in the claim that mental states are no more than physical states of the brain or that qualia do not really exist. One could agree with Paul Ricoeur's view:

> I propose that we say that the brain is the substrate of thought (in the broadest sense of the term) and that thought is the indication of an underlying neuronal structure. Substrate and indication would thus constitute the two aspects of a dual relation, or correlation (Changeux & Ricoeur 2000: 47).

For our purpose, what is of importance to the discussion is that the concepts of *sentience*, *qualia*, and *consciousness*, as referred to by some moral philosophers, seem to be used in a much broader sense, not to say in an intuitive sense, than by neuro-scientists. It should now appear more clearly that one should make a clear distinction between *sentience* (the *ability* to feel pain) and *self-consciousness* (the *awareness* of feeling pain) (Lewis 1940: 131). In other words, it is one thing to have a succession of perceptions – Edelman's *remembered present* – but it is altogether another thing to experience pain as being "my pain" (or "my pleasure" for that matter)(Pence 1995: 205). Whenever these distinctions are blurred, conceptual problems do arise, and ill-defined concepts are erroneously ascribed to certain entities to make questionable arguments. In the next sections, I will illustrate what has just been said by the claims made by Sumner, Singer, and Steinbock about sentience.

L. Wayne Sumner's *sentientism*

According to Helga Kluge (1998: 209), *sentientism* is the thesis that only sentient beings have moral standing. L. Wayne Sumner's thesis, in *The Morality of Abortion* (1983), is that the possession of sentience is what ascribes moral standing to a living entity, and that this moral standing ascribes the right to life and the right not to be inflicted pain. He defines sentience as follows:

> In the most *primitive* form it is the ability to experience sensations of pleasure and pain, and thus the ability to enjoy and suffer. It's more *developed* forms include wants, aims and desires (and thus the ability to be satisfied and frustrated); attitudes,

> tastes, and values; and moods, emotions, sentiments, and passions (emphases added) (1997: 108).

It is quite clear from this passage that Sumner recognises the existence of different types or rather levels of sentience: a *primitive,* and a *developed* level of sentience. Referring to Edelman's distinction between primary and higher-order consciousness, one could suggest that what is called by Sumner *primitive* sentience requires primary consciousness and that the so-called *developed* sentience is linked to the presence of higher-order consciousness. Unfortunately, the confusion arises where Sumner goes on saying:

> Consciousness is a necessary condition of sentience, for feelings are states of mind of which their owner is aware. But it is not sufficient; it is at least possible for beings to be conscious (percipient, for instance, or even rational) while utterly lacking feelings (1997: 108).

This passage obviously refers to entities with higher-order consciousness. At the same time, however, it deepens the confusion by the introduction of the concept of consciousness and its link with rationality (which should perhaps rather be called self-consciousness) *or* with perception (sentience?). Let us briefly remember Sumner's argument: the possession of sentience is what ascribes moral standing – that is, a right to life - to human and non-human animals. Without sentience, there is no moral standing and hence no right to life. The difficulty is not that much to define sentience (although two levels of sentience may have to be acknowledged). The problem is to define consciousness versus self-consciousness. A sentient being with only consciousness (in the sense of primary consciousness as defined by Edelman) is not equal to a sentient being with self-consciousness (in the sense of Edelman's higher-order consciousness). Therefore, unspecified sentience may not be good enough for the ascription of moral standing. Sumner seems to be aware of the difficulty, for he further states: "If rationality embraces a set of cognitive capacities, then sentience is rooted in a being's affective and conative life" (ibid.). What this means is that rationality should not be seen as a necessary condition of sentience, for rationality cannot exist without cognition, the faculty of knowing independently from emotion and volition. Sentience, on the other hand, he says, is how one feels emotionally and the capacity of willing or rejecting what causes these emotions.

This view on sentience takes us then back to Sumner's distinction between what he calls the "primitive" and the "developed" levels of sentience. An affective life with volition (read *developed* sentience) is, however, something more than a sensory-motor reflex to a physical stimulus (read *primitive* sentience). But this distinction would result in limiting sentience to entities with higher-order consciousness (self-consciousness) and in depriving so-called lower animals and pre-sentient fetuses from moral standing. Sumner does reach this conclusion with regards to pre-sentient fetuses. He is in trouble with the lower animals, for we do not really know enough where the threshold of sentience is situated in the animal kingdom. In view of this difficulty, Sumner needs to modify the concept of sentience:

> It is in virtue of being sentient that creatures have interests, which are compounded either out of their desires or out of the experiences they find agreeable (or both). If morality has to do with the protection and promotion of interests, it is a plausible conjecture that we owe moral duties to all those beings capable of having interests. But this will include all sentient creatures (1997: 108).

The twist in the tail is that, instead of higher-order consciousness (too exclusive) and instead of primary consciousness (which, on Sumner's view, would still be compounded by sentiments and volition), the concept of sentience has to be watered down to the concept of interest. One may argue, however, that the mere fact of having interest in experiencing as much pleasure as possible and in avoiding pain still involves desires, intentionality, and volition. If the experience of pain and suffering is to some extent a passive experience inflicted against the will, the fact remains that one has to be pro-active when it comes to pleasure. One has to do something, and has to be willing to take some steps in order to have a pleasurable experience. In addition, it is not self-evident that one has the moral duty to promote someone else's pleasure. Neither is it self-evident that one has a moral duty to relief someone else's toothache or migraine headache. If I have some aspirin tablets available, it is a nice thing to share them to alleviate the other's pain. This is not a moral obligation. It is a very different thing to inflict voluntarily pain to a living entity. The right not to be tortured is the only absolute and unrestricted human right acknowledged by the 1947 Universal Declaration on Human Rights. According to Wennberg (1985: 69), the only right linked to sentience is the right not to be tortured. Most of us would have no problem extending those same rights to non-human animals, whatever is known about

their level of sentience. None the less, if the argument is based on sentience/interests (as Sumner does), it is not enough to *feel* that one should not inflict pain, for we know very little about nonhuman animals' and fetuses' level of sentience.

It would appear that the confusion in Sumner's argument follows from treating as unitary, what in fact is composed of three distinct things. In other words, what is sentience? Is it a univocal concept? Or what are the levels of sentience? Those components are described as follows by Eilan *et al.*:

> First, there are internal *proprioceptive systems*, namely those channels of information whose source is the body. Second, there is *proprioceptive information*, understood to include all the information available to the body. Third, there is *proprioceptive awareness*, where this is taken to be conscious experience of the body, characterized as experience of the body as from inside. We would like to suggest that any talk of a specific body sense will need to take into account the distinctions between those three things (1998: 14).

What is said of proprioceptive[5] stimuli and responses can equally be said of nociceptive[6] systems, information and awareness. The sensory nervous system is what allows an entity to become and to be aware of events in the body, producing a sense of ownership. In an evolutionary perspective, the neurological equipment has adapted to the milieu in order to be able to cope the best possible. The way a mosquito has to cope with the environment differs from an oyster, and an oyster differs from a mammal. The perception of nociceptive stimuli and the reflex arc[7] in response to it may be a simple spinal nerve reflex in so-called lower animals, but it may borrow very complex loops and feedbacks between the peripheral receptor and the brain of higher animals. What we perceive as being a pain reaction in lower animals may well be a *behavioural pattern resembling the reaction to pain* of a so-called higher animal. Both pains may *look* similar to us as qualia-laden observers; there is, however, no reason to think that they *are* similar. The problem, then, is to find out what level of sentience is linked to what type of consciousness, or self-consciousness, and awareness, or self-awareness.

Sumner tries to answer that question. The capacity for sentience, he says, requires some neurological equipment to guide us in "locating a threshold in the phylogenetic continuum" (1997: 110-111). He writes (1983: 143): "Biologically [sentience] is marked by the emergence of the forebrain (the primitive ancestor of the

human cerebral hemispheres) in the first vertebrates".[8] The forebrain – that is, the cerebral hemispheres, thalamus, hypothalamus, and amygdala – he claims,

> especially the cerebral cortex, is the site of cognitive, perceptual, and voluntary motor function. Sensation (pleasure/pain), emotions, and basic drives are controlled by subcortical areas... Although the nerves that transmit pleasure/pain impulses are routed through the cortex, their ultimate destination is the limbic system (amygdala, hypothalamus). The most primitive forms of sentience are thus possible in the absence of cortical activity (1997: 110-111).

Sumner is correct in saying that the brainstem and the midbrain play no *direct* role in conscious life. He is also right when he states that the limbic system is what is called the hedonic center. He is, however, mistaken when he claims that subcortical areas *control* emotions (unless subcortical is to be understood as a generic term for any brain structure that is not the cortex). Current views on brain function reject the concept of any *control centre*. For instance, Ronald Melzack writes:

> It is traditionally assumed that pain sensation and response are subserved by a "pain centre" in the brain. The concept of a pain centre, however, is totally inadequate to account for the complexity of pain. Indeed, the concept is pure fiction, unless virtually the whole brain is considered to be the pain centre, because the thalamus, hypothalamus, brain stem reticular formation, limbic system, and frontal cortex are all implicated in pain perception. Other brain areas are obviously involved in the emotional and motor features of pain (1973: 93).

Edelman (1992: 106) clearly states: "The *frontal portions of the cortex* functions are related to behavioural planning and emotions". Edelman further states that "animals without cortex or its equivalent lack primary consciousness" (123) and, therefore, lack true qualia (135). In addition, whereas Sumner correctly acknowledges that the nerves are routed through the cortex, he then pulls back and ignores that essential anatomic feature to conclude that the cortex is not necessary to the most primitive form of sentience.

What is of concern, to say the least, is that Sumner boldly makes in a couple of sentences a *summary* of the neurophysiology of pain, a topic neurobiologists have a hard time to fully understand. We can assume that by the *subcortical* areas, Sumner refers to the diencephalon. As we have seen in Chapter 4, the diencephalon is a

complex structure composed of a multiplicity of nuclei interconnected by internal feedback loops, and connected with the entire cortex through afferent and efferent pathways. From animal experiments, human pathology, and brain imaging, we have just started to gain some insight in the complexity of the brain. Furthermore, subcortical areas do not *control* emotions; the mere concept of a "control centre" is at odds with the current views on distributedness and reentry.[9] Without the "cognitive function" of the cortex and especially the major role played by the prefrontal cortex, there could not be any slightest hint of higher-order consciousness. If the most primitive form of sentience is "the ability to experience sensations" (this is what it really is), we can agree that an amoeba is sentient. To say that sentience entails "the ability to enjoy and suffer" is to ask for a leap of faith, from mere sensing to the possession of qualia. Let us recall that the amoeba simply has no brain.

On should bear in mind that Sumner's book is an argument to support what he later called a "Third Way". He argues that early abortion is permissible, and that late abortion is morally wrong. Early abortion is permissible because the embryo/fetus is pre-sentient[10]; late "abortion" (in reality, a misnomer since it should be called termination of pregnancy, for abortion refers to the pre-viable stages of pregnancy) is morally impermissible because it inflicts pain to a sentient fetus. He is, however, not sure when a fetus becomes sentient. Therefore, he sets an arbitrary threshold corresponding roughly to the onset of viability[11] – that is, around 24 weeks of gestation. Because of the scientific uncertainty concerning the onset of sentience in human fetuses, Sumner acknowledges that there is a gray-area ranging from roughly 18 to 24 weeks. Now, Sumner wants to avoid to be charged of speciesism. Therefore, and to stick to the logic of his argument, namely that it is morally wrong to inflict pain to a sentient being, he has to include all sentient non-human animals in his theory on moral standing. Any sentient being has a moral standing and a right to life derived from it. But where does this lead us in the animal kingdom? Here again, one needs a bottom-line, a threshold – that is, the neurological equipment that is sufficient and necessary to possess sentience. The difficulty now arises with the use of ill defined and unconvincing allegedly neuroscientific data. The theory is in trouble. Instead of tricky qualia, let us then rather talk of interests: it is in a sentient being's interest to be given a maximum of pleasure and to avoid being inflicted pain. Intuitively this sounds a good thing. But how does this apply to a fetus?

With the popularisation of sonography in pregnancy, physicians show pregnant women how the fetus moves, sucks his or her thumb, exhibits chest motions called breathing (although there is no air to breath!).[12] Anti-abortion, or so-called pro-life, activists use these pictures to illustrate the *happiness* of the fetus. On the other hand, pictures and videos are shown of fetal bodies dismantled by abortive procedures. The "sufferings" of undesired but innocent fetuses have a tremendous emotional impact. But do they suffer? Who knows? Is, in all fairness, an embryo or fetus equipped with the necessary neurological apparatus to "suffer"? Or, does it merely *behave* like a living entity with qualia and higher-order consciousness? Talking again about pain, why then is there no mention of the "pain" and "suffering" of the fetus squeezed through a woman's birth canal at the time of childbirth, but only of the pain endured with abortion? Is it morally permissible to have all those babies going through that ordeal? Shouldn't we rather deliver them all by Caesarean section to give them a painless birth? The rules of logic state that to draw a valid conclusion the premises must be true. If the first premise – that the fetus is sentient – is true, and if the second premise – that it is wrong to inflict pain to a sentient fetus – is true, the conclusion should be that a normal vaginal delivery is morally impermissible. Now that sounds absolutely outrageous. Therefore, the premises, or at least the first premise cannot be true.

Peter Singer's *sentientism*

Hugh LaFollette has encapsulated Singer's thesis as follows:

> Creatures deserve moral consideration, he claims, not because they can think, reason, envision a future, have obligations to others, or are a subject of life, but simply because they suffer...Equality demands that the similar suffering of each [a college professor, an infant, or an adult with Down's syndrome] count similarly (1997: 114).

This sounds very much like a paraphrase of Jeremy Bentham's dictum: "The question is not, Can they reason? Nor Can they talk? But, Can they suffer?" and "Everybody to count for one, nobody for more than one". These are the two basic tenets of Bentham's utilitarian stance: what is morally right is what results in the greatest

happiness for the greatest number, taking into account that every one's pleasure/happiness carries the same weight in the hedonic calculus. An important point, not reflected in LaFollette's summary, is Singer's (1993: 850) advocacy of animal rights linked to their sentience: "If a being suffers, the fact that it is not a member of our species cannot be a moral reason for failing to take its suffering into account". This is Singer's anti-speciesist position. In short, sentience is what ascribes moral standing to a living entity; therefore, it is morally wrong to inflict pain to any sentient being. Singer's position is thus different from Sumner. Sumner goes one step beyond Singer's thesis in the sense that sentience does not only grant moral standing, but also the right to life. As it will be discussed, Singer has no definite position in this regard.

The main argument is about sentience. What does Singer mean by sentience? It is, he says, "a convenient, if not strictly accurate, shorthand for the capacity to suffer or experience enjoyment or happiness" (1997: 120). *Stedman's Medical Dictionary* (1997: 792) defines sentience as the capability of sensation (from the Latin *sentire*: to feel, to perceive). According to the *Concise Oxford Dictionary* (1995: 1261), a sentient being has the power of perception by the senses. So, we have different understandings or concepts of sentience. To possess senses is to have the faculty of perceiving external sensory stimuli (light, sound, odours, tastes, and touches) and to perceive proprioceptive stimuli (the awareness of the position of the body and of the body parts). It seems like a reductionist approach to limit sentience to the "capacity to suffer" –that is, to *feel* pain – the ability "to experience enjoyment or happiness". Sentience as the capacity to feel entails a wide range of different kinds of perceptions. Moreover, the temptation to place pain as the mirror image of pleasure (a utilitarian view) may have to be resisted. Thirdly, as suggested by Jamie Mayerfield (1999: 129), suffering needs to be distinguished from both physical pain and the frustration of desire. C.S. Lewis (1940: 131-133) made a similar point saying that one should distinguish between sentience (the ability to *feel* pain) and self-consciousness (the *awareness* of feeling pain). All animals are conscious, he argued, but only human beings are also self-conscious.

What is pain? What is the intensity of pain? Blackburn writes this about pain:

> [Pain] a favourite example of an experience that seems to resist reduction in terms of behaviour. Although pain obviously has behavioural consequences,

> being unpleasant, disruptive, and sometimes overwhelming, there is also something more than behaviour, something 'that it is like' to be in pain, and there is all the difference in the world between pain behaviour accompanied by pain and the same behaviour without pain. Theories identifying pain with neural events subserving it have been attacked on the grounds that whilst a genuine metaphysical identity should be necessarily true, the association between pain and any such event would be contingent (1996: 275).

What is important in this quote is that it addresses the behavioural aspect of pain, which must be distinguished from experiencing pain as "my pain", and that it refers to the eternal mind/body dichotomy. Is pain just a bodily unpleasant experience, or does it all happen in the mind? Does one need a brain/mind to feel pain? Is another's pain something an observer can talk about? Or does one need a personal experience of pain to gain some insight in another's pain? The latter seems to be John Stuart Mill's point:

> What means are there of determining which is the acutest of two pains, or the intensity of two pleasurable sensations, except the general suffrage of those who are familiar with both? Neither pains nor pleasures are homogeneous, and pain is always heterogeneous with pleasure (1972: 11).

What might have to be distinguished are the pain *affect* and the pain *intensity*. The pain *affect* is "the emotional arousal and disruption engendered by the pain experience" (Jensen & Karoly 1992: 143), that is, the effect of pain on a person's overall feeling. At most, they say, it refers to the *contribution* of physical pain to suffering. This, again, suggests that pain and suffering are two different things. *Stedman's Medical Dictionary* (642) defines pain as "an unpleasant sensation associated with actual or potential tissue damage, and mediated by specific nerve fibers to the brain where its conscious appreciation may be modified by various factors". This confirms the idea that the physical pain needs to be integrated or *processed* by the mind/brain to result in suffering. The pain *intensity*, on the other hand, is something perhaps more objective, as it is said to be quantifiable by humans on "self-report scale" (Jensen & Karoly ibid.).

Having made the above distinctions, let us return to Singer's argument. Singer's crusade in favour of animal rights argues basically against industrial animal farming methods aimed at producing more animal proteins for the consumers. His

main claim is that animals suffer from factory farming procedures. They suffer from the way they are treated (crowding, forceful feeding, lack of sleep, etc.), but not that much from the way they are killed. If, say, a chicken is allowed free range, Singer would have no fundamental objection against keeping a couple of chickens in the back yard; as a vegetarian, however, he would not have a bite of it at the Sunday dinner table. He is "less certain about [killing animals] than about the issue of suffering" (1993: 281). For instance, he claims (1993: 282) that if useful and necessary animal experiments are possible without inflicting pain (if the experiment is run under general anaesthesia and if the animal is killed while still under general anaesthesia), they might be permissible provided also that there would be no alternative experimental model.

Why is it morally wrong to inflict pain to animals? The answer is: Because it is in that entity's *interest* to avoid pain and to experience pleasure (1993: 851). And what is a prerequisite to have interests? It is "consciousness, or the capacity for subjective experience" (ibid.). The next question then is: What grounds do we have for believing that animals are conscious? This is Singer's answer:

> We do believe that other people are conscious...on the basis of a perfectly reasonable *inference* from similarity of their *behaviour* to ours when we are in pain. When we turn to nonhuman animals, we find that within those species most *nearly related to our own*, the situation is fundamentally the same as it is with humans (1993: 285) (emphases added).

Let us unravel the argument. The behaviour of an animal, provided it is close to us humans, reacting to pain is similar to the behaviour of a conscious human reacting to pain. Therefore, higher animals (apes and cetaceans) are conscious and suffer exactly the same as their human counterparts. Now the behavioural reaction to a nociceptive stimulus says little, if any thing, about the real nature of the perception of pain. If, say by accident, I cut an earthworm in two, the severed parts are twisting "as if" the earthworm was in pain. The poor animal has not even anything that compares to a brain structure (each of the severed parts can live on its own and has its own nervous structure for independent life) (Lazorthes 1999: 15). It would sound outrageous to claim that the earthworm is in pain, although it reacts as if it were suffering.

Moreover, as Paul Churchland reminds us, we should beware of arguments from analogy saying:

> How do we appreciate the psycho-behavioural connections at issue if we don't possess the concepts for making identifying judgements and a grasp of the meanings of the terms such as 'pain'. And we know that these concepts rest on assumptions (1999: 69).

Second, to separate the higher animals from the so-called lower ones might be seen as *speciesism* in disguise, or perhaps a type of *weak speciesism* – that is, that the human species is extended to include some higher animal species, "those most nearly to our own", whilst different criteria apply to the rest of the animal kingdom (not so closely related to us). Does this not contradict the title of his chapter *All Animals are Equal* (1997: 119)? Third, Singer assumes from a similar behaviour that there is a similar mental state to process the pain into suffering: consciousness (whatever that may be).

Let us now unpack Singer's argument about consciousness. He claims that consciousness is equivalent to "the capacity to experience pleasure or pain" (283). Singer now goes on with distinguishing consciousness from self-consciousness (or self-awareness). Self-consciousness, he claims, includes and requires a "minimally rational understanding of the world", as well as the need "to be aware of oneself as existing over some period of time, however brief" in order to be "capable of having desires about its own future" (296). In other words, the argument claims that to be self-conscious (or self-aware) an entity needs: (1) some rationality; and (2) some degree of memory. It is this "minimal" degree of consciousness that is sufficient and necessary to have interests. And the mentioned interest is to have at least the right not to suffer. If the argument is taken as it stands it follows that not the entire animal kingdom meets the conditions set by Singer. A waiver is needed:

> The capacity to feel pleasure and pain is something that we might be able to separate from self-consciousness in theory, but in the world as we know it a self-conscious being will always be a being capable of feeling pleasure and pain (296).

In other words, since it is not possible to prove that nonhuman animals do possess self-consciousness, that is a certain degree of rationality and memory, we need no further argument but to say: look around. Isn't it obvious that nonhuman animals

suffer? The argument misses the point. We have no doubt that self-conscious beings (perhaps that includes the higher animals) do experience qualia (even if it is hard to know what they feel like when they are experienced by others, more especially when there is no language to express it). The point is: are nonhuman animals conscious or are they self-conscious? This distinction makes all the difference about sentience, qualia, pain, and suffering. What is Singer's answer to that question? He states: "That some animals, at least, are self-conscious appears to have been shown by experiments in teaching American Sign Language to apes" (301). And: "If language is required to be a person with reflective thought, nonhuman animals are conscious but not self-conscious"(302). This looks like the collapse of the entire edifice.

Like others (Sumner, Tooley) Singer then refers to neuroscientific data to underpin (or rescue) his argument:

> We know that all the mammals and birds have the same basic nervous system that we have, and scientists have observed that they respond physiologically to pain in much the same way that we do. Feelings and emotions are associated with the diencephalon...In the case of vertebrate animals, at least, the analogies are sufficiently close to make it reasonable to *suppose* that they too possess *consciousness*. Even crustaceans have complex nervous systems, and their nerve cells are very much *like our own* (1993: 286) (emphases added).

Here Singer is asking from us a leap of faith. From mere assumptions and analogies, we are requested to be reasonable and to agree with the conclusion that at least vertebrates[13] possess consciousness. We have sailed away from the dangerous high sea of self-consciousness and reached the safe (or safer) haven of consciousness. We have sailed away from Charybdis (the apes' self-consciousness, rationality and memory) to Scylla (the vertebrates' consciousness). Are we not a bit like crustaceans? Our nerves are pretty much the same!

On the other hand, in *Practical Ethics* he states:

> [what is relevant to the wrongness of killing a human being] is characteristics like rationality, autonomy, and self-consciousness. Infants lack these characteristics... No infants – disabled or not – has as strong a claim to life as beings capable of seeing themselves as distinct entities, existing over time (1993: 182).

This passage is taken from the section *Justifying Infanticide and Non-voluntary Euthanasia* (1993: 182). The argument is obviously very close to (if not simply borrowed from) Michael Tooley's *Abortion and Infanticide*. It means that an entity devoid of self-consciousness, that is unable to have a concept of a self that is different from the rest of the world and not possessing some degree of memory, have no intrinsic right to life and can be disposed of. Abortion and infanticide are permissible.

This seems *prima facie* to be in contradiction with Singer's position on animal rights related to the possession of sentience. The question is: What is it that ascribes a right to life? We have seen that Singer's position on animal rights is that they have an interest not to suffer provided they are able to experience pain and pleasure. He is less clear on animals' right to life, for painless killing might be morally justifiable. The contradiction or the inconsistency is that in *Justifying Infanticide and Non-voluntary Euthanasia*, Singer argues that infants (or at least the severely disabled) can be subjected to non-voluntary euthanasia. He claims:

> Infants are sentient beings who are neither rational nor self-conscious... [and] the principles that govern the wrongness of killing non-human animals who are sentient but not rational or self-conscious must apply here too. As we saw, the most plausible arguments for attributing a right to life to a being apply only if there is some awareness of oneself as a being over time, or as a continuing mental self (1993: 183).

Now this is confusing. First Singer claims that it is wrong to kill a sentient being. Second, he acknowledges that infants are sentient. It should follow that it is wrong to kill a sentient infant. But that is not Singer's conclusion. He claims that only self-conscious beings have a right to life. And infants, he says, are not self-conscious:

> Self-consciousness...is not to be found in either the fetus or the newborn infant. Neither the fetus nor the newborn infant is an individual capable of regarding itself as a distinct entity with a life of its own to lead, and it is only for newborn infants, or for still earlier stages of human life, that replaceability should be considered to be an ethically acceptable option (1993: 188).

It seems inconsistent to use somewhere the concept of sentience to make a case for animal rights, and, elsewhere, while acknowledging that fetuses and newborns are

sentient (logically this would endow them with an inalienable right to life), to require self-consciousness to protect the right to life. Now, since this is clearly inconsistent, Singer shifts the argument to the concept of replaceability: "Instantaneous and painless killing of a being that will not be missed would be permissible" (Singer 1993: 306). In other words, if putting an end to the life of a sentient being has no impact on the amount of suffering of his or her next of kin, that being, although sentient, can be done away with. Another can replace it, because:

> [For classical utilitarianism] killing is wrong if it deprives the world of a happy life, but this wrong can be righted if another equally happy life can be created...it regards sentient beings as valuable only insofar as they make possible the existence of intrinsically valuable experiences like pleasure (308).

But this seems in contradiction with any possible hedonic calculus. On the one hand we have a sentient being that has the ability to experience pain; on the other hand, we have sentient beings who do not *feel* anything for that sentient being, or, at least, make the assumption that that being is not "likely to experience more pleasure than pain" (309). Hence, the former one can be disposed of because it is *assumed* that it is qualia-free! I fail to see the ethical permissibility of this calculus, which seems to be incompatible with utilitarianism. Furthermore, is there any life possible without a certain amount of pleasure and pain? When the amount and the magnitude of pain become intolerable, it is the individual's judgement and decision to put an end to it if he or she so wishes (voluntary euthanasia). Involuntary euthanasia remains a complex ethical issue that cannot be addressed, much less solved, simplistically or intuitively. Singer's so-called "pluralistic consequentialism" (Landman 1990) – a blend of act and preference utilitarianism – is problematic when applied to abortion and infanticide.

Singer's quote about the resemblances of humans and non-human animals raises also a series of questions. To be the *guru* of animal rights is one thing. To use unjustified analogies between human and non-human nervous systems to make a case is another thing. What does it mean that "mammals and birds have the same basic nervous system that we have", and that "crustaceans have a complex nervous system, and their nerve cells are very much like ours"? To say, "feelings and emotions are associated with the diencephalon" (1993: 286) is just to tell us part of the story. It

does not do justice to the complexity of the brain nor to the intricacies and subtleties of emotions and feelings.

Bonny Steinbock on sentience

Steinbock claims to be pro-choice on the basis of two different premises. She advocates women's right to self-determination, *and* (contrary to other pro-choicers who rest their case on a single principle – either women's rights or the absence of moral standing of the unborn) the moral standing of the unborn or the lack thereof. What is pertinent to this essay is Steinbock's view on the moral standing of the unborn.

The divide between the possession of moral standing, she claims, is whether the unborn is sentient or not, because it matters to sentient beings how you treat them:

> Pain is pain, no matter who feels it. So long as a being is sentient that is, capable of experiencing pleasure and pain – it has an interest in not feeling pain, and its interest provides moral agents with prima facie reasons for acting. Sentience, then, is sufficient to give a being moral status (1992: 24).

The question then, is: When does the unborn acquire sentience? Like Sumner, Steinbock acknowledges that we are not really sure about it. She says: "It is possible, though unlikely, that a fetus of 20 weeks gestational age is sentient, but there is virtually no chance that fetuses become sentient before the end of the first-trimester" (193).

Another difficulty relates to the concept of sentience. In the above mentioned quote sentience is clearly defined as the ability to experience pleasure and pain. Later on Steinbock states that "the ability to feel pain would precede more highly developed cognitive states, such as thoughts, emotions, and moods" (50), but "precisely when fetuses attain conscious awareness is controversial and perhaps indeterminable" (40). And: "*Perhaps* late fetuses, like babies, are capable of sensuous pleasure, from sucking their thumbs, from the warmth of the womb, from the sound of their mother's heartbeat" (69) (emphasis added). Now this looks like a to and fro. If sentience, in its most primitive expression as the ability to feel/sense, appears somewhere around

twenty weeks of intrauterine life, why should one wonder whether the late fetus might *perhaps* experience features of basic sentience?

Finally, a last difficulty with Steinbock's view relates to her statement that "some sentient beings may have lives that are more valuable than others" (70). Now this seems to discredit her thesis that "it matters to sentient beings how you treat them". Furthermore, it seems also to weaken the argument from sentience. If there are degrees of sentience, and if sentience is *the* criterion of moral standing, it follows that, there are also degrees of moral standing. And that is difficult to accept. Either one has a moral standing or one does not. The same view on degrees of sentience and degrees of moral standing was presented by Wayne L Sumner (1974) in his article *Toward a Credible View on Abortion*: "[one] must allow for the gradual acquisition by the fetus of the status of a moral person and the accompanying right to protection of life"

Concluding remarks

Sentience, together with the ability to move, says Hans Jonas (1996: 71-74), are the manifestations of what he calls "the principle of mediacy" that separates the animal world from plants. Plant survival is assured by organic function. Animals, on the other hand, "distance themselves from nature". Animals have the ability "to move about [pursuit/flight] and to perceive at a distance [transcendence instead of dependency, to reach a distant goal] and the ability of emotion". Emotion means, in this context, the desire (appetite) that is at the root of the chase, and fear that is at the root of flight. In other words, the perception of a goal requires appetite – the intention to reach the goal – and this, says Jonas, "involves the development of feeling"; "sentience, feeling, and motility are different manifestations of the essential *distancing nature* of animal existence". Jonas further states:

> The capacity for feeling is the mother-value of all values. The gain is double-edged like every trait of life. Feeling lies open to pain as well as to pleasure (74).

It seems, thus, that on Jonas' view, feeling and sentience should be seen as one and the same thing (as opposed to Sumner's position about feeling as being a state of mind of which the owner is aware) – a "means of survival", a way to deal with the world and "self-assertion of freedom" (71). This would then correspond to a *primitive* form of

sentience. What would be emotions, and specifically human emotions, is when "mediacy becomes reflective, an explicit relation between a self-conscious subject and objects" (11).

This brings us to the question of self-consciousness/self-awareness/higher-order consciousness versus consciousness/awareness/primary consciousness. In other words, the point is to try to clarify the distinction between basic or primitive sentience (the mere ability to perceive a stimulus) and qualia, as defined by Paul Churchland (1989: 23) as "the intrinsic or monadic properties of our sensations discriminated in introspection". For, as pointed out by Gerald Edelman (1992: 135), "qualia are discriminated through differences in neural structure and behaviour in different sensory pathways". Or,

> Qualia are categorisations by higher-order consciousness of the scenes and memories provided by primary consciousness. They involve recategorical relationships that are ultimately governed by how evolutionary selected values interact with memory (151).

Animals with primary consciousness of the most primitive type respond to stimuli with either consummatory or aversive responses. A more elaborated primary consciousness allows to correlate value and perceptual categorisation, but without long-term memory (the "remembered present"). Higher-order consciousness is the "ability to construct a socially based selfhood, to model the world in terms of past and the future, and the ability to be directly aware" (125), to be "conscious of being conscious" (131).

Let us now see what is required from a living entity to possess either primary or higher-order consciousness. What is required is specific neural equipment, the nature of which results from evolutionary selection (natural selection), as well as from somatic selection (what makes each and every nervous system something special and not simply a replica). For the time being one of the most plausible theories to explain what the brain is and how it functions, is Neural Darwinism, or Edelman's theory of neuronal group selection (or TNGS for short) (1992: 81-89).[14]

The TNGS is the theory that the mind must have arisen as a result of natural selection and somatic selection. The first tenet, i.e. natural selection, hinges on Darwin's theory of evolution; it is hardly doubted. The mechanism of somatic

selection is the main focus of the TNGS. In summary, it says the following. During the development of an individual's brain, a first coarse brain map, or "primary repertoire", is produced partly by genetic constraints and partly through the interaction between the neurons themselves. This stage of development happens without neural activity; it is a "topobiological" process where cells migrate and find their proper place. This is what Pasko Rakic (1999: 90) refers to in his paper entitled "The importance of being well placed and having the right connections" (although the connections will take place only after the right place has been reached). In a second stage a more refined brain map, or "secondary repertoire", is produced through the strengthening or weakening of synaptic connections in response to the value of incoming signals. This stage of development entails neural activity. The right connections are being established. Finally, in a third stage, signals are exchanged between the primary and the secondary repertoire that permit an adaptively valuable behaviour. This is a global mapping made up of cortical maps and subcortical structures; it exhibits recursive interaction (*i.e.*, *reentry*), necessary for conceptual categorisation and the integration of perception and behaviour.

In neurophysiological and neuroanatomic terms, the primary repertoire – the brain "value system" – comprises the brain stem and the limbic system; it is concerned with appetite, sexual, consummatory and defensive behaviour patterns (*i.e.*, the automatic or vegetative processing system). The secondary repertoire is the thalamocortical system that receives sensory inputs and gives motor outputs; it is a key-structure for the connectivity responsible for the emergence of consciousness. The interaction through key-reentrant circuits between the primary and the secondary repertoire "transforms signals from the outside world into nonconscious perceptual categories, or a *value-category* memory that allows the construction of an ongoing scene but without a socially constructed self" (151). The full integration of brain functions allowing higher-order consciousness requires reentrant signaling, enabling the brain to integrate distributed functions (71). And, "reentry is the unique feature of higher brains" (72); and this is the main point.[15]

There is a general consensus among neuroscientists that high-level brain functions depend particularly on the frontal cortex (Changeux & Ricoeur 2000: 85), the main locus of non-automatic processing for more difficult and novel tasks (Raichle 1999: 115). It is implicated in processes involving planning, choice, volition, and memory (Frackowiak 1998:119). The prefrontal cortex is directly associated with

the capacity to interpret one's own behaviour and that of others in terms of inferences about mental states (157). In other words, the prefrontal cortex should be what Chalmers (1999) calls the *cerebral correlate of the mind.* It is now well established that the frontal cortex "takes some time to develop fully after birth", and that "the child's immature brain finds it difficult to make an adaptation and to change a habitual response" (Raichle 1999:115-116). The density of synapses in the prefrontal cortex before birth is only 15 percent of the density reached in early childhood (Rakic 1999: 105-106). This means that the prefrontal cortex of the unborn is still in a condition that is hardly compatible with any significant cognitive function.

The prefrontal cortex is the *cognitive* component of the mind, says Jean-Pierre Changeux (Changeux & Ricoeur 2000: 227), and the limbic system is the *affective* component; "*happiness* links the cognitive of the prefrontal with the limbic affective". If the link between the prefrontal cortex and the limbic system is severed (through leukotomy or frontal lobotomy) the cognitive component of pain is dissociated from the affective aspect of suffering (Mayerfield 1999: 26). Although the limbic system is established in the unborn, the connections with the prefrontal cortex are still extremely limited. It could be said that the unborn is close to a "frontal" being.[16] Therefore, it is very unlikely that a fetus could "suffer" although it cannot be ruled out that a fetus might "feel pain". It is an obvious shortcoming of sentientism that pain and suffering are not distinguished. As pointed out by Mayerfield:

> Pain usually means "physical pain" – a disagreeable feeling that we locate in our body. Physical pain doesn't cover the many mental kinds of suffering, such as fear, panic, terror, grief, depression, humiliation, loneliness, anxiety, dread... Pain and suffering are not synonymous...many factors affect the perceived "meaning" of somebody's pain (1999: 24-25).

And mental states, says Changeux (Changeux & Ricoeur 2000: 140) – that is, desires, intentions, beliefs, knowledge, emotions – are part of long-term memory. Memory is the ability "to recreate an act separated by a certain duration from the original set, i.e. a form of *recategorisation* (not of replication)" (Edelman 1999: 77). And without long-term memory – that is, without a fully mature and fully functional prefrontal cortex *and* its connections with the limbic system – pain is "stripped of its meaning for the future" and of its "emotional threat" (Carpenter 1996: 250). Hence, a fetus

might feel pain but does not suffer; it does not have yet a neural correlate of higher-consciousness.

7 Utilitarianism and moral theory on sentience revisited

Doth God take care of oxen?

Paul, 1 Cor 9:9

Introduction

Moral theories ascribing moral considerability to sentience are inspired by the utilitarian principle that an action is good if it produces the greatest utility/happiness/ pleasure for the greatest number affected by that action. Conversely, an action is wrong if it produces disutility/unhappiness/pain for those affected by the action. To be sentient is to possess the ability to feel pleasure or pain; to be insensate is to lack this property. The importance of being sentient is that it matters what is done to you; on the other hand, it is said (arguably) that nothing matters to an insensate entity. These are, briefly, the premises supposed to lead to the conclusion that either it is in all sentient beings' interest not to be inflicted pain (call it minimalist sentientism) or that sentience *qua* sentience ascribes a right to life (call it maximalist sentientism).

In the first section, we will look at the roots of utilitarianism and at the various interpretations of the basic principles of utilitarianism. In the second section, we will focus on the concept of sentience with special attention to the suggestion that sentience should be qualified. If, following ideal utilitarianism, there are degrees of pleasure, there should be no reason not to support the view that there are degrees of pain – that is, that pain should be distinguished from suffering. In the last section, we will consider the issue of pain and suffering in the context of abortion.

Utilitarianism

Central to all forms of utilitarianism are the following three basic principles: (1) the greatest happiness principle – the duty to maximise happiness and to minimise suffering/pain; (2) the hedonistic principle – happiness (or absence of pain) is the pleasure of *all* sentient beings, and suffering (or the absence of pleasure) is the pain of *all* sentient beings; and 3) the principle of impartiality – that is, Bentham's "everyone to count for one and only one" (the classical utilitarian calculus). As we shall see, the

origin of these principles reaches back to early Western philosophy; the interpretation of the principles varies, and has led to various subsets of utilitarianism.

Aristippus of Cyrene professed hedonism (from the Greek *hedonê*, pleasure) as early as the beginning of the fifth-century BCE. For him, the question was: What mode of life will supply the greatest amount of *bodily* pleasure? (Gordon 1990: 29). He and his followers, the Cyrenaics, saw in hedonism the pursuit of mere physical pleasure. Hedonism, in a Cyrenaic perspective, leads to a paradox, for if one follows the strategy of maximising personal pleasure at the same time one decreases one's chance of obtaining personal pleasure. Or, in Schweitzer's (1987: 279) words: "only anticipated pleasure is really pleasure; in pleasure which is fulfilled its opposite is already stirring".

In the *Phaedo*, where Socrates appears as Plato's mouthpiece, Socrates says:

> What a strange thing what we term pleasure seems, my friends! And what an odd relationship it has to pain which passes for its opposite! They refuse to be brought together in man (quoted in Rey 1995 : 38).

In the *Eudaimian Ethics* (1216 a 11), Aristotle wrote: "Some things that make life worth living may debatably have to do with happiness" (quoted in Schweitzer 1987). The notion that pleasure might provide a standard for evaluating action was widely canvassed by Epicurus (341-270 BCE). Unlike Aristippus, Epicurus established a hierarchy of pleasures: the natural and the necessary, and those that have to be eliminated (honours, glory, and riches). He saw himself compelled at last to exalt the absence of desire for pleasure as being itself the purest pleasure, leading him to an ethics of resignation (Schweitzer 1987:119,154). He saw pleasure as the absence of bodily suffering and of "troubles of the soul" (Changeux & Ricoeur 2000: 226). For Epicurus, "there is no profit in philosophy if it does not expel the suffering of the mind" (Amato 1990: 35).

Epicureanism and Stoicism shared a common view on pleasure and pain. For the Stoics "pain is not an evil", and "there is not evil but what is morally vile" (Rey 1995: 40). As far as pleasure is concerned, Cicero, in *De finibus* (III, VI, 20(2) 18), wrote: "The pleasure we consider to be the supreme pleasure is the one we are conscious of when every pain has been eliminated" (quoted in Rey 1995 : 68). Unlike

later utilitarianism, their concept of pain and pleasure was devoid of any attempt at collective transformation that would be one of Bentham's main emphases. It is noteworthy to mention what Roman Emperor and late stoicist, Marcus Aurelius (121-180 CE) wrote in his *Meditations*:

> Treat as befits a man endowed with reason, that is magnanimously and nobly, the animals that are not so endowed, and indeed all whatever that can feel but have no reason
> (quoted in Schweitzer 1987: 137)

Because of his conviction that nature has bound up together what is ethical and what is advantageous both to the individual and to the community, Marcus Aurelius can be seen as an "enthusiastic utilitarian"(Schweitzer 1987: 137).

The ancient roots of utilitarianism and the first appeal to sentience can thus be traced back to the origins of Western philosophy. The modern roots of utilitarianism appeared during the seventeenth-century. According to Häyry (1994: 11), the first modern anticipation of what he calls "psychological utilitarianism" can be found in Richard Cumberland's *De Legibus Naturae* (1672). In an attempt to refute Hobbes' view of the law as founded upon nothing more than the will of the sovereign, Cumberland stated that human beings are either inherently benevolent or can be educated to be universally benevolent towards their fellow beings. He, like David Hume would later, believed in universal altruism (18-19).

In *An Essay Concerning Human Understanding* (1690), John Locke defended the view that ethical theories which rely upon moral intuitions are false – a view that would later be opposed by Hutcheson. In *Passive Obedience* (1712), bishop George Berkeley held the view that human beings are egoistic by nature. Therefore, he claimed, only rewards can motivate them to do good, and only punishment can deter them from doing wrong. Berkeley's view was in line with the traditional teaching of the Church on reward and punishment, a form of "theological utilitarianism" (Häyry 1994: 12).

Frances Hutcheson, an Irish Presbyterian minister who became professor of moral philosophy at the University of Glasgow, is credited for writing the first formulation of utilitarianism in his *Inquiry into the Origin of our Ideas of Beauty and Virtue* (1725). For him, that action is best which procures the greatest happiness for

the greatest number. His teaching was that the standard of moral goodness is the promotion of the happiness of others and that moral sense is innate and directed towards the approval of those actions that benefit human beings. His "descriptive psychological utilitarianism", as Häyry (1994: 18-19) calls it, was further elaborated upon by David Hume in *A Treatise of Human Nature* (1739-1740), and in *An Enquiry Concerning the Principles of Morals* (1751). In short, for Hume, human beings are not motivated by reason or by any innate moral sense, but rather by approval and disapproval. In the *Enquiry* he claimed that our natural sentiments of benevolence "engage us to pay [regard" to the interests of mankind and society". He believed that the average human being is only mildly benevolent; and that it is the principle of sympathy that makes humans, by psychological association, moderately sensitive to others' suffering and happiness. He further believed that egoism is not necessarily incompatible with some degree of altruism, and that it is all in all beneficial to be benevolent (Häyry 1994: 18-19).

The first full secular version applying the three basic principles of utilitarianism is credited to William Godwin. In the *Enquiry concerning Political Justice* (1793), he made the anarchistic claim that all apparatus of legal coercion corrupts human nature. His "radical utilitarianism" stated that legislative and political reforms need the implementation of the requirements of both altruism and benevolence (Häyry 1994: 12). A virtuous agent, he claimed, should consider the happiness or misery that might result from a chosen course of action, and should be impartial (30, 34). Godwin illustrated these principles in his famous *Gedankenexperiment* of the palace of Archbishop Fénelon being on fire. Two people are trapped inside: the Archbishop and his chambermaid. The dilemma is this: the rescuer has time to salvage only one of the two, either the Archbishop or his chambermaid, who happens to be the rescuer's mother. Now, by natural inclination, the rescuer would choose to save his mother. The right thing to do, however, should be to save the Archbishop's life because that would bring more benefit to mankind.

The stage was now set for a group of radical English social reformers, amongst whom Jeremy Bentham was one of the most influential. In *The Principles of Morals and Legislation* (1789), he erected the three pillars of all forms of utilitarianism: the greatest happiness principle, the hedonistic principle, and the impartiality principle. As mentioned earlier, unlike Epicurus, Bentham thought that happiness should be pursued by seeking the collective transformation of the world

rather than by individually fleeing it (Amato 1990: 77). The greatest utility was for Bentham "that property in any object, whereby it tends to produce benefit, advantage, pleasure, good or happiness". In his assessment of pleasure, Bentham stated that one has to consider seven dimensions: its intensity, duration, certainty or uncertainty, propinquity or remoteness, fecundity, and purity. Although Bentham's axiological foundation was about a balance of pleasure over pain, he made it clear that in ethics the concept of pleasure was synonymous with benefit, advantage, utility, and good (Häyry 1994: 9). Bentham's close friend and collaborator, James Mill, put emphasis on the function of law and the rights of individuals in self-regarding matters. In *An Analysis of the Phenomena of the Human Mind* (1829), he emphasized that the task of an educator was to lead students to associate personal pleasure and the common good. His son, John Stuart Mill, sophisticated the concept of happiness (lower and higher pleasures) in *Utilitarianism* (1861), and the concept of individual freedom in *On Liberty* (1859). His two alleged additions to Bentham's utilitarianism were, one, that the quality of pleasure and pain should play a definite role in the hedonic calculus, and, two, that legal regulation should not be extended to people's private matters. According to Häyry (1994: 10), however, these two amendments can already be found in John Locke's writings. Classical Benthamite utilitarianism is regarded as *act-utilitarianism*. Mill's utilitarianism once is said to be closer to ideal utilitarianism (because he gives more weight to higher pleasures, intellectual or spiritual pleasures), or else is qualified as non-maximising-utilitarianism (that is, that actions are right in proportion as they *tend to promote* happiness) because it leaves room for supererogation (Curzer 1999: 158). For Smart (1967: 173), Mill is a rule utilitarian and a quasi-ideal utilitarian.

For Henry Sidgwick, ethical egoism and universal altruism are equally rational alternatives, provided the moral agent is endowed with both intelligence and genuine moral concerns. That is, in other words, the problem of taking advantage of exceptions one can make to the rules when doing so is to one's benefit (a form of restricted utilitarianism). He introduced in utilitarianism the distinction between the rightness and wrongness of an action and the goodness or badness of the agent (Smart & Williams 1973: 55). In his *Methods of Ethics* (1874), Sidgwick charged J.S. Mill's argument about happiness as the *summum bonum* with the "fallacy of composition", or natural fallacy – that is, to proceed from facts to norms without sufficient conceptual justification (Hume's famous no *ought* from *is*).

George Edward Moore, in *Ethics* (1903), claimed that some states of mind have intrinsic value independent of their pleasantness (Aristotle said something similar[1]); therefore, Moore's utilitarianism is labeled ideal utilitarianism (Smart and Williams 1973: 12). He replaced the concept of happiness with the concept of good, and the maximum net sum of good. He claimed that goodness is a simple, unanalysable quality, fortunately known by intuition. He also defended the view that where individual happiness ceases to be the only source of value, justice, virtue, and social order acquire a different dimension. Finally, Moore is credited with the first explicit and exclusive statement about act-utilitarianism: "A voluntary action is right whenever and only when its total consequences are as good, intrinsically, as any that would have followed from any action which the agent could have done instead"(quoted in Häyry 1994: 68).

The distinction between act and rule utilitarianism was further worked out by Richard B. Brandt in *Ethical Theory* (1959). Rule-utilitarianism holds that an action is right if and only if it conforms to a rule that, if followed by all moral agents, would maximise the good/utility/happiness. Other utilitarians, like Richard M. Hare (1987: 132,136), however, resist the separation: "There is a kind of rule-utilitarianism, which is quite consistent with act-utilitarianism, namely that kind which, while insisting that its rules be universal, does not insist on their being simple or general, but allows them to become, through qualification in the light of particular cases, both complicated and specific". As a non-cognitivist utilitarian[2], Hare (118) also claims "if two people ought to be treated differently some difference must be cited as the ground for a different moral judgement" (Aristotle said something similar!). Like Hare, Williams (1993: 92) believes that "the application of a rule still has actual or particular consequences"; moreover, he raises the question of cases where breaking the rule would produce more utility. Utilitarians respond to that objection by saying, "the overall pattern of behaviour in following the rules will have better results than if one followed act-utilitarianism"(Sikora 1993: 105).

We can now add to the list of variations on the theme of the greatest utility or happiness the offshoots called respectively negative utilitarianism, preference utilitarianism, cooperative, motive, personal, restricted, and liberal utilitarianism. In *The Open Society and its Enemies* (1966), Sir Karl Popper, advocated the view that "we should concern ourselves with the minimisation of suffering" (negative utilitarianism) – that is, "misery involving actual pain, not just unhappiness" (Smart &

Williams 1998: 28). For Raphael (1994: 130), negative utilitarianism was ironically expressed by Arthur Hugh Clough in his new version of the Sixth Commandment "Thou shalt not kill, but need'st not strive officiously to keep alive", meaning that conformity to prohibitions is not the whole of our moral duties. In Jonathan Glover's view (1990: 95), negative utilitarianism's emphasis on negative duties is a variant of the acts and omissions doctrine. Preference utilitarianism states that "a value judgement ought to be based on the autonomous choices, or comparative assessments made by individual human beings" (Häyry 1994: 59). In other words, the right action is that which leads to the greatest number of satisfied desires (Gordon 1990: 160). This is because practical decision-making is most of the time the result of weighting people's preferences rather than of following rules. Co-operative utilitarianism states that each agent must be ready to take part in a co-operative effort – that is, it is a community's enterprise to be involved in "the business of producing good consequences"(Regan 1990). Motive utilitarianism is rooted in Sidgwick's position that the test of utility is to be applied directly not only to consequences, but also to the agent's motives.[3] This is because "the perfect motivation is identified with an all-controling desire to maximise utility"(Adams 1990: 237-238). Personal utilitarianism is not concerned with making people happy but with making happy people. In other words, "acts are only good if there are people who are made happier by them" (Narveson 1990: 120). For restrictive utilitarianism, actions are to be tested by rules and rules by consequences (Smart 1967: 172). Consequences are relevant only in deciding what rules are good reasons for acting in a certain way in a particular case (176).[4] Liberal utilitarianism's claims are the following. First, it is always right to promote basic need satisfaction when there is no conflict between the basic needs of individuals and groups. Second, it is right to maximise the satisfaction of non-basic needs provided it does not cause the frustration of more important needs. And, third, when basic needs of individuals are not in conflict, liberal utilitarianism does not assign clear-cut rights and duties to a moral agent because an exceptionless utilitarian theory is incompatible with intuitive acceptability. Conflicts should be solved by "appeal to conceptual coherence and emotional acceptability"(Häyry 1994: 169).

Needless to say, that utilitarianism has its strengths and weaknesses. The numerous variants of utilitarianism are various attempts to meet its shortcomings. This is not the place to discuss the arguments pro and con. As Bernard Williams (1973: 78) put it: "The first question for philosophy is not 'do you agree with

Utilitarianism's answer?', but 'do you really accept Utilitarianism's way of looking at the question?' ". The aim of this overview, in line with William's suggestion, is rather to point to the fact that pleasure and pain, as well as egoism and altruism are old companions of mankind. How to reach a compromise between them in a moral theory that avoids the excesses of both has been a long endeavour of moral philosophers. It seems that in the context of the abortion debate the utilitarian stance faces three main objections: 1) the reliance on a "simple-minded" concept of sentience (that is, the ascription of sentience to what might just be behavioural in nature)[5]; 2) the arguable claim that nothing matters to insentient entities (against environmental ethics)[6]; and 3) a "simple-minded" concept of pain (against the complexity of pain and suffering).[7]

Before closing this brief overview on utilitarianism, a word should be said about Peter Singer's *pluralistic consequentialism*, a combination of classical utilitarianism and preference utilitarianism (Landman 1990). Singer is an act-utilitarian who draws on classical hedonistic utilitarianism. Moral standing is conferred by sentience, and the best action is that that produces the maximum utility for all concerned sentient beings. All sentient beings have equal weight in the hedonistic calculus. Killing a sentient being reduces the sum total of happiness. Therefore, killing a sentient being is wrong. On his view, the only moral objections to killing non-personal sentient beings could be: (1) the side-effects on others (if I kill, say, a dolphin then its next of kin will grieve); and (2) the decrease in the total sum of happiness (with one dolphin less the total sum of happy dolphins is diminished by one unit). Needless to say that this example is questionable, since one may claim that dolphins (as well as whales and primates, for that matter) are endowed with personhood. However, we do not really know the boundaries of personhood, as much as we do not know the boundaries of sentience. Therefore, it is difficult to provide a satisfactory example unless one designs a *Gedankenexperiment* that, too, has its limitations. Now, since objections 1 and 2 are not really convincing, Singer introduces the objection from preference utilitarianism that killing thwarts the desire to keep on living. The question then is: How does the desire to live of one entity outweigh the preferences of others? Applied to the problem of abortion, preference utilitarianism should have to answer the question: On what moral principle does the (alleged) preference to live of the unborn outweigh the woman's preference not to be pregnant? The continuation of an unwanted pregnancy, no doubt, does thwart this woman's personal preference.

It seems difficult to follow the logic of Singer' arguments. On the one hand, he rejects speciesism: *all* sentient beings must be treated equally – that is, it is in their interest that their pleasure be maximised, and their pain minimised. So far so good, this is plain utilitarianism. On the other hand, Singer admits that infants (and late fetuses) are sentient (1993: 183), and that "the principles that govern the wrongness of killing nonhuman animals who are sentient but not rational or self-conscious must apply here too" (183). He then goes on with the "replaceability argument", or "total view" of utilitarianism, saying that infants are replaceable in much the same way as non-self-conscious animals (186). He then gives an example: abort a defective fetus and become pregnant again (186). It would thus appear that Singer is speciesist. It is in the interest of sentient nonhuman beings not to be inflicted pain; however, a sentient human fetus/newborn/infant is replaceable because of a lack of consciousness. Even if it is true that, unlike other utilitarians, Singer, like Tooley, does not link sentience with a right to life (but only a right not to be inflicted pain), his position is at least counterintuitive and at odds with commonsense morality. Furthermore, it is paradoxical to use different criteria for human and nonhuman sentient beings and, at the same time, to reject speciesism. If a moral theory has to be twisted to the extreme to justify an ethical position, there might be something problematic with the theory. However, one could object (with Sumner) that a moral theory is unavoidably complex.

This overview of utilitarianism has mainly stressed the variety in interpretations, not to say the many ways it has to be salvaged through interpretation and re-interpretation, of the principle of utility. If one restricts the discussion to the two main variants, act and rule utilitarianism, two major differences do emerge. For act utilitarianism, action-guiding principles are rules of thumb. For rule utilitarianism, rules are firm (not mere rules of thumb) but non inviolable (Sikora 1993: 86). In other words, it is usually wrong to break the rules; the rules should be followed as well as one could expect actual people to do (105). This is supposed to provide "a basis for determining which sorts of exceptions are acceptable derivative principles" (90). Rule utilitarians claim that their view has three advantages over act utilitarianism: 1) it avoids the counterintuitive consequences of act utilitarianism; 2) it maximises utility more than act utilitarianism; and 3) it avoids the unpredictability of the consequences of an act (105).

In the context of this essay, let us now imagine an act and a rule utilitarian approach to abortion. At issue is the *basic principle* of the right/interest of a (alleged) sentient being, and the *derivative principle* of the right to life.

Sikora (1993: 94-96) makes the following rule utilitarian argument in defence of abortion on demand. He states that one has to show that "killing fetuses is permissible even though it is wrong to kill innocent individuals who are or have been rational". This, he says, requires showing that the same reasons for refraining from killing do not apply to fetuses and paradigm rational persons, *and* that there is not other reason that should prevent abortion. To make the first point, Sikora claims that it would be "disastrous" and "fatal for civilization" if the killing of paradigm rational persons were not prohibited. This is the classical (and arguable) argument that the breaking of socially accepted conventions would weaken the general faith in and the respect for a rule or institution, with its usual equally arguable corollary of the snowball effect or slippery slope (what if every one would...?). After this statement Sikora sees no need for a further defence of the first point but in a footnote (108 n.11), where he states that the "indirect effects"(that is, the weakening of the general faith and respect for a rule or an institution) resulting from killing innocent persons in general would be enough to make it wrong. These indirect effects, he says, do not exist with abortion. No reason is given. With regard to the condition that no other reason should exist to prohibit abortion, he applies the hedonic calculus: in an overpopulated world, an increase in population would decrease the sum total of happiness. This reminds us of Bernard Williams' "unblinking accountant's eye of the strict utilitarian" (Smart & Williams 1973: 113). Like other utilitarians, Sikora seems more concerned with animal rights (or rather pleasure for that matter) than with the right to life of the unborn and infant, sentient or insentient, healthy or handicapped. Paradoxically, however, for a self-confessed rule utilitarian, Sikora claims:" our moral rules for the treatment of animals should be different from those applying to persons, and closer in some respects to act utilitarianism"(97). If utility/happiness/pleasure is to be promoted and if any sentient creature has the same weight in the hedonic calculus, it is inconsistent to apply different rules to animals and to humans. Is utilitarianism not against any discrimination and against speciesism?

For act utilitarians, the best action is the one that produces the most utility/good/happiness for all concerned, that is, for all sentient beings. An action is wrong if it maximises disutility/unhappiness for all concerned. Let us assume that you

are an act utilitarian. You have two children. Your job provides you with an income that allows you just to make ends meet. Your wife has a heart condition that would worsen with pregnancy. Therefore, she was sterilised. Sterilisation by tubal ligation is, however, not fool-proof.[8] Now she is pregnant. Her health would be seriously threatened, perhaps even her life. Your budget cannot afford an additional child. A third child would seriously jeopardise the well-being and the education of your two children. Since you are an act utilitarian you adjudicate. The sum total of happiness would be achieved through an abortion, regardless of the fact that the unborn is (or might be) sentient.

It thus appears that the rule utilitarian argument (at least the one presented by Sikora) in favour of abortion on demand is unconvincing. It is unconvincing because even if overpopulation should be considered very seriously, it should not be solved through the globalisation of abortion. Abortion is a *personal* moral problem. The global aspect of abortion lies with education, and family planning policies.[9]

The appeal to act utilitarianism (at least the plausible one presented above) in defence of abortion needs to ignore the emphasis put on sentience. In a hedonic calculus, the pain of the unborn does not outweigh the disutility inflicted to the woman and her next of kin.

If one agrees with Holmes Rolston III (1993: 271) statement that "all ethics seeks an appropriate respect for life", one should perhaps turn to Smart's (1967: 172) restricted utilitarianism. The basic principle is that "actions are to be tested by rules and rules by consequences". This implies that "in every case if there is a rule *R* the keeping of which is in general optimific, but such that in a special sort of circumstances the optimific behaviour is to break *R*, then in these circumstances we should break *R*". And, "let us go down to realities, human happiness and misery, and make these the objects of our pro-attitudes and anti-attitudes"(181).

Sentience

Having briefly overviewed the main thrusts of utilitarianism and of its multiple variations let us again focus on the concept of sentience and sentient beings. Although this essay is about the use of sentience as a criterion of moral standing for the unborn, and not a manifesto for animal rights, it is impossible to dissociate the issue of sentience from its use by animal rights activists. If the general principle of

utilitarianism is that we have a moral duty to maximise the pleasure of *all sentient beings*, we should clarify the concept and the category referred to, and, importantly, the boundaries thereof. As Mary Anne Warren put it:

> If sentience is the criterion of moral standing then not even a fly should be killed without some good reason...If killing people is harder to justify than killing rabbits, it must be because people have some moral standing that is not based on sentience alone (1991: 309).

Marcus Aurelius recommended respect for all sentient creatures. Nevertheless, he does not appear to have had much impact on the way animals were treated for centuries. For René Descartes, "animal non agit, agitur" (animals do not act, they are activated like a puppet)(Lorenz 1979: 42). Animals are ultimately only *res extensa*, merely fleshy machines; their apparent pain behaviour is not a true reflection of real pain. Only beings with mental states, *res cogitans*, do really feel pain (Pence 1995: 203-204). Immanuel Kant (1963: 239) wrote in *Lectures on Ethics*: "animals are not self-conscious and are there merely as a means to an end". Jeremy Bentham's dictum, "what matters is not whether they can reason or talk but whether they can suffer" is supposed to mean that there is no good reason for excluding the pleasures and pains of animals from the ethical calculus. Bentham also recognised that it is perfectly possible to slaughter animals painlessly (Baird Callicott 1993: 349). However, like Marcus Aurelius, he too had no real impact on the recognition of animal rights during his lifetime. The earliest manifesto for animal rights is probably the one by Berlin physician Wilhelm Stern in his *Foundation of Ethics as a Positive Science* (1897). He wrote:

> All ethics are an affirmation of life, the characteristic of which is determined by perception of the danger to existence which living beings experience in common...The whole animate creation is to be included within the basic principle of the moral. The fundamental commandment of ethics, then, is that we cause no suffering to any living creature...unless it is to effect some necessary protection to ourselves (quoted in Schweitzer 1987: 259-260).

To be consistent with the three basic principles of utilitarianism one has the moral duty to refrain from inflicting pain to any sentient being, and to promote the

pleasure of all sentient entities. For many utilitarians that includes nonhuman animals. Singer states his "principle of equal consideration" as follows:

> So where human and nonhuman animals share an interest -as in the case of the interest in avoiding physical pain – we must give equal consideration to *similar amounts of felt pain,* and what this is will vary from case to case (1993: 852).

These two quotes, once again, raise the difficulty that follows the equation of pain with suffering. Ideal utilitarianism is distinguished from classical hedonistic utilitarianism for having elaborated a sort of sliding scale of pleasures: the pushpin equal to poetry against a pig satisfied and Socrates unsatisfied. It seems that what is lacking from utilitarianism is a sliding scale for pain and suffering. As we have seen earlier, both friends and foes of sentience are borrowing from alleged neuroscientific data to either ascribe or to deny sentience, and keep the concept within the narrow boundaries of the ability to feel pain and pleasure (with the main emphasis on the ability to feel pain).

The *Concise Oxford Dictionary* (1995: 1261) defines sentience as "having the power of perception by the senses". This is similar to Stedman's *Concise Medical & Allied Health Dictionary* (1997: 792) definition: "capable of characteristic sensation". Sensation is defined as "a feeling; the translation into consciousness of the effects of a stimulus exciting any of the organs of sense"(791). In the glossary of *Embryo Experimentation* edited by Peter Singer *et al* (1990: 252), sentience is defined as follows: "strictly, the ability to sense something; but in ethics the term is normally used to refer to the ability to feel (at least) pain". This contrasts with Scarry's (1985: 22) view on "human sentience" as "the felt-fact of aliveness that is often sheerly happy". In addition, Scarry writes: "pain is like other forms of sentience but devoid of self-extension that is ordinarily the counterpart of sentience"(162); "pain enters into our midst as at once something that cannot be denied and something that cannot be confirmed"(13).

The pursuit and the promotion of pleasure is a fundamental feature of hedonistic utilitarianism. Some of its advocates have elaborated on the concept of pleasure leading to the two notions of the so-called lower and higher pleasures. Other utilitarians have given more weight to the duty not to inflict pain to any entity capable to feel. It would appear, however, that sentientism falls short from establishing a

hierarchy of pain. Is pain just pain? Is pain always bad? Is feeling pain synonymous with suffering? Is there a threshold or minimum neural equipment that demarcates the category of beings only able to feel pain from those able to suffer? If so, what are the criteria? Alternatively, is sentientism just an argument from emotion? One may also wonder whether the thesis of sentientism is tenable. Is it a version of the doctrine of the sanctity of life – every sentient being is sacrosanct. It appears that some of the advocates of sentientism do recognise that such a rule is not tenable and see the need to qualify the concept of sentience. For instance, for Steinbock (1992: 23), it is in a sentient being's *interest* not to experience pain. However, to support her "interest-based approach", she feels it necessary to argue that the possession of interests requires "the capacity of conscious awareness"(13). If this is the case, we return to the suggested links of pain/primary consciousness against suffering/higher-order consciousness. It then follows that pain and suffering are not synonymous and that mere sentience would only confer a kind of low-ranking moral considerability (as suggested by Mary Anne Warren's quote). An alternative position has been defended by Tom Regan in *The Case for Animal Rights* (1983). Regan argues that consciousness is not necessary for having interests and that sentient beings can be given treatment which is good for them, for their own sake. His postulate is that animals have inherent value not only because they are sentient but also because they are "subjects of life". This view sounds very close to Henri Bergson's thesis of *vitalism* – "the mystically inclined observation of nature" (Lorenz 1979: 41); the view that a living entity is not reducible to a physico-chemical machine, but that there is something supervenient, a property of some kind added to the physical substrate, something like Bergson's *élan vital*, Aristotle's *psyche*, Spinoza's *conatus* (the desire to exist), or Schweitzer's will-to-live. In the same line of thought, Pierre Teilhard de Chardin said:

> Life, if fully understood, is not a freak of the universe – nor *Man* a freak of life. On the contrary, life physically culminates in *Man*, just as energy physically culminates in life (quoted in Lewin 1993: 141).

The battle between vitalism, reductionism, and emergentism is not over. Neuroscientists are charged of reductive materialism – that is, that the mind and the brain are one single thing, a complex network but still just a network of neurons, a

purely physical thing. This is in contrast with emergentism that holds that "life, at all its levels, is but the result of a common, fundamental, internal dynamic" (Lewin 1993: 179). On this view, "the assembly of a living organism is subject to physical law", but, contrary to reductionism, "the product is not derivable from the laws themselves"(ibid.). Emergentism is an attempt to explain the order in nature in a holistic perspective, a quest for an "internal self-organising principle", a global property, an emergent structure that results from the interaction of entities in a complex system (188).

I am not arguing that it does not matter how you treat any living entity. Neither am I arguing that it does not matter how you treat a sentient being (whatever sentience might be). I am arguing that sentience as a criterion for moral standing – whether linked only with the right not to be inflicted pain and/or the right to life – *as it is presented by its utilitarian advocates* – does not seem convincing, and, moreover, might not even be tenable. It is as untenable as the doctrine of the sanctity of life. If life is sacrosanct, real practical daily life is impossible. If the sanctity of life applies only to human life, we have no choice but to be speciesist (and why not racist, machos or whatever kind of ideological supremacist?). It seems more conceivable and realistic to consider life in all its manifestations in the perspective of "respect for life". Sentientism, as portrayed by some utilitarians, is unconvincing in the way they underpin their thesis with weak or unsubstantiated alleged neuroscientific arguments. Finally, it also suffers from a lack of attention to the difference between pain and suffering.

The issue of pain and suffering has attracted much attention especially since the end of World War II. What happened in the concentration camps (not to mention the Soviet gulags, the Armenian genocide, etc.), everywhere in the world, when revealed after the armistice, has rightfully horrified us and led to the Universal Declaration on Human Rights. In medicine, interest in the pathophysiology of pain is only about one century old. In 1903, French neurologist Jules-Joseph Déjerine presented two cases of "thalamic syndrome" – instances where in the absence of cortical control of the body (hemiplegia), the paralysed half of the body is the site of sharp and persistent pain, an indication that the thalamus is a major relay station for sensory nervous pathways, as it was confirmed by Gustave Roussy, in 1907. In 1911, Henry Head and Gordon Holmes concluded that the thalamus is the *pain center*, the locus of conduction, control, and regulation of the body's sensory afferents. When the

tuning role of the thalamus is lost (as it is in the thalamic syndrome) it results in unbearable loud and painful sounds (Rey 1995: 264,279). Against William James' reduction of emotion to a physical expression or behaviour, Walter B. Cannon's book, *Bodily Changes in Pain, Hunger, Fear and Rage* (1915), was an argument in defence of the thesis that pain is not a mere sensation, but rather a sensation pregnant with emotion.

Influenced by Henry Head's work on the thalamic syndrome, McGill University pain researcher Ronald Melzack published a trilogy: *The Puzzle of Pain* (1973), *The Challenge of Pain* (1983) (a revised edition of the former, published with Patrick D. Wall), and *Gate-Control Theory of Pain*. With W.S Torgerson he developed what has become known as the *McGill Pain Questionnaire*, a tool to assess the quality and intensity of pain in clinical practice. Melzack's main emphasis, expressed in the gate-control theory of pain, is that the perception of pain is affected by psychological processes – such as past experience, attention, emotion, etc. – that open and close the spinal gating system. He insists on the distinction of pain *affect* and pain *intensity*. The pain affect is "the emotional arousal and disruption engendered by the pain experience" – that is, the contribution of physical pain to suffering. The pain intensity is "the dimension of pain as measured on a scale" – the scale being the McGill Pain Questionnaire (both quotations in Mayerfield 1999: 62).

The difficulty with physical pain is that "it differs from any other sensory perception by not having an object in the external world...it is itself alone"(Scarry 1985: 161). Physical pain cannot be denied and cannot be confirmed. Pain does not occur in isolation; it elicits an affective reaction, a quale, without which it is not pain in the true sense of suffering. As Melzack (1973: 47) put it: "If injury or any other noxious input fails to evoke negative *affect* and aversive drive the experience cannot be called pain". It should be stressed that Melzack is a pain researcher who, as such, focuses on the pathophysiology of the human body in pain. He is not expressing himself in philosophical or phenomenological terms. When he talks about the affect of pain he is, in fact, talking about suffering.

If the wrongness of abortion rests on the premise of the wrongness of inflicting *pain*, a series of questions need an answer. This is what we are now turning to.

The "pain" of abortion

The issue of abortion cannot be addressed *in vacuo*. Abortion involves two aspects: medical and non-medical. The medical aspect of abortion is about the different categories of abortion, and the way they are handled in strict medical terms.[10] The non-medical aspects of abortion are social, psychological (or psycho-somatic in the sense that there is undoubtedly physical pain and psychological affect), legal, and ethical. In addition, pregnancy is by its nature a very special and unique condition where two human beings are intricately and undissociably involved. Equally by virtue of its nature, the end of a pregnancy, be it an abortion (in the general medical sense of an interruption of pregnancy prior to the viability of the conceptus) or a delivery, is a painful event. Women experience uterine contractions as painful; they feel "labour pains" (the term used in labour wards to refer to uterine contractions). In proper medical conditions, good clinical practice requires these pains to be alleviated. The nature of labour pains, however, is such that in the best conditions - that is, a planned pregnancy, an uncomplicated labour, and the psychological support of the consort (and attending staff) - they do not have an untoward psychological effect on women. In other words, there is no real *suffering* involved. This is not to say that even in these ideal conditions adequate pain relief should not be administered.

Abortion (spontaneous or induced), however, should be seen in a different light. With abortion, there are uterine contractions, and they too are painful. The difference is that these pains occur in a very different psychological context. The spontaneous abortion of a planned pregnancy thwarts a woman's desire to bring to life a new human being. In societies where a woman's ability to bear children is paramount for her status, both in the family and in the community, an abortion is undoubtedly a cause of deep suffering. On the other hand, one should not minimise the agony of women who have no choice but to terminate an unwanted, unplanned or forced upon pregnancy. There is little doubt that even in societies where abortion is used as a method of family planning, abortion leaves scars.[11]

These points are not difficult to make and to understand. We are talking about women, persons, people with rationality, who are sentient, able to feel pain and pleasure (lower and high), and able to suffer and enjoy, as we are. We know that their *brain* has reached the structure and function needed to reason, to feel emotions, to

experience painful stimuli and to integrate all these things that make what philosophers would call a paradigm mature person. The question, now, is: Can we say the same about the unborn?

The thesis of the "soft pro-choicers" is: 1) nothing matters to the pre-sentient fetus; and 2) it is in the sentient fetus' interest not to be inflicted pain. It follows that the pre-sentient fetus can be aborted. So far so good, in a utilitarian perspective. Statement 2, however, raises questions. First, it has not yet be proven beyond reasonable doubt that sentience is actually acquired, at least before the stage of fetal viability. Second, what do we know about the pain allegedly inflicted to an allegedly sentient fetus? Moreover, third, with respect to the hedonic calculus, whose pain/suffering takes precedence? Is it the one we know of, or is it the one we only might suspect? Is the choice in favour of a harmless, defenceless, and innocent unborn not purely emotional?

Emotions run high around the issue of abortion. One of the latest examples making headlines in the United States is the so-called "partial birth abortion" – a non-medical term for second trimester abortion, where allegedly the fetal body is dismembered and the skull suctioned out to allow the passage through the cervix.[12] This is not only a misrepresentation of the real facts about abortion, but also a misrepresentation of the character of women seeking an abortion and of the providers. Another good example is the "hit list" (sic) of *The Nuremberg Files* (sic) accessible on http://www.christiangallery.com/atrocity/. Abortionists are equal to the mass murderers on trial at Nuremberg! Women are not less callous! The use of misoprostol and of mifepristone to medically induce the termination of a pregnancy is called "chemical genocide". Is this purely emotional or is it not rather fundamentalism, intolerance, and ill-conceived ideology?

Let us look at the straight facts. Before the availability of the medical drugs to induce uterine contractions, say, for the purpose of abortion[13], abortion was achieved instrumentally. So-called "unsafe" (backstreet, illegal, septic, or "criminal") abortions were practiced by introducing all sorts of tools/instruments poking inside of the uterus. This, for sure, was "damaging" the embryo/fetus, not to mention the physical and psychological damage to the woman. Needless to say that these procedures were (are) done "live". If the embryo/fetus were sentient, this sort of procedure would be painful. On the other hand, the use of "uterotonics" (agents inducing uterine contractions) results in contractions, dilatation of the cervix and expulsion of the

uterine contents, just the same as with a normal delivery. What probably differs is that the embryo or early fetus is unable to withstand the decrease in oxygenation that occurs during the uterine contractions. As a result, at the time of expulsion the conceptus is mostly already dead. Did it suffer? Did it feel pain? A comparable situation is encountered in case of stillbirth, an intra-uterine death after viability. A macerated stillbirth is an intra-uterine death that occurred at least 24 hours before birth; a fresh stillbirth is an intra-uterine death less than 24 hours before birth, usually during labour. The former may be due to congenital malformations or to intra-uterine infections; the latter is usually the result of asphyxia, a lack of oxygenation. Was the death painful? We do not know. In fact, we do not even wonder! What we know definitely is that the woman suffers from the loss; we know hardly anything about the pain/suffering of the unborn.

Concluding remarks

A *hard pro-life* position follows the rule "thou shalt not kill" – an exceptionless categorical imperative. This kind of stance motivates what could be called a "restrictive" pro-life attitude in the sense that it means usually that the commandment applies to the sanctity of *human* life. In a much broader sense, the rule applies equally (and even more strongly) to the position advocated by environmental ethicists who extend the value of life beyond the world of sentient beings. For instance, Rolston (1993: 271) argues against sentientism for, in his view, it limits the world of ethics to what he calls "mammalian ethics" (or "vertebrate chauvinism" for Baird Callicott) – "an extension of humanistic ethics to mammalian cousins". He further argues against sentientism and its view that nothing matters to insentient beings. He writes:

> Nothing matters to a tree, but much is vital to it...Something more than physical causes, even when less than sentience, is operating within every organism...Without it, the organism would collapse into a sand heap (277).

In other words, sentience does not mark the boundaries of life and of the type of life that warrants respect. On his view, "all ethics seeks an appropriate respect for life"(271); this does not mean that all life is sacrosanct. Rolston's position is similar to

Schweitzer's (1987: 311) claim: "thoughtless injury to life [is] incompatible with ethics". It is quite paradoxical that, for instance in the United States, conservative politicians use the anti-abortion/pro-life platform to be elected, and that the same conservatives are reluctant to implement the international agreements that would help to protect the environment. Such a position is not only shortsighted, but also unethical and contradictory.

It is not clear to me what the soft pro-life stance really does bring to the abortion debate. Like the casuistry of the doctrine of double effect and of the doctrine of self-defence it makes, in my view, no significant contribution to solving the agony and the complexity of the issue at hand.

The soft pro-choice stance claims to have contributed to a new approach – a "Third Way". Nothing matters to the pre-sentient embryo/fetus (hence early abortion is permissible and morally neutral). Everything matters to the sentient fetus (and to the non-human sentient animal). What matters is: one, that the sentient fetus should not be inflicted pain (because it is alleged that abortion inflicts pain to the sentient fetus) (no mention is made of the ordeal of the birth process); and two, that a life full of happiness is awaiting him or her (no mention of suffering during extra-uterine life as though only a blissful life is ahead of all fetuses). Besides the arguments made earlier – that we hardly know anything about the fetus' ability to feel pain (much less to suffer); that we know nothing about the alleged pain endured by the fetus during abortion; that there is a grey area or a transition period between insentience and possible sentience – it seems that the ***thesis of*** sentientism is no more than the argument from potentiality in disguise. And the argument from potentiality can be seen as the use of a utilitarian premise in a deontological argument (Wennberg 1985: 93). Sentientism assumes that there is a pre-sentient stage followed by a gradual acquisition of sentience. The latter is not a marker event in the sense that sentience would appear suddenly out of the blue. Sentientism assumes that there is a sliding scale from non-sentience, through partial sentience, to full sentience. In other words, the pre-sentient entity is potentially sentient. Sumner, a self-confessed "moderate" classical utilitarian, writes:

> A prethreshold fetus, unlike an oyster or a radish, has sentience in its future. For classical utilitarianism, the future matters, indeed it is all that matters... Once it is capable of being harmed, the future awaiting a human fetus is highly relevant to the extent to which it can be harmed (1981: 221,227).

Is this position different from the claim made by the argument from potentiality that, since the embryo/fetus is a potential person, it deserves the same right to life as a real person? Like the soft pro-choicers, the soft pro-lifers admit that there is a stage where the pre-embryo is not yet an individual, a person (hence not even a potential person), and that abortion of the pre-embryo is morally neutral. Hence, it can be argued that there is no fundamental difference between the two arguments, and that the "Third Way" is a pro-life stance in disguise rather than a genuine pro-choice advocacy.

Kenneth Goodpaster (1978) has argued that sentience is not an end in itself but evolved as a means to further the goal of survival. Therefore, since sentience is ancillary to life, the capacity to live should be the criterion of moral considerability. He suggested that a living being might be defined, for the purposes of ethical analysis, in terms of conations – an inherent tendency, direction of growth, and natural fulfillment (something like Aristotle's telos). Holmes Rolston III (1988) argued that sentience adds a "value bonus" to conativity; the richer an entity's sentience, the more intrinsic value it possesses (in addition to being a subject of life). For Baird Callicott (1993: 354) "minimal moral considerability doesn't mean ***rights***". It could then be said that the claim that sentient beings have a right to life should be replaced by the claim that sentient beings are intrinsically valuable.

In conclusion, Susan Dwyer's comment on the gradualist view (footnote 7) is worth quoting:

> It is worth noting here that not all philosophers think that the moral standing of the fetus is determined by the fetus' intrinsic properties. Some argue that the fetus' moral status is also function of its relational properties (1997: 5).

On this phenomenological view, advocated by Catriona Mackenzie (1997: 175-193), the pregnant woman and the unborn are a single entity. Therefore, "the moral status is determined not only by features it lacks or possesses but also by the relations in which it stands to others" (Dwyer 1997: 10). And the first relation in which the unborn stands to others is nobody else than the pregnant woman who says: "I invite you in" (to use Judith Jarvis Thomson's expression, although out of the context of her argument), or "I grant you moral status". This view then becomes rather what Rorty

(1998: 38) says about personhood, "an acceptance of another being into fellowship rather than a recognition of a common essence".

8 Post-structural neurophilosophy

> *Happily to endow inanimate nature with sentience and a capability of moral action is one of the severest tests of the poet.*
>
> Edgar Allan Poe (1850)

Introduction

In this section, the concept of sentience will be posited in a broader perspective than the mere ability to feel pain and pleasure. As we have seen, sentience is mostly portrayed as a property of *living* entities, human and nonhuman. Moreover, sentience is linked with rights – more specifically, the right not to be inflicted pain and the right to life – by a number of moral philosophers. I wish to argue that the concept of sentience, as it is appealed to in the moral philosophy of sentientism, is part of a deterministic algorithm. In other words, the advocates of sentience categorise and dichotomise the living world into sentient and insensate beings; the former have a moral standing and the later lack it. The advocates of sentience see it as *the sine qua non* qualifier of moral considerability. They regard sentience as a physical state of the machine (the nervous system) that realises a certain functional state (the ability to feel). Therefore, sentientism is stuck with the inescapable "either/or" dilemma and its metaphysical commitment. Finally, sentientism belongs to one of the traditional rule-based views on abortion with its own master key for unlocking the dilemma: pro-life/pro-choice, anti-choice/pro-choice.

In order to escape from the metaphysics of presence (the ability to feel is present or is not) one has to relinquish the simplistic, reductionist and functionalist view on sentience. To my mind, sentience cannot fit into a simple unifying discourse. Sentience and pain are much more complex than portrayed by sentientism. As an alternative, I propose to deconstruct the concept of sentience to show that it can be supported, not proven. Furthermore, I will argue that fixing the boundaries of moral standing – that is, sentient *vs.* insensate – is not only impossible, but leaves out of our moral consideration a vast world of entities with moral considerability.

Connectionism and sentience

As we have seen in Chapter 4, the two mainstream contemporary theories of the mind – that is, how the brain (the anatomical substrate) allows the mind (the function) – are functionalism and connectionism. The former can be qualified as rule-based, deterministic, and algorithmic. Put simply, the brain is equivalent to the hardware of a computer, and the mind is the software. In other words, the brain is hard-wired, pre-programmed; it interacts in a linear fashion with the information originating from the outside. Connectionism, on the other hand, sees the brain-mind unit as a fluid, flexible, non-linear, non-algorithmic, soft wired, non-pre-programmed, non-deterministic, complex system.

In a functionalist perspective, an input produces a predetermined specific output. A blow on the head produces pain. Indeed, this is how it goes, but only partly though. An input produces an output depending on the structural and the functional condition of the body. For instance, when a physician taps the patellar tendon of the knee wit a patella hammer a tendon-jerk is elicited, provided the synaptic connections within the spinal cord, the motor nerves and the descending motor pathways are intact. Similarly, the Babinski sign (the extension of the big toe with fanning of the toes) in response to stroking of the lateral aspect of the foot sole is also a spinal reflex but it indicates an upper neuron lesion (i.e. brain damage). What this means is that the presence of a reflex reaction to a stimulus may be indicative of a well functioning nervous system as well as of a malfunction. Advocates of sentience do not seem aware of these simple and basic neurological facts, for they interpret a reaction to a stimulus as a clear indication that the entity is sentient and able to feel pain and pleasure. However, this is no more than a mere assumption. Similarly, concerning pain, sentientism fails to address the complexity of pain. Pain is not just pain.

Indeed, pain is "a complex subjective phenomenon made up of sensation indicating real or potential tissue damage and the affective response it generates"(Berkow *et al.* 1992:1407). Furthermore, there is acute and there is chronic pain. Acute pain is a biological signal, short-lived, aimed at avoiding a potential injury or at signalling an established injury. Acute pain is accompanied by anxiety and by hyperactivity of the sympathetic nervous system (*i.e.* accelerated heart rate and

respiratory rate, sweating, dilatation of the pupils, and increased blood pressure)(ibid.). Chronic pain is further subdivided into nociceptive (an ongoing activation of pain-sensitive nerve fibres), neuropathic (a nerve tissue damage), and psychogenic pain (without organic lesion as, for instance, the Munchausen syndrome)(1408). This is only a very limited overview that can only give a glimpse on the complexity of pain (seen from a neurological point of view, not to mention the affective aspects of pain) and point at the shortcomings of sentientism. What is it to have the ability to feel pain? What does a sentient entity really feel? What does a so-called lower animal[1] feel (assuming that it does)? What is the affective response to pain, if any, of a lower or higher animal? What is the affective response, if any, of an embryo or fetus to the alleged pain inflicted by abortion? The list of unanswered (if not unanswerable) questions could be extended *at libitum*. As long as the concept of sentience remains unqualified (if ever it can be) or limited to the mere alleged ability to feel, sentientism is bound to fail as a neurophilosophical argument. Even if (perhaps one day) the neurosciences were advanced enough as to unravel the mystery of sentience and qualia, would it change our ethical behaviour towards insensate entities?

It is my contention that a connectionist approach to sentience stands a better chance than functionalism. The point is not to deny that the ability to feel pain should be taken into consideration. We should be neither blind to nor blinded by sentience. The point is rather to acknowledge the complexity of sentience and to expand the attribution of moral considerability beyond the boundaries of a shaky and ill-defined concept of sentience. The question is: Can we analyse sentience? Can we dissect sentience into elementary components? The answer is no, because sentience is a dynamic interaction between the elements that make what it is. The concepts of sentience and pain are complex and we must admit that, to a large extent, we do not understand them. Sentience has most of the characteristics of complex systems described by Cilliers (1998). It is a system characterised by a large number of elements that transfer information in a non-linear fashion. The interaction can be increased or decreased. There are loops and feedbacks. Sentience is an interaction with the environment. The elements constituting sentience 'inter-interact'.

What distinguishes connectionism from functionalism is the acknowledgement of complexity. Complex systems are characterised by two vital properties:

representation and self-organisation (Cilliers 1998: 11-12).[2] Representation refers to the mode of "storage" of information for future use, and self-organisation refers to the ability to cope with unpredictable changes in the environment. Representation is the fact that "a certain pattern of activity will be caused in the system each time a specific cluster (*i.e.* the values of the weights in the network) is present"(93). For instance, "if a certain state of affairs regularly causes harm to the system, the system will associate that condition with harm"(ibid.). In a neural network, representation involves that the structure of the system is not determined by the outside but involves elements from the inside and the outside, and that the previous states of the system are of vital importance. Sentientism dwells on the idea of a closed system, of a distinction between the inside (the ability to feel) and the outside (the infliction of a painful stimulus). It looks at sentience in a synchronic manner and in terms of deterministic rules. The concept of sentience should rather be seen in a diachronic perspective (how the state of the system was arrived at), and in terms of a relationship.

A neural network has to be trained. Training allows the system "to 'evolve' in the direction of a solution"(28). This might suggest that the first experience of harm/pain needs repetition in order to learn what it is to feel pain (or pleasure). In other words, representation is a learning process that requires training of the network, the neural network of the brain that is.[3] The mesh of the network comprises nodes (*viz.* like the knots in a fishing net). The strength (or the weight) of the connection (or the synapse) between an input node and an output node depends on its positive (or excitatory) or negative (or inhibitory) connections. The weights characterise the network. A strong fishing net can catch big fish and a weak one only a few sardines. With holes in the net, you catch nothing. A single knot is not a net, but each knot of a net contributes to the overall strength of the whole fishing net; the quality (the strength) of the net is distributed throughout the mesh and the knots. The analogy ends here because you cannot train a fishing net to catch fish, and the fishing net is unable to repair itself. It is unable to self-organise; it needs a designer. Connectionism rejects the concept of a designer, and favours self-organisation.

It should be clear from our current knowledge and understanding of the neurosciences that the concept of distributed representation is incompatible with Gall's concept of phrenology. The brain contains no pontifical cell and no homunculus. Although the brain does possess areas where a specific function is

predominant (*e.g.* Broca's speech centre in the left temporal lobe of the brain), it is now obvious that none of these "centres" operates in isolation. They are interconnected mainly through the associative cortex in a manner similar to the hidden layer of a neural network. Therefore, the argument of the presence of a "pleasure centre" that the utilitarian animal lover has the moral duty to stimulate to make his or her pet happy has no leg to stand on. Interestingly, no such "centre" is claimed (and actually does not exist) for pain; the loci involved in the perception of pain are scattered throughout the peripheral and central nervous system. They are truly *distributed* and in reciprocal contact through loops and feedbacks.

The other leg of complex systems is self-organisation, which refers to the way an internal structure handles new situations, "the way in which a complex system develops organised structures" (12). It is obvious that if the brain were hard-wired and pre-wired it would be impossible to adapt to new circumstances and to learn. If that were to be the case, living entities, human and nonhuman, would be no more than automatons. There would be no way to learn that a specific stimulus results in a specific reaction. It would be impossible to avoid to be repeatedly damaged or to repeat a pleasurable experience. We have seen in the previous chapters that the brain is in constant reorganisation. Cells die. New connections are established all the time. Synaptic plasticity is an ongoing process. If this were not the case, the brain would shut down. In Kauffman's (1995: 25) view, self-organisation "is the root source of order". Against the Darwinian theory of natural selection (that ontogeny – the development of a fertilised ovum into an adult – is spontaneous) where stability arises after a series of evolutionary experiments, Kauffman argues that "this stability cannot be imposed from outside by natural selection...but from within as a condition of evolution itself". Ontogeny, he says, "is a natural expression of the self-organisation that abounds in very complex regulatory networks" (25). Self-organisation, "order for free", lies in "the ordered regime between order and chaos, a phase transition between order and disorder...a web of compromises...with no certainty about the next step" (26). A small cause can have huge consequences like in Per Bak's experiment with the sand pile.[4]

It is safe to say that the contemporary neurosciences have a strong leaning towards connectionism. Therefore, a neurophilosophical argument about the moral implications resulting from the ability to feel pain should take the neuroscientific

evidence into consideration rather than to rely on folk psychology – belief-desire psychology.

In the following section I wish to argue that the misconception of sentience has wider implications than could be imagined if sentientism were pushed to its philosophical limits.

Sentience and global issues

Thomas Malthus' *Essay on Populations* (1798) had an undermining influence on the Enlightenment belief in unlimited possibilities of human progress. His thesis was that since the natural tendency of populations is to grow faster than resources this would inevitably lead to famine. In *Animal Liberation: A Triangular Affair* (first published in 1980), Baird Callicott (1995: 243) holds a similar argument: "A global population of 4 billion persons and showing no signs of an orderly decline presents an alarming prospect to humanists, but is at present a global disaster for the biotic community". At the time of the present writing, the world population is close to 7 billion! Does it follow that, in Garrett Hardin's (1995: 334) words "freedom to breed is intolerable"? What is worse: unrestrained population growth, followed by crash and die-back, or stringently imposed population control limiting reproductive rights (Battin 1998: 161)? Cornucopians argue that the earth's resources are not in danger, and that the planet could sustain up to 1,000 billion people. However, this view does not take into consideration the problems posed by pollution, waste disposal, water supply – the most burning issue, so to say, to face in the near future -, etc. The levelling-off assumption does not take into consideration that it is unlikely to happen in the least developed nations, and that where it happens economic development brings with it dramatic increases in rates of consumption (155-156). The situation leads to the utilitarian dilemma of the highest average level of welfare versus the greatest aggregate total of welfare. Margaret Pabst Battin reminds us:

> Neither coercive population control, nor cavalier acceptance of die-back, nor naïve acceptance of optimistic but unfounded Cornucopian hopes is a satisfactory solution. The population issue

> is a real one, with massive human consequences...What if everybody, both male and female, were to use long-term reversible, 'automatic' contraception, so that the sustaining or siring of pregnancy required a positive choice, rather than simply a negative choice to prevent it? Such a picture would be morally acceptable...if it were genuinely universal...[no effective effort to control population at all] is potentially starker and more cruel than any form of rigorous population control at all, since it involves widespread crash and die-back – that is, human death or non-reproduction on a widespread scale, either from starvation or other population-related causes (1998: 160).

Battin's argument is that family planning does not work because it is a negative decision. One has to decide not to procreate. Her suggestion is that every one should be on a contraceptive method, and make the positive choice to stop it when deciding to procreate. Although the argument is debatable, she has a point in that the population issue is a real problem one has to face. Each act of procreation has moral consequences, not only on the individual that is created but also on society and the planet. John Stuart Mill stated, in *On Liberty* (quoted in Ladd 1996: 68), that to bring a child into existence without fair prospects of a happy life is a "moral crime" because of the wrongness of bringing needless, avoidable suffering in the world. He (arguably) considered that it was the State's duty to take care of such children. One could argue, like Harris (1996: 68), that the right to found a family "might involve constraints on the sorts of people judged fit to produce and rear children" for the sake of securing the interests of the next generation. One of Harris' arguments is that in the case of adoption "we think it matters that people establish that they are fit and proper potential parents before we permit them the custody of children" (79). Why not, then, would the same not apply to genetic parents? Archer (1996: 112) argues: "the right to bear children is not absolute and that it only grounds a right to rear upon an objectionable proprietarian picture of the child as owned by its producers". Unlike LaFollette (1980), who defends the view that parents should be licensed to rear children for it is a potentially harmful activity that requires skills, Archer extends the argument to a licence to procreate (115). To determine the "fitness to parent" would raise enormous difficulties. This is not the point of Neo-Malthusianism. The point of Neo-Malthusianism is rather whether the planet earth will be able in the near future to sustain the exponentially increasing world population and provide it with a decent

quality of life (the global view on procreation). In other words, it raises the question asked by Melinda Roberts (1998: 145):"Can existence make someone worse off than non-existence". Instead of *someone*, one should say the *world population.* If the prospects of the planet are what futurologists and environmentalists suspect – overpopulation, depletion of the ozone layer, global warming, water shortages, and famine – the morality of procreation needs serious attention. To bring into existence "wrongful lives" – that is, living human beings with prospects of suffering pain and harm rather than an acceptable level of quality of life – is worth our moral consideration.

As I have said earlier, it is unlikely that contraception or family planning will eliminate the need for or the fact of abortion and of the disposal of frozen embryos. I would agree with the abovementioned reasons pointing at a need to limit the population explosion. Even in the (hypothetical) event that all pregnancies were planned, there is and will be nevertheless a need or a request for genetic screening (e.g. Down's syndrome, thalassaemia, Tay-Sachs disease, Duchenne muscular dystrophy, etc.) and the ensuing request for abortion. Anencephalic babies will still be born. Reproductive technologies will still be needed to help infertile couples (with the resulting supernumerary embryos, or the need or request for fetal reduction). Responsible reproduction is one thing (direly needed). Pregnancy-related ethical dilemmas will remain with us in spite of contraception. The difficulty is to reach an acceptable and decent ethical stance. Commenting on John A. Robertson's (quoted in Roberts 1998: 186) words, "amorphous concerns regarding subtle indignities experienced by entities whose ethical status is at best unclear would not weigh in at all" (*viz.*, the frozen embryos and stem cells), Roberts says the following. What matters is not the "profound respect" due to human embryos or the "prima facie demands" regarding their treatment, "but rather [the effect] on the flesh-and-blood children that are produced" (187). Quoting Konrad Lorenz again:

> The fate of humanity hangs on the question whether or not responsible morality will be able to cope with its rapidly growing burden. We shall not lighten this burden by overestimating the strength of morality (1979: 218).

This passage, first written in 1963, is about the world population. As an ethologist, he writes basically about nonhuman animals but makes inferences about human behaviour (as compared to nonhuman animal behaviour). In the case of rats, he writes, reproduction stops automatically when a certain state of overcrowding is reached (204). Should we then hold the renegade view that rats are cleverer than we are? Perhaps this section on the global consequences of sentientism should conclude with Hans Jonas' (1996: 19, 37) words:

> The moral worth of life only comes into being with the phenomenon of obligation, and obligation requires the evolution of a being capable of moral responsibility...To be against biotic egalitarianism (or radical nonanthropocentrism) is not to say that we should not extend our existential interpretation to the biological world, because it helps us to acknowledge the continuity and kinship among life-forms and to appreciate what we lose when we cut ourselves off from them.

Sentience and complexity, or the complexity of sentience

The leitmotiv of sentience has been repeated almost *ad nauseam* throughout this essay. The leitmotiv of sentientism is to provide us with a metanarrative that gives order and meaning to the realm of sentient beings: once it is established that an entity possesses the ability to feel pain and pleasure it *ipso facto* is endowed with the right not to be inflicted pain and the right to pleasurable experiences. In addition, for some, this also entails the right to life. Sentientism is thus the quest for the overarching narrative that provides the master key to unlock Pandora's box, the intractable question of the sanctity of life of human and nonhuman living entities.

It is sentientism's claim that sentience is present or absent. If it is present, the entity has an interest in experiencing pleasure; therefore, the (utilitarian) moral agent has a duty to promote or facilitate the sentient entity's pleasurable experiences. Conversely, the moral agent (utilitarian or otherwise) has the duty to refrain from any action that would inflict pain to the sentient being, including the pain that would result in death (e.g. the alleged pain inflicted to the unborn by the procedure of termination

of pregnancy). If the entity is insensate, nothing matters. If this argument is taken to its logical conclusion that since nothing matters to the insensate entities anything can be done to the environment and even to the products of human craft. Obviously, this would be extremely controversial, not to say unacceptable. Therefore, regardless of the neuroscientific weaknesses of the defence of sentientism, the moral theory based on the concept of sentience leads to ethically doubtful conclusions.

Besides the claim made by Baird Callicott (1995: 240) that "[instead of sentience] *sensibility* would be a more precise word choice", one could also argue with Paul Taylor (1995: 127) against the view that nothing matters to insensate entities. If *being morally considerable* means to have intrinsic value (Goodpaster 1978), one should expand the circle of moral considerability or moral standing beyond the ill-defined boundaries of sentience. To conceive of sentience as the possession of interests (to experience pleasure and to avoid pain) does not take into consideration the fact that "we can act in a being's interest or contrary to its interest without its being interested in what we are doing to it in the sense of wanting or not wanting us to do it" (ibid.). This view is a reflection of the environmental ethical argument against the atomistic view of competition for moral standing held by animal liberationists and in favour of the principle of "equal consideration" (Baird Callicott 1995: 242). This means that even insensate entities possess intrinsic value (and not only instrumental value). It is quite clear, however, that "the question of ultimate value is a very sticky one...for all ethics"(ibid.). One view, held by Harley Cahen (1995: 300), is that "nonsentient organisms – those not capable of consciously taking an interest in anything – have interests (and thus are candidates for moral considerability) in achieving their biological goals". This is encapsulated by Holmes Rolston III (1993: 277) as follows" "Nothing matters to a tree, but much is vital to it ... Organisms have ends, although not always ends in view".

It then could be said that sentientism is a "closed system" that denies or overlooks the complexity of the matter by clinging to an oversimplified notion –that is, the relatively undefined concept of sentience – to categorise the world in which we live. In doing that, sentientism excludes from moral consideration the insensate world without which sentient beings could not even exist. An "open system" would entail the expansion of moral considerability beyond the boundaries of sentience without denying the moral weight that sentient beings deserve. On this view, the ability to feel

is no longer the ultimate, the last word, the master key, the overarching principle to guide our moral acts and decisions. If we are concerned about the current life and the prospects for life of sentient beings, we have no choice but to pay moral attention to the insensate world that sustains and will sustain the sentient entities. This, then, leads us to a "life-centred environmental ethics" where "the well-being of the Earth's biotic community is a end in itself" (Taylor 1995: 126). This view, in turn, leads to the nagging question whether life *qua* life is the ultimate moral value (the principle of the sanctity of life). It has been suggested (Chapter 2) that the principle of sanctity of life, as opposed to the principle of reverence for life, is untenable and anthropocentric. However, "how exactly to express or manifest respect...is a difficult and delicate question" (Baird Callicott 1995: 274). If one shares Rachels' (1995: 71) view that "there are good Darwinian reasons for thinking it unlikely that any other support for human dignity [i.e. that man is made in the image of God, or that man is a uniquely rational being] can be found", it would follow that "inherent value, then, belongs equally to those who are the experiencing subjects of life" (Regan 1995: 77). In other words, there should be no reason to assign preferential value to human life. On the contrary, if human life is given more weight than nonhuman life, the planet earth is unavoidably on the path of a disaster. The question then is: How can we prevent this impending catastrophe? In addition: What is our moral duty to prevent it?

For reasons already mentioned, neither the absolute pro-life nor the absolute pro-choice answer to abortion (and population control) is satisfactory. The soft pro-choice stance based on sentience lacks scientific grounding. Christine Pierce and Donald VanDeVeer (1995: 3) remind us that "what are needed, so it seems, are normative or moral principles as well as empirical assumptions...ethic requires our best efforts at ascertaining the most reasonable understanding of the world *and* our best efforts at ascertaining which principles of morality deserve our allegiance". It has been my endeavour to give a reasonable understanding of the issue of the brain. The brain is complex; it is the epitome of complexity. We have so far only some clues about its evolution, its embryologic development, and its mature function. We know a little more about its dysfunction. We are grappling with the mind/brain problem. Will we ever know "what it is like to be a bat"? Our inquisitive and rational minds want to find explanations. We try to explain what is complex by dissecting it into little bits. It seems that the advocates of sentience are still in the eighteenth century when Luigi

Galvani (1737-1798) and later Alessandro Volta (1745-1827) demonstrated the twitching of frogs' legs when in contact with certain metals. As emphasised by Pierce and VanDeVeer (1995: 2-3), "the central province of science is the investigation of empirical claims...that are not logically true or false...it must be compatible with and embody the best scientific understanding". In my mind, our scientific understanding of the function of the brain has made dramatic progress but still has a long way ahead.

None the less, in the current state of our (or at least my) knowledge, it might be honest to say with Goethe: "It is the greatest joy of the man of thought to have explored the explorable and then calmly reverse to the inexplorable" (quoted in Lorenz 1979: 201). Most of what we know about sentience is drawn from what we, qualia-laden observers, believe by association that other living entities feel (what Paul Churchland coined folk-psychology, or what could be Goethe's inexplorable). There is little doubt that the ability to feel pain and pleasure and that the capacity to suffer and to experience "higher pleasure" depend on the structure of the central nervous system and its experience-dependent functional development.

I have been at pains to show that sentientism has no neurophilosophical leg to stand on. Furthermore, it is my contention that far from being a good anti-speciesist argument, sentientism meets two fundamental objections. First, it establishes an arbitrary division between allegedly insensate lower animals and allegedly sentient higher animals (including human animals and "post-threshold" fetuses). Second, it promotes an arbitrary concept that nothing matters to insensate living entities. On this suicidal view, the "members of the Earth's biotic community" (to use Paul Taylor's vocabulary) – that is, Nature with all it comprises – are not worth of our moral consideration. As Baird Callicott (1995: 274) reminds us: "The land ethic does not cancel human morality, neither does it leave unaffected". When I first thought of investigating the relevance of the concept of sentience in the abortion debate, I was far from thinking that it would lead to the topic of land ethic and its correlate, the population explosion. In my mind, the latter follows the former.

Having deconstructed the simple-minded concept of sentience, we have to now to turn to its sister-concept, pain.

The complexity of 'pain'

In this section, I wish to show the shortcomings of sentientism's views on pain. To be fair to sentientism one should give pleasure its fair share. However, in the context of this essay, the main focus has been placed on sentient beings ability to *feel* pain and the moral duty that ensues. But what is it to *feel*? The verb *to feel* and the word *feeling* are ambiguous. We have *feelings* of love, hatred, empathy, hunger, thirst, and so on. We *feel* softness, smoothness, roughness, etc. We *feel* like eating a hamburger, and we do not *feel* like waking up and go to work. There is a whole subtle world of feelings. Sentientism focuses on the ability to *feel* pain and pleasure. Alternatively, should we say, reduces the world of sense perception to the mere ability to have two opposed sensations. It follows, they claim, that we have the moral duty to maximise utility/pleasure/happiness and to minimise disutility/displeasure/unhappiness/pain. How do we maximise the pleasure of a sentient being? Which pleasures do we maximise? Bodily sensuous "lower pleasures" or intellectual, spiritual "higher pleasures"? How do we maximise the pleasure of an ant, oyster, porcupine, human embryo or fetus? It is notoriously tricky to come up with an answer to these questions. Therefore, sentientism dwells rather on the mirror image of pleasure. This is no less problematic. A normal human being would agree that torture is morally wrong and that killing of an innocent evil. Torture is wrong not so much because of the infliction of physical pain, but rather because of the pain affect, the suffering it causes.

It seems that the advocates of sentience equate two different things: pain and suffering. This is problematic. As Roselyn Rey puts it:

> Isn't an in-depth analysis of pain also a means of probing the relationship between mind and body, and of examining the dualism that somehow underlies our various ways of thinking? It is spontaneously evident in the opposition between pain, which is physical, and suffering, which can be considered moral...
> But if we take a closer look at the linguistic meaning of the terms pain and suffering, a second distinction can be superimposed on the first: the word suffering seems more to refer to the subject while pain seems more the objectification of this suffering, which legal parlance translates perfectly when it evaluates the "*pretium*

> *doloris*"...The etymology of the verbs from which the nouns pain and suffering are derived provides another perspective on their specialised meanings: to suffer, for instance, from the Latin *sufferre*, means to bear, to endure, to allow, or so many verbs, which necessitate an active subject or even more, a person; the older French verb *se douloir* (to feel physical pain, to complain) could be constructed with an inanimate subject because its Latin root, *doleo*, could use an impersonal form or, more often, the painful member itself became the subject: "*caput dolet*", *i.e.* my head feels pain (1995: 1-2).

This quote clearly emphasises the fact that pain and suffering have different connotations. Pain has individual, social, and cultural characteristics. Pain has its roots in anatomy and in physiology; it is, according to Frey (5), a commonality that manifests the human condition's universality and the species' biological unity. It should be noted that Rey's book, *The History of Pain,* is about the history of *human* pain as perceived throughout Western civilisation and tradition (it does not address the nonhuman pain). The point with this quote is to emphasise the importance of the objectification of pain, and the reference to pain as a price to pay (*pretium doloris*). The latter connotation can also be found in the etymology of the word pain: "the fact that the very word 'pain' has its etymological home in '*poena*' or '*punishment*' reminds us that even the elementary act of naming this most interior of events entails an immediate mental somersault out of the body into the external social circumstances that can be pictured as having caused the hurt" (Scarry 1985: 16). Like Frey, Scarry writes about human pain/suffering in the context of torture (and not about nonhuman pain or human purely physical pain). The point, however, I want to make again with this quote, is that sentientism not only fails to make a distinction between pain and pain affect, but also attributes the ability to feel pain in an anthropomorphic manner or by analogy. In other words, for Singer, for instance, animal behaviour is convincing evidence that they suffer. Singer also argues that language is not necessary for the ability to feel pain (Pierce & VanDeVeer 1995: 45-50).

The issue of pain is about a sensory perception, an internalisation (a "mental" affect), and an externalisation (a bodily expression such as a scream, a withdrawal, etc.). The neurophysiological aspect of pain has received a lot of attention in Chapter 4. The mental affect of pain – the quale – is something we know about from personal

experience and from language (to communicate, share, and compare the experience). It is notoriously difficult to express pain linguistically. As Scarry put it:

> This brief array of examples illustrates the benign potential of the language of agency, its invocation by those who wish to express their own pain (Melzack's patients), to express someone else's pain (Amnesty, Sophocles), other people's pain (Walzer); and a detailed examination of any of these uses would confirm the critically important point stressed earlier, that in order to express pain one must *both* objectify its felt -characteristics *and* hold steadily visible the referent for those characteristics. That is, the image of the weapon only enables us to see the *attributes* of pain if it is clear that the attributes we are seeing are the attributes *of pain* (and not something else). The deeply problematic character of this language, its inherent instability, arises precisely because it permits a break in the identification of the thing to which the attributes belong. While the advantage of the sign is its proximity to the body, its disadvantage is the ease with which it can be spatially separated from the body (1985: 17).

In *Fruits of Sorrow. Framing Our Attention to Suffering,* Elizabeth Spelman (1997) analyses the concept of the Greek *lupe* that can mean pain of either body or mind. She emphasises: "We should not treat grief, suffering, pain, and unhappiness as synonymous"(17). In *Suffering and Moral Responsibility*, Jamie Mayerfeld (1999) makes a similar point: " There is widespread confusion about the meaning and the measurement of suffering, which in turn breeds confusion about its moral relevance"(1). "Suffering can have sources other than physical pain" (62), and "There is a latent ambiguity in the word *pain*, such that we are not sure if a 'pain sensation' is pain in the true sense of the word if the person experiencing it truly does not mind it or is able to put it out of his mind"(28). With regard to animals, he writes: "To understand the feelings of animals attention needs to be paid to the organisation of the nervous system"(59) (a view to which I have subscribed earlier in this essay and that, to my mind, applies to the unborn as well).

Then there is the *value* (or disvalue) of pain. From a purely biological point of view, pain is positive; it is an important signal. Take your hand from the fire if you do not want to loose the use of it. John Baird Callicott writes the following:

> Pain and pleasure seem to have nothing at all to do with good and evil if our appraisal is taken from the vantage point of ecological biology. Pain in particular is primarily information...Pleasure appears to be, for the most part (unfortunately it is not always so) a reward accompanying those activities, which contribute to organic maintenance (1995: 247).

On the other hand, the pain inflicted by a torturer is morally evil. Pain from cancer has no apparent positive value; it causes physical pain and suffering. It is a sign that the body is decaying combined with the understanding that life is coming to an end (the time dimension of the pain affect). Does it have any moral value other than the duty of health care workers to alleviate it? Believers (in life after death) argue that human pain and suffering has a redeeming value. It is the price to pay to gain access to paradise. Others, like Baird Callicott, argue against that view:

> Not all suffering makes us better...even if it would it does not disprove the claim that suffering is intrinsically bad. It's bad, period. It is self-evident (86).

I do support the view that it is morally wrong to *inflict* pain and suffering. One must insist on the wrongness of the wanton infliction of pain and suffering. One must equally insist on the distinction between the pain affect (suffering) and pain (physical pain). In order to experience the pain affect one needs a neural equipment that allows at least what Edelman calls primary consciousness, which, in turn, requires a specific brain structure. Edelman might not agree with this view. If the experience of pain affect requires the faculty of memory (and primary consciousness allows only memory of the present, a very short chunk of time, the "remembered present" says Edelman), then non-human animals (and the unborn human) are unable to suffer. But this does not mean that we can harm entities with no higher-level of consciousness. Gerald Edelman is a neuroscientist, not a moral philosopher. He, and other neuroscientists alike, tries to unravel the structure and the function of the brain. What

I have tried to do is to find out whether, based on my understanding of the current state of the art in the neurosciences, it is fair to say that the embryo/fetus is sentient (at least the post-threshold fetus). Based on my understanding, there is no prove beyond reasonable doubt that this is the case. Collaterally, there is evidence that nonhuman animals down to a certain level in the animal kingdom –that is, those with a brain- do possess the ability to feel pain and pleasure.

The nagging question then is: Is there a moral divide between the sentient and the insensate entities? My answer is no. If that is the case, the argument from sentience does not help to address the morality of abortion.

The morality of abortion revisited

The abortion debate is intractable. It involves the moral standing (or the lack thereof) of the unborn. It involves the conflict of rights (women *vs.* unborn). It involves demographic issues. It involves public health problems. It involves economic and educational aspects. The list of problems could be extended. An issue that has so many facets cannot be solved by one single moral theory without the risk of leaving out one or more important ethical, health, and socio-economic aspects. The Neo-Malthusian demographer would solve overpopulation with drastic contraceptive methods at the expense of human liberty. The Cornucopian, on the other hand, would allow procreation to go wild at the expense of ecology. The fundamentalist liberal would go for an onslaught. The fundamentalist Roman Catholic would condemn without reservation any contraceptive method (unless "natural" of course). The public health policy maker would support "safe" abortion on request. The animal liberationist would populate the world with pets and free-range farm animals. The land ethicist would rather see nature populated with wild animals (and much less people). The reproductive scientist would like to use unclaimed frozen embryos to harvest stem cells. Sick or disabled people are looking forward to seeing a cure for their disease thanks to the advances gained by stem-cell technology. Is it really more ethical to dump unclaimed frozen embryos down the drain than to give diseased or disabled people a chance to alleviate their pain and suffering? Is the two, three or four

day pre-embryo not suffering from being frozen or from drowning in the sewer? This is a pretty provocative question.

Is abortion wrong because it inflicts pain to a sentient entity? This is the thesis of the advocates of sentience. The pre-threshold embryo/fetus is insensate. Nothing matters to an insensate entity. Therefore, abortion of the pre-threshold unborn is permissible. Conversely, they say, the post-threshold fetus *is* sentient. It matters what is done to it – that is, it is in its interest to feel good and not to feel pain. Therefore, abortion of the post-threshold fetus is impermissible. As we have seen, the argument from sentience suffers from two major flaws. First, it has so far not been established neuroscientifically beyond any reasonable doubt if and when sentience is acquired during intra-uterine life. Second, if some degree of sentience were acquired during gestation, it would not appear before the stage of viability. A viable fetus, sentient or not, cannot be aborted in the strict sense of the word. Abortion refers to the spontaneous or induced termination of a pregnancy before the stage of viability; once a fetus is viable, the pregnancy can be terminated giving birth to a viable though preterm infant. This is not casuistry but a biological fact. And if a moral theory relies on a biological property, the facts must be set right.

Argumentation in moral philosophy is about the strengths and weaknesses of the purported theory. Like all moral theories, utilitarianism has its pros and cons. Sentientism, an offshoot of utilitarianism, has its pros: it commands our sensitivity to the pain of others. However, in my analysis, even the alleged strength of sentientism is too weak so to speak. It is weak because it denies moral standing to a vast portion of the world we are living. It is also weak because it does not provide a proper answer to the central question of this essay: Is abortion (always/sometimes/never) permissible? If the permissibility or impermissibility is a matter of inflicting pain to the unborn, a utilitarian cannot ignore the physical and psychological pain of the pregnant woman (not to mention the possible side-effects on her immediate entourage) who makes the choice of terminating an unwanted pregnancy. The hedonic calculus requires fairness and justice. This does not appear in the sentientist defence of abortion. The balance tips on one side only.

Concluding remarks

Konrad Lorenz (1979: 247) said that there are three unconditional values: Art, the pursuit of beauty; Science, the pursuit of truth; and Medicine (a combination of art and science), the attempt to mitigate human suffering. One might find somewhere amongst the three a place for neurophilosophy as a combination of pursuit of truth – the neuroscientific facts – and beauty – the awe inspired by the beauty of Nature, animate and inanimate, human and nonhuman. In tackling the thorny issue of abortion, one may add to the value of neurophilosophy the attempt to mitigate human suffering.

Michael Tooley's impeccable logic leads to the "repugnant conclusion" that only conscious life deserves moral consideration. Wayne L. Sumner and Bonny Steinbock's argument leads to indecisive conclusions. Baruch Brody's argument is acceptable only to the supporters of the principle of sanctity of (human) life. Peter Singer's argument has the merit of calling attention to the value of nonhuman animals, but falls short of an equally "repugnant conclusion" about the value of disabled human beings. Sentientism places arbitrary limits to what is and what is not morally considerable, and, therefore is speciesist. Rights rhetoric leads to an impasse; not all rights can be protected. Rights conflicts are inescapable.

As already mentioned in the former chapter, but is worth mentioning again, Jonathan Glove, has encapsulated the dilemma in the following terms:

> Pursuit of personal ideals is a large but bounded part of morality, and in desperate cases the right action can be the one that most revolts you. The cultivation of your own character is something that should sometimes take second place to the plight of others (1990: 153).

The ideal is that ideal people live in an ideal world. All would have the right moral character and make the right moral decisions. We know that neither the world nor we are ideal. The world is messy. Messy decisions are made. To decide to terminate an unwanted pregnancy is messy. To practice abortions is messy. For a vast array of reasons, the reality of abortion is there. For a large number of reasons unwanted pregnancies are not prevented and unwanted unborn are created. Traditional moral

philosophy has not yet been able to come up with a satisfactory answer. For Glover, the two mainstream moral theories – deontology and consequentialism –lead to three possible attitudes: 1) uncomplicated or simple deontology (thou shalt not kill, full stop); 2) uncomplicated consequentialism (the hedonistic calculus provides the answer); and 3) "whichever choice I make I'm appalled" (153). Let us now apply these options to the problem of abortion. Choice 1) is the easiest; I preserve *my* integrity, what happens to pregnant women is none of my business. Choice 2) boils down to saying that, in any case, somebody will be willing to help women to abort, and that, if it is not performed in proper medical conditions, the consequences might be disastrous (severe sepsis and even death). Therefore, I practice abortions with a clear conscience; my integrity is not at stake, my hands are clean. Choice 3, presented by Glover, does not really fit into deontology or consequentialism, neither into any blend of both doctrines. It betrays part of me, of my deepest feelings; gone is my integrity. It leaves one with the question on what moral grounds choice 3 might rest.

It is relatively easy to reach the conclusion that an answer can be found in one of the overarching principles – sanctity of life, moral standing of the unborn, women's right to dispose of their body – to justify a pro-life or a pro-choice stance. This is what moral theories on abortion have done so far. The difficulty is, however, that none of these stances takes into account the complexity of the issue. Therefore, none of them is satisfactory. I have been at pains to try to show the complexity of the abortion issue. To be pro-choice is not simply a matter of getting rid of an unwanted appendage. To be pro-choice in a responsible (and hopefully respectful and respected) manner requires from us to think things through. It needs a virtuous character of the woman and of the health professional. It needs a thorough consideration for duty to oneself and to others. It necessitates weighting of the consequences. It appeals to conflicting rights. It requires respect for life in all of its aspects. It faces us with the problem of death, overpopulation, famine, pollution, etc. There is no ethical issue more complex than abortion.

In the centre of the Tibetan Buddhist "Wheel of Life" are pictured a pig, a rooster, and a snake. These are identified respectively as the "three poisons": ignorance, attachment, and hatred, the central causes of suffering infecting all sentient creatures (Elder 1998: 158). Ignorance of the complexity of the abortion issue, attachment to overarching principles and hatred of opposing views has obscured the

debate. Expanding our options and views is the only way we can address the intractability of the abortion issue. Albert Schweitzer (1987) said: "The great enemy of ethics is insensitivity", and:

> Ethics is nothing but reverence for life (79)...Ethics consists in this: that natural happenings in man are seen, on the basis of conscious reflection, to carry within them an inner contradiction (225)...Life-affirmation (Nietzsche) and life-negation (Schopenhauer) are both for a certain distance ethical; pursued to a conclusion they become unethical...The ethical consists in a mysterious combination of the two (248).

Schweitzer wrote this in a broad context after World War I, trying to come to terms with the atrocities committed during wars and the view he had on the decay of the Western civilisation. He was deeply concerned about Nature, animals, and humanity. Human and nonhuman beings have a "will to live" that seems to be incompatible with the inescapability of death. On his view, pain and suffering sometimes can be alleviated only by the infliction of death. But to *kill discriminately* we need respect for life, reverence for life – a mysterious combination, indeed. From reading Schweitzer, I am not aware of any reference to abortion in his writings. However, I believe that the mysterious combination of reverence for life and of discriminate termination of pregnancy is an ethical stance I can subscribe to.

I have tried to present and to consider all the aspects one should take into account when talking about the im-/morality of abortion. I have placed the main emphasis on the analysis of sentience as a possible candidate for moral standing. This took us through the evolution of the brain, the organogenesis of the human brain, and the neurophysiology of pain. I have attempted in vain to find scientific grounds supporting the claims made by some moral philosophers that the unborn acquires (somewhere during intra-uterine life) the ability to feel pain and to suffer, and that it does suffer in the process of abortion. No robust neuroscientific evidence supports that view. Neurophilosophy is about a philosophical conclusion supported by neuroscientific evidence – in this case, the neuroscientific prove that the unborn is sentient and, therefore, the owner of moral standing. Since the neuroscientific evidence is lacking (at least for the time being), the philosophical conclusion does not

follow. But it does not follow either that any abortion "on demand" is ethical. Neither does it follow that the negation of the complexity of the abortion issue is ethical. As asked by Cilliers (1998: 137): can behaviour in accordance with an abstract, universal set of rules be called 'ethical' at all? Is it ethical to be pro-life in all circumstances? Is it ethical to be pro-choice against all odds? Is it ethical to deny moral consideration to insensate entities? Is it ethical to look at the world with the "unblinking eye of the utilitarian accountant"? It is quite clear that pro-lifers leave out women's plights to the only potential benefit of the child to be born. It is equally clear that the strict pro-choicers leave out the subtleties of the moral choice in favour of women's rights. The deconstruction of the concept of sentience shows that, in spite of the laudable intention not to harm an entity that is able to feel, a vast world of possibly insensate (in the strictest neurophysiological acceptance of the term, that is) is denied moral consideration. The reality is that there is no final and universal ethical rule to address the complexity of abortion. But this does not mean that anything goes. Each case has to be dealt with on its own merits. And that is the ethical paradox of postmodernity, as expressed by Zygmunt Baumann (1992: xxii): "it restores to agents the fullness of moral choice and responsibility while depriving them of the comfort of the universal guidance that modern self-confidence once promised".

The reader might rightfully ask: What is the ethical alternative? Is it enough to debunk sentientism? Is this an exercise in sophistry? A partial answer could be, first, that sophistry sounds rather pejorative and that “situation ethics” would sound more positive. Second, the aim of this essay has been to try to show that sentientism does not satisfy the quest for a satisfactory moral theory on the ethics of abortion. I hope that I have given a glimpse of the complexity of the problem. Complexity cannot be explained in a simple manner. The morality of abortion needs to be addressed in a multifaceted way, taking into consideration virtue, duty, consequences, care, rights, situation, and even sentience.

9 Afterword

The great enemy of ethics is insensivity.

Albert Schweitzer

It is the responsibility of philosophy not to answer our questions but rather to question our answers.

John Howie (1981)

The central question that motivated the venture into the world of sentience is: Is it really true that abortion inflicts pain to the embryo or to the fetus ? The answer to this question can only be: yes or no. If the answer is a loud and convincing yes, then abortion is reprehensible and indeed morally wrong since it is undoubtedly wrong and impermissible to inflict wanton pain to any sentient being. This is a categorical imperative regardless of the moral philosophy one may advocate, be it virtue ethics, deontology, consequentialism, or whatever ethical stance. It the answer is a categorical no, then the moral theory advocating sentience against the permissibility of abortion proves irrelevant.

The fundamental question, however, does not have a simple, clear-cut and easy answer unless sentience is understood as an unequivocal basic concept. It has been my endeavour to show that sentience is not a simple and unequivocal concept. The concept needs qualification.

First, it appears that much of the argumentation in favour of sentience as the most primordial criterion of moral standing, and the extension of sentience with the attached moral standing beyond the boundaries of the human species, is question begging. In other words, the premise of the moral theory *assumes* that human animals (including the embryo and the fetus) and nonhuman animals (how far down the scale of the animal kingdom is difficult to establish) are sentient. And since it is wrong to inflict pain to a sentient being, it is wrong to inflict pain to human and nonhuman animals. The extension of the argument – that is, the claim that the moral standing that results from sentience implies the right to life – runs similarly and is, therefore, also a circular argument.

Second, to support the argument from sentience one should agree with the premise that a biological property ascribes a moral standing. In other words, one must accept that a moral philosophical argument may rest on a biological premise. This is the core of a neurophilosophical argument. In the present case, the argument is that, provided there is a certain type of neural equipment or machinery that enables the living entity to feel (whatever that means), it possesses moral considerability. In order to be valid, the neurophilosophical argument needs more than mere assumptions. It needs well-established neuroscientific premises. In the case of sentientism, the neuroscientific argument has been shown to be unsubstantiated (*e.g.*, the EEG claim) or thin (*e.g.*, the structure and function of the fetal brain). There is ample evidence that the newborn's brain may be well structured but not fully functional.

Third, in addition to the need for scientific evidence and clarification, the following question needs an answer: What is it like to feel? The verb *to feel* and the word *feeling* are ambiguous. We can have feelings of love, hatred, empathy, hunger, thirst, and so on. We can feel cold, hot, pain, dizzy, sleepy, high, low, happy, and miserable. There is a whole subtle world of feelings. Sentientism focuses on the ability to feel pain and pleasure. It reduces the world of senses to two. Sentientism obliges us to maximise those two feelings. How do we maximise the pleasure of a sentient being? Which pleasures do we maximise? Bodily sensuous or intellectual? How do we maximise the pleasure of an ant, oyster, porcupine, human embryo or fetus? Since that is problematic, sentientism dwells rather on pain and the duty to refrain from inflicting pain. This is not less problematic. We all agree that torture is wrong because of the *suffering* it inflicts rather than the *pain*. The distinction between the two is a major shortcoming of sentientism.

Furthermore, the experience of pain as "my pain", the ability to experience qualia, requires a much more complex brain structure and function than for feeling pain. Sentientism provides a functionalist approach to pain: pain is a signal of tissue injury (Harnad 2001: 38). Arguably, this view could only apply to lower animals with a rudimentary neuronal network but no brain so to speak. Moving upwards in the animal kingdom the complexity of the brain increases. But, still, this allows the neurovegetative functions required for survival: fight, flight, nutrition, and reproduction.

The real difficulty starts with the so-called higher animals, especially those bonding with humans. The closer to us the more we are tempted to endow them with

feelings. And we, as qualia-laden observers, can only interpret animal behaviour as suggesting that they are sentient. As we have seen, the neurosciences teach us that there are degrees of consciousness and that there is a difference between consciousness and self-consciousness. The presence of the latter is linked to a specific brain structure and function. The concept of time (past, present, and future) is intimately linked to the ability to *suffer* (as opposed to the ability to feel *pain*).

It could then be argued that if sentientism is functionalistic, the neurophilosophical view is reductionistic. And the nagging question remains how and why do qualia come in other than the usual mysterious, unexplicated correlations (Harnad 2001: 39)? Are qualia an epiphenomenon – an extra-force, something nonfunctional and inexplicable – or telekinesis – an independent power on their own (38)? The choice then would have to be between functionalism, reductionism, and a sort of vitalism. We still do not know what it feels to be a bat. As Rorty (1998: 29) writes, "understanding about the physiology of pain does not help us feel pain". To talk about the causal role of neurones – the feeling-neurone problem – as what is essential to pain, does not explain what is essential to being in pain, for feeling painful (31).

Finally, sentientism suffers from the either/or dichotomy. In other words, insensate entities are of no moral concern since they have no moral standing. In this perspective, the insensate world has only instrumental value. Although the advocates of sentientism are vocal against speciesism, the limitation of moral standing to sentient entities could be seen as speciesism in disguise. Environmental philosophers and ethicists could rightfully argue against the argument from sentience by asking: What good moral argument do you have to deny moral considerability to insensate living entities?

In the current state of our neuroscientific knowledge, it seems fair to admit that the human embryo has no brain to speak of. It is equally fair to admit that the fetal brain acquires gradually the potentiality to function once it reaches viability. It is also fair to admit that it is only after some amount of time that the infant's brain establishes the neuronal connections required to function in an adaptive manner. To admit that along these steps there is a gradual transition from non-sentience, to sentience and to qualia, from the ability to fell pain to the ability to suffer, is quite reasonable. It does not follow, however, that abortion inflicts pain (much less suffering) to the aborted embryo or fetus.

Hence, the question remains: Is abortion immoral, or is abortion *always* immoral? The overarching principle of the sanctity of human life is not the answer. The overarching principle of women's rights is not more satisfactory. The overarching principle of sentience not only fails to be proven, but leaves too much out of the realm of what deserves our moral respect and consideration. Even if the issue of sentience was to be solved, would it really matter? Jamie Mayerfield (1999: 159) reminds us:

> I am sure that it is wrong to seek destruction of sentient life, even if it could be done painlessly. I am not sure I know how to defend this conviction. Or I should say: I do not think I could articulate the defense it deserves. The right defense may rule out the thought that the world is not worth having.

Is pain always evil? Is killing always wrong? As we have seen earlier, pain is an inescapable part of life. Without sentience no living entity could even survive. What is wrong is to kill indiscriminately. We live at the edge of chaos, as Stuart Kauffman put it. To kill discriminately we need reverence for life, as Schweitzer (1987) put it:

> Ethics is nothing but reverence for life (79)...Ethics consists in this: that natural happenings in man are seen, on the basis of conscious reflection, to carry within them an inner contradiction (225)...Life-affirmation (Nietzsche) and life-negation (Schopenhauer) are both for a certain distance ethical; pursued to a conclusion they become unethical...The ethical consists in a mysterious combination of the two (248).

Is it then possible to be ethically "pro-choice"? Is it possible to be ethical with no rules or by bending the rules? Can we do as we like and still be ethical? In a postmodern perspective, the answer is: Make your personal moral choice and accept the discomfort that results from your choice (Bauman 1992: xxii). This choice making involves "respecting otherness and difference as values in themselves" (Cilliers 1998: 139). It also requires "gathering as much information as possible" (ibid.). This is not equal to lawlessness.

A distinction should be made between a metaphysical pro-choice position as adopted by Michael Tooley and the complex facts of life. It is easy to make an impeccable and logical argument showing that the infant's brain does not function as paradigm rational brain and to deduce that therefore it has no right to life. In real life, no one has the "guts" to kill it. In fact, even if it has anatomically no brain at all (the anencephalic newborn who stands no chance to survive) we let it die (we don't kill it).

The same dilemma arises with brain dead persons in ICU. Is it wrong to kill them or should we let them die? Is a potentially fully functional brain or a dead brain what makes the difference? Or is it reverence for life and the hard decisions it implies? In *Civilisation and Ethics* (1923), Schweitzer wrote:

> Reverence for life is an attitude of mind, not a code of rules or a set of propositions. It commands nothing. It forbids nothing. All it requires is that whatever is done should be done in full awareness. It lays on everyone the responsibility for every action. Reverence for life involves awareness – it begins with sinking deep into oneself, as a meditation – but does not stop there. It proceeds to action. It avoids the kind of busy and unconsidered helpfulness that often stems from guilt feelings and generally does as much harm as good- and it avoids the self-centredness of dedicated navel-gazing. Reverence for life is not in itself an activity. It is a means of checking all activity... When life is harmful to other life a choice must be made (quoted in Brabazon 1976: 253-255).

It is doubtful that Schweitzer ever had to deal with the problem of abortion. However, it is equally doubtful that he would not have recognised the compelling necessity of thoughtful and discriminate abortion as fitting with his ethics of reverence for life. In his October 20th 1952 address to the French Academy of Moral and Political Sciences, he said:

> The term reverence for life is broader and, for that reason, less vital than that of love, but it bears within the same energies. This essentially philosophical notion of good has also the advantage of being more complete that that of love. Love includes only our obligations towards other beings. It does not include our obligations towards ourselves. One cannot, for instance, deduce from it the necessity of telling the truth; Yet this, together with compassion, is the prime characteristic of the ethical personality. Reverence for one's own life should compel one, whatever the circumstances may be, to avoid all dissimulation and, in general, to become *oneself* in the deepest and noblest sense (quoted in Brabazon 1976: 404).

In other words, the ethics of reverence for life forces us to face our responsibilities and the ensuing dilemmas. Derrida (1995) has tackled this dilemma in his analysis of Abraham's choice between upholding the right to life and sacrificing consideration of rights. To take one's responsibilities, he says, "is both a scandal and a paradox". And:

> The absolutes of duty and responsibility presume that one denounce, refute, and transcend at the same time, all duty, all responsibility, and every human law... Ethics must be sacrificed in the name of duty...I can respond only by sacrificing ethics (66, 67, 68).

Martin Benjamin has expressed a similar view in the context of the abortion dilemma:

> We cannot employ the Kantian principle of respect for persons to resolve the problem of abortion because what is at issue is precisely whether this principle is applicable to such entities. Whether one regards the principle applicable or not depends on one's worldview and way of life (1990: 104).

Annette Baier (1993: 141) writes:

> A moral theory of which we are initially suspicious, because we do not trust the theorist, given his lack or non-display of relevant credentials, can still be one that, if studied, proves helpful. A theorist we fully trust can come out with a trite or unhelpful theory. ...My suggestions that it would be helpful if moral theorists identified the position from which they spoke, and the range of relevant experience informing their conclusions...
> So let a thousand theoretical flowers bloom...and a thousand thousand styles of criticising theories and critis.

What Baier is talking about is the male biases in moral philosophy and the lack of "hands on" of moral theories. It can be said that I have criticised the argument from sentience, and that my view on the morality of abortion is influenced by Schweitzer's worldview. What I want to conclude with is to meet Baier's invitation.

To avoid the charge of male bias, it must be said that, with the exception of Bonnie Steinbock, the argument from sentience has been addressed mainly by males. Now I will identify the position from which I spoke by presenting my personal narrative. I am a European male born to a mother of nine. I grew up in a conservative Roman Catholic environment. I received my under- and post-graduate education at theCatholic University of Louvain (Belgium). As an undergraduate, I was fully aware of the thalidomide disaster; as a postgraduate in Obstetrics & Gynaecology, I was equally aware of the fetal risks and damages resulting from the exposure of pregnant women to toxoplasmosis, rubella, cytomegalovirus, and herpes. For some, so-called "therapeutic" abortions were a matter of debate; I was "pro-life". My first face-to-face encounter with a botched backstreet abortion was in the late sixties. The woman, a 27 years old mother of four, died in spite of our desperate efforts. In the late eighties, I collided once again head-on with a victim of a backalley abortion. She was in her early twenties and died. The South African *Choice of Termination of Pregnancy* Act (1996) forced me to meet once more the challenge. I became "pro-choice". There are a number of reasons for that: abortion is a public health issue (prevention of deaths from "unsafe" abortions, and prevention of mother to child transmission of HIV)), it is a "reproductive rights" issue, it is a male chauvinism issue, it is a failed

contraception issue, it is a reproductive technology issue, it is a socio-economic issue, etc. The choice is between an unwanted/unplanned child (potentially abused) and a wanted child. The choice is between the clean and the infamous "dirty" hands. The choice is between the sanctity of human life and the hard choices of *reverence for life.*

Notes

2 Approaching the complexity of the abortion debate

1. The 1996 Act came into effect in February 1997. Since then about 40 000 terminations of pregnancy (TOP) are performed per annum. It is believed that the number of illegal abortions (also called "unsafe") – that is, those practiced in facilities not accredited by the Department of Health – exceeds the number of legal ones. Although they are illegal *stricto sensu*, no prosecutions are made to prevent them. The reason for this is that the overall percentage of serious complications of abortion has decreased substantially. This is attributed to the fact that safer methods are used to induce abortion (*viz.*, the use of misoprostol instead of intrauterine instrumentation/manipulation).
2. According to Luker (1984), the first crusade against abortion was launched in 1797 by Doctor Buchan's book *Domestic Medicine*, followed in 1869 by Hugh Hodge's *Foeticide, or Criminal Abortion.* The earliest American Catholic stand on abortion was that of Francis B. Kenrick, bishop of Philadelphia, who, in 1841, declared that there were no therapeutic indications of abortion. He wrote: "Two deaths are better than one murder".
3. In the seventies second trimester abortions were induced by injection of a hypertonic saline solution inside of the amniotic cavity. Haemolysis (the destruction of red blood cells) was a serious potential complication (du Plessis 2001: 29). Misoprostol (Cytotec®), a prostaglandin E_1 analogue, is now used instead to terminate pregnancy at any stage. It is safe for the pregnant woman; there are very few contraindications to misoprostol (mainly bronchial asthma). Fetal viability outside of the uterus is now set at 24 weeks of gestation (provided sophisticated neonatal intensive care is available).
4. Some current views on ontogeny see the development of a zygote (a fertilised egg cell) into an adult as under control by networks of genes and their products in each cell of the body. This is in contrast with Darwin's theory of evolution that contingent useful accidents allowed the fittest to survive. According to Stuart Kauffman (1995: 151), "one of the most important presuppositions of Darwin's entire thesis is *gradualism* – that is, that mutations to the genome (or genotype)

can cause minor variations in the phenotype (or the organism's properties), and that these variations can be accumulated piece by piece over time to create the complex order in the organisms we observe". In Kauffman's opinion, Darwin's view on evolution as "random variation, selection-sifting" falls short of a concept of self-organisation. Furthermore, against Darwinism's tendency to see the current state of affairs as "frozen", Kauffman advocates the theory that "life evolves toward a regime that is poised between order and chaos"(26). He claims that "all living systems are nonequilibrium systems and *no* general law can predict the detailed behaviour of all nonequilibrium systems"(21).

5. Traditionally care of women in pregnancy and labour was (and is still) called obstetrics. There is controversy concerning the etymology of the word. Some believe that it comes from the Latin *obstare* – to be in front of and to watch carefully. The new trend is to talk of feto-maternal medicine or fetal medicine, and to say that the fetus is a patient. The fetus can, indeed, be a patient that requires, for instance, intra-uterine repair of a surgical condition. With surrogacy, wombs can be rented and the fetus can become a third-party disputed by the biological mother. I remain quite happy to be just an obstetrician and to try not to make of the fetus *a third-party*.
6. There is scientific evidence indicating that pesticides that infiltrate the soil and contaminate water have some estrogenic side effects responsible for a significant increase in male infertility (Bhatt 2000).
7. With in vitro fertilisation (I.V.F.), women are treated with hormones that increase the number of ovulations. There are two reasons for this. First, it allows reducing the number of retrievals of ova, and, second, by fertilising more than one ovum one increases the chances of successful implantation. The drawback is that the risk of abortion, of preterm delivery, and of maternal complications is proportional to the number of embryos/fetuses. In order to prevent this problem *fetal reduction* is practiced. The issue was highlighted by Nancy Hill-Holtzman's article *More Coffins than Cribs* in the Washington Post (May 2, 1990). A Mormon couple conceived sextuplets. They refused fetal reduction. Four fetuses died in utero; the three survivors suffered from cerebral palsy. Professional ethical regulations are now in place aiming at limiting the need for fetal reduction.
8. The embryologic concept of pre-embryo (or pro-embryo) is relatively new. It refers to the embryo between day-one and day-fourteen since fertilisation. The

first appearance of what is to become the nervous system occurs on day 14/15. Afterwards one speaks of the "embryo proper". There is controversy surrounding the term pre-embryo (strictly speaking, a stage that is not yet a real embryo); others promote the term pro-embryo, a first step in embryogenesis instead of a separate phase (in line with the argument from potentiality).

9. The morning after pill and the IUD prevent the implantation of a possible conceptus by modifying the endometrial environment and making it unsuitable for implantation. Mifepristone, as an anti-progesterone, if used to "induce" menstruation (even if fertilisation has occurred), has a similar action. Both mifepristone and misoprostol are most commonly used to induce abortion; mifepristone (with or without misoprostol) till nine weeks of pregnancy, and misoprostol at any stage. If one agrees with the Warnock Commission's recommendation (or even with Donceel's theory on delayed animation) only the methods preventing implantation would be morally neutral or permissible.
10. The similarity in gene structure, embryology and neuroanatomy between humans and chimpanzees is such that they are almost indistinguishable (Miklos 1998: 203).
11. At a recent meeting of the Advisory Committee on TOPs for the National Department of Health (February 2001), it was made quite clear that health workers involved in TOPs were stigmatised (and even penalised) by their coworkers and suffered from a lack of support from Provincial Health Authorities. Many were keeping their "real" job secret from close relatives and friends. During counselling sessions most of them claimed to be ready to continue in spite of the hardships because they felt that they were rendering a service to their fellow human beings (by preventing the birth of unwanted children and/or the maternal health hazards from illegal abortions). The same issue was highlighted by the SABC 3 programme *Special Assignment* (October 2, 2001).
12. Warren has compared abortion with a "hair cut"!
13. In the case of ectopic pregnancy, the placenta erodes the tubal wall and causes life-threatening internal haemorrhage; there is no chance for the embryo to survive. In the case of cervical cancer, one should distinguish early pre-invasive, early invasive, and gross invasive stages. In the early stage, there is no absolute need to proceed with a hysterectomy (a cone biopsy, that is, a cone resection of the cervix, would be sufficient). In the advanced stage, the possibility of getting

pregnant is extremely thin. The example of obstructed labour might well be outdated, unless it happens in a rural setting remote from any health facility. Even then, who would do the destructive procedure? Definitely not the traditional birth attendant (who would have no alternative but to let the woman die). Such patients are referred to a hospital for Caesarean section. The only condition that might fall under the DDE would be that of a medical disease (usually a heart disease) that would worsen during pregnancy.

14. This refers to another thought experiment imagined by Thomson where a baby is strapped in front of a tank. The tank driver threatens an innocent passer-by. Is the strapped baby still innocent?
15. The Warnock Commission, chaired by philosopher baroness Mary Warnock, was created on a request by the British Government to make recommendations concerning the ethical issues resulting from the new advances in reproductive technology. The commission supported the concept of the pre-embryo and the permissibility of the abortion of a pre-embryo.
16. The concept of embryo experimentation should be clarified and cleared from simplistic views with a Mephistophelean flavour. The fact is that, in the current state of the art no experiment can be done in vitro beyond 3 or 4 days after fertilisation, because the pre-embryo does not survive beyond 3 to 4 days (Singer *et al.* 1993). Even the argument from potentiality that is advocated to ascribe moral standing to supernumerary embryos (van Niekerk & van Zyl 1996) might have to be rethought. An embryo produced in vitro has no potentiality unless it is implanted in a woman's uterus. If not, it has no potentiality whatsoever.
17. It is noteworthy that Beauchamp and Childress (1994) make fifteen references to abortion and that none of them faces the dilemma head on.

3 Four moral philosophers on alleged brain function of the unborn

1. The term fetus (from the Latin, *fetus*; the English spelling is *foetus*, but the American spelling *fetus* has gained acceptance instead) is used instead of "baby" because the latter denotes an emotive bias when used in the context of the abortion debate. The same would apply to the use of pregnant woman

instead of "mother". In strictly medical terms, it is more appropriate to use the neutral terms *fetus* and *pregnant woman*.

2. The term unborn may sound impersonal, if not denoting even a negative bias in support of a radical pro-choice position. Like fetus, it is here employed with an intention of neutrality. Moreover, unborn covers the whole spectrum of a pregnancy from conception to birth.
3. With the exception of Steinbock (1992), Brody, Tooley, and Sumner published their book or original article in the early 70s and 80s. Their texts are republished many times in contemporary texts on moral philosophy. Tooley and Sumner, however, have made some amendments to their original script. Therefore, where relevant reference is made either to the original or to the reprint. It should also be borne in mind that Brody's book was published at the times of the *Roe v Wade* court case which sparked in the US the controversies and debates around maternal versus fetal rights, fetal personhood and potentiality. *Roe v Wade* is still on the agenda of electoral political debates between Republicans and Democrats in the US. Matters are even worse since the introduction in the debate of the so-called "partial birth" – that is, the extraction of dismembered fetuses with late abortions. The Partial Birth Abortion Ban Act of 1995 was passed by the US Congress and vetoed in 1996 by President Clinton. See also Viveca Novak's Abortion on Trial, Again (*Time*, May 1, 2000), and Anna Quindlen's RU-486 and the Right to Choose (*Newsweek*, October 9, 2000).
4. The term pre-embryo is relatively new and was instrumental in the recommendations made by the Warnock Committee. The gist of the concept is that the neural ridge, the very first structure that will give rise to the central nervous system, appears on day-14 after fertilisation. During the 13-14 days after fertilisation, the pre-embryo may divide (twinning), or (much more exceptionally) twins may fuse (chimera). In other words, the identity (i.e. whether there will be one or two embryos) is not yet established, and hence there is no "person" yet. Therefore, it may be considered that abortion (and the disposal of supernumerary embryo resulting from in vitro fertilisation) of a pre-embryo is morally neutral.

5. The term conceptus refers to the product of conception, which is a zygote, a pre-embryo, an embryo proper, or a fetus as well as the placenta and amniotic membranes. Like "unborn", it covers the whole of intrauterine life.
6. The gestational sac consists of the amniotic membranes and the early placenta, which is not yet really individualised (*i.e.*, not yet localised to its final site). The gestational sac is filled with amniotic fluid and contains the pre-embryo or the embryo proper. Because of the small size of the embryo in the early weeks of pregnancy (till 7-8 weeks) the ultra-sonographic dimension of the gestational sac is used to estimate the gestational age (Jeanty & Romero 1987).
7. The zygote is the result of syngamy, the process of fertilisation (that takes about 24 hours to be completed) of an ovum by a sperm cell.
8. Same comment as in note 2 of this chapter.
9. Speciesism refers to the ascription of a certain value to a being for the mere fact that it belongs to a specific species. Although the term is mainly used to ascribe value to human beings because they belong to the species *Homo sapiens*, it may apply to other forms of segregation such as racism and sexism. Speciesism can be direct or blatant, or indirect in the sense of judging things by human standards (Frey 1997: 149). The term speciesism, or species chauvinism was coined by Ryder (1975), but its use was popularised by Peter Singer.
10. It makes no real sense to talk about "physiological *structure*". Physiology refers to the natural normal functions of living beings. Although a normal function operates on a structured entity, and although a dysfunction may result from a structural abnormality, it is odd to speak of a "physiological structure" unless physiological is meant to indicate normal and properly functioning. Physiology refers to a function and anatomy refers to a structure. There is a normal or abnormal physiological function and/or a normal or abnormal anatomy. There is no physiological structure.
11. Tooley (1983: 149) calls Brody a "theological voluntarist". It is noteworthy that in spite of being a self-proclaimed moderate pro-lifer, Brody claims that even in the case of rape or incest abortion is impermissible.
12. A fascinating picture of a brain scan of a 23-year old male patient during schizophrenic hallucinations was published by British psychiatrist Lars

Hansen (2001). The brain scan shows activity at the level of the visual and auditory areas. Although there is no visual or auditory input from the outside during hallucinations, the patient "sees" and "hears" them. In other words, the brain cortical areas function *as though* there was an input from the outside.

13. The real scope of sleep is far from being understood (Borbéli & Tononi 1998).

14.Table 1*

Approximate age	Approximate length	Morpho-functional observations
Embryo proper:		
5 weeks (35 days)	5-8 mm	3 primary brain vesicles
		limbs appear as paddle-shaped buds
6 weeks (42 days)	10-14 mm	
7 weeks (49 days)	17-22 mm	fingers and toes begin to form
8 weeks (56 days)	28-30 mm	reaction to peri-oral stimulation
Fetus (pre-viable):		
9 weeks		first olfactory receptors 10 weeks first movements (flexion and extension of the chest)
14 weeks		first taste buds
		first swallowing movements
16 weeks		first "breathing" movements
20 weeks		onset of myelinisation of spinal and peripheral nerves
		appearance of Merkel's bodies in the hands (for pressure sense)
22 weeks		reaction to noise
		appearance of first cortical convolutions
Fetus (potentially viable):		
24 weeks		first sucking movements
28 weeks		sensitivity of the eyes to light
30 weeks		non-REM deep sleep EEG waves
36 weeks		REM sleep

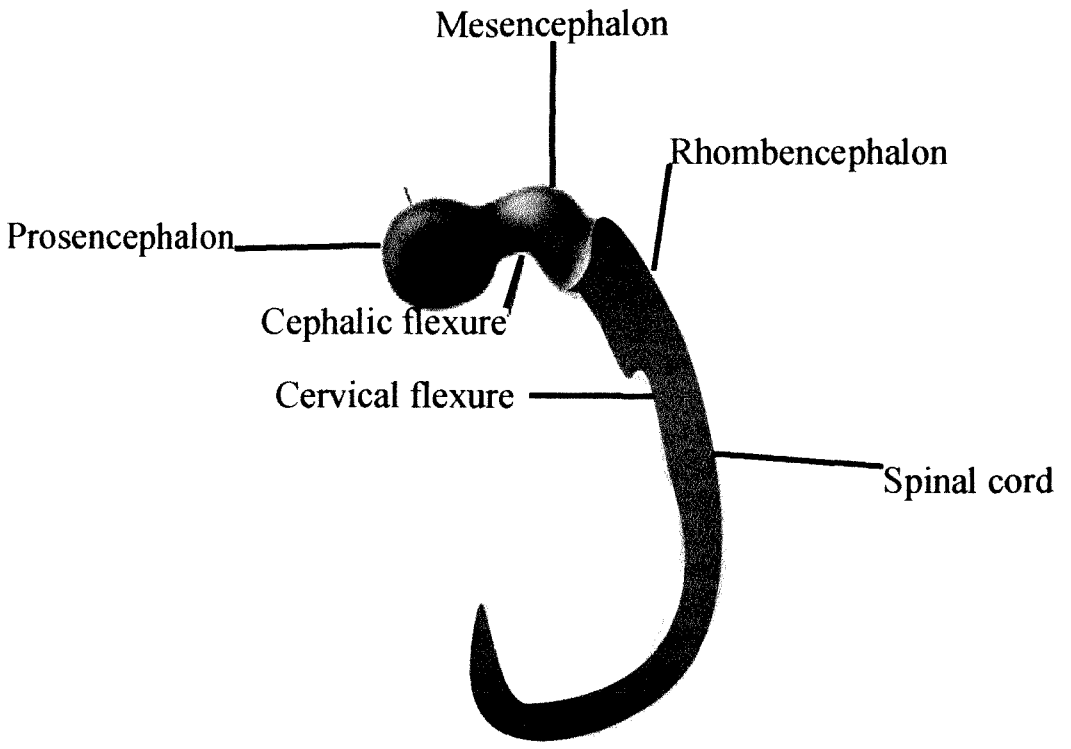
* Compiled from Carpenter (1996), Cunningham *et al* (1998), Lazorthes (1999), and Sadler (2000).

4 Approaching the complexity of the brain

1. According to Edward O. Wilson (1995: 139-142), the estimates are that there is a total of 42,580 vertebrate species, of which 6,300 are reptiles, 9,040 are birds, and 4,000 are mammals. There are 990,000 species of invertebrates, of which 290,000 alone are beetles. George L. Gabor Miklos (1998) has shown that, except in the extreme comparisons, there is little relationship between gene number, neural components, and the morphological or behavioural characteristics of organisms. Comparing the nervous system of an octopus and of a mouse, he states that it is not objectively possible to decide which of them is more complex at any level. Furthermore, he indicates that the comparison between vertebrates and invertebrates is irrelevant. For instance, the brain of a worker honeybee has 850,000 neurons, whereas the brain of a miniature salamander has only 300,000 neurons. Miklos states: "apparent neuroanatomical simplicity does not correlate with apparent behavioural complexity"(202).
2. *See* Appendix with pictorials.

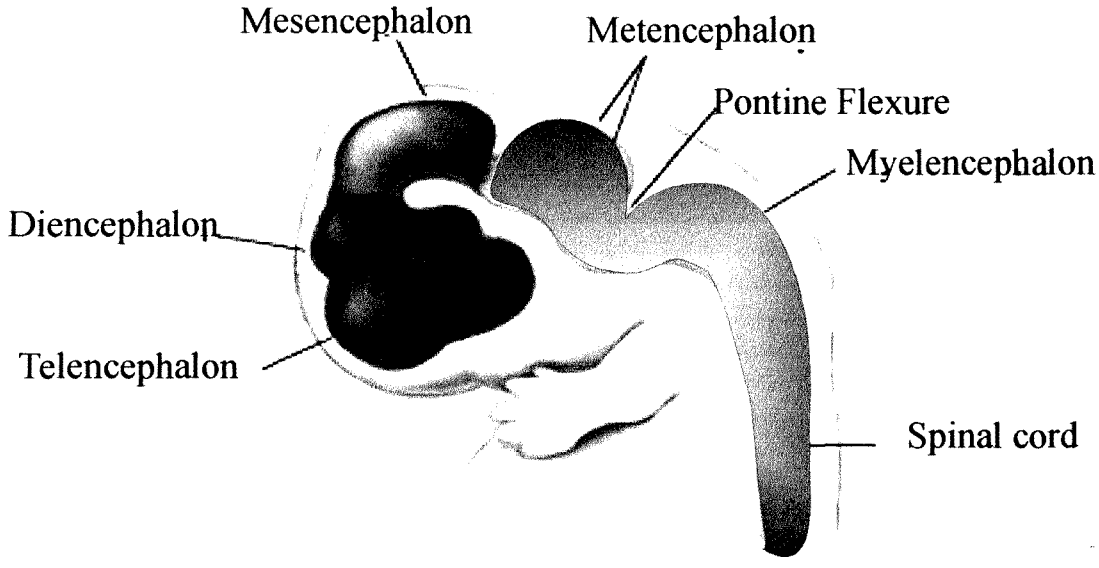
Appendix 3. Intrauterine brain development.

Figure 1.Schematic view of the brain vesicles of a 27 days (4 weeks) human embryo.



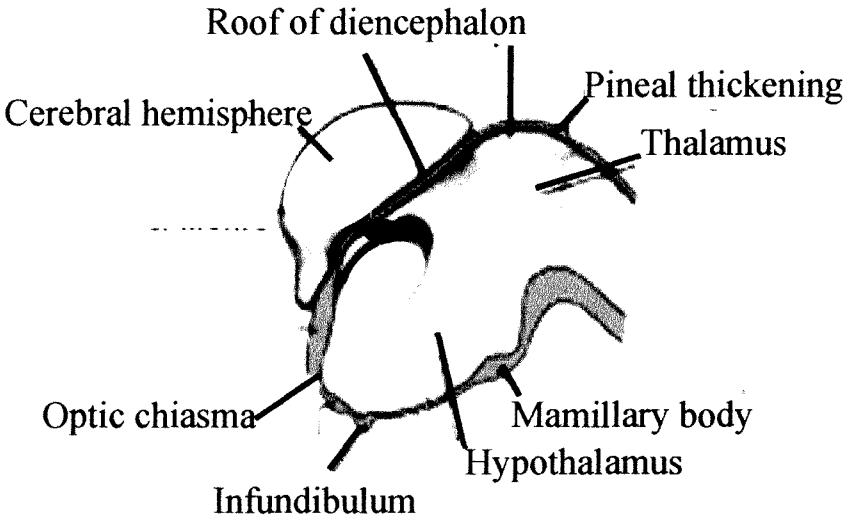
On day-27 after fertilisation (at this stage the total length of the embryo is about 10 mm), the primitive neural tube is formed; its cephalic and caudal ends are now closed. The cephalic end of the neural tube exhibits a dilatation as well as a flexure. This is now called the 'brain vesicles'.
What is to become the future brain is theoretically subdivided into three barely distinguishable portions: the forebrain (prosencephalon), the midbrain (mesencephalon),and the hindbrain (rhombencephalon).
At this stage the histologic structure (that is, the tissue architecture and the cell component) is still uniform (that is, there is no differentiation yet into specific neural cell types).
The term 'brain' refers, strictly speaking, to the paired parts derived from the telencephalon (the foremost part of the prosencephalon). The term 'brain-stem' refers to the unpaired portions: the mesencephalon and the rhombencephalon.

3. Figure 2. Schematic view of the primitive brain vesicles of a 32-days human embryo.



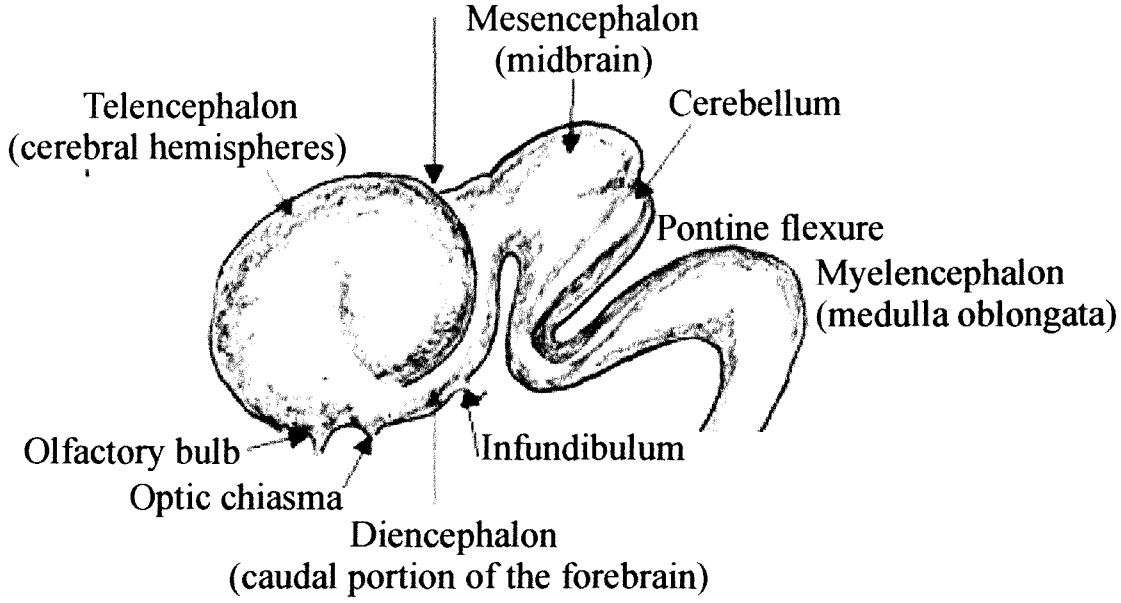
At day-32 (four and a half weeks embryo), the three main brain vesicles (forebrain, midbrain, and hindbrain) have become much more individualised. The whole flexure of the central nervous system is increased and the incisures demarcate the vesicles from each other. The first thickening of the neural tube appears in the hindbrain to constitute the roof of the fourth ventricle. The latter indicates that the first part of the brain that develops is the hindbrain (the regulator of the neuro-vegetative or autonomic system and function. The future brain hemispheres (the telencephalon) is still undifferentiated at this stage of intra-uterine development..

4. Figure 3. Schematic view of the brain of a 7-weeks (49 days) human embryo



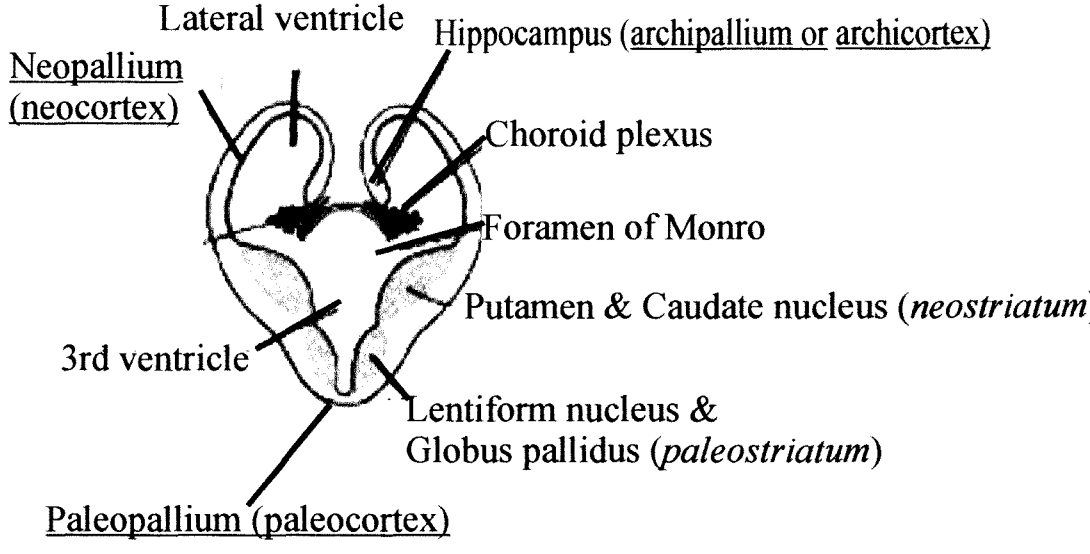
At 7 weeks, the first features of the thalamus and hypothalamus appear in the lateral wall of the diencephalon (i.e. the caudal portion of the forebrain). It should be noted that the size of the cerebral hemispheres is very small compared with the size of the diencephalon. In the adult, the two areas (i.e. the thalamus and the hypothalamus) are no larger than a fingernail or a peanut. (Adapted frpm Sadler 200: 433, figure 19-24).

5.Figure 4. Schematic general view of the central nervous system of a 56-days human embryo.



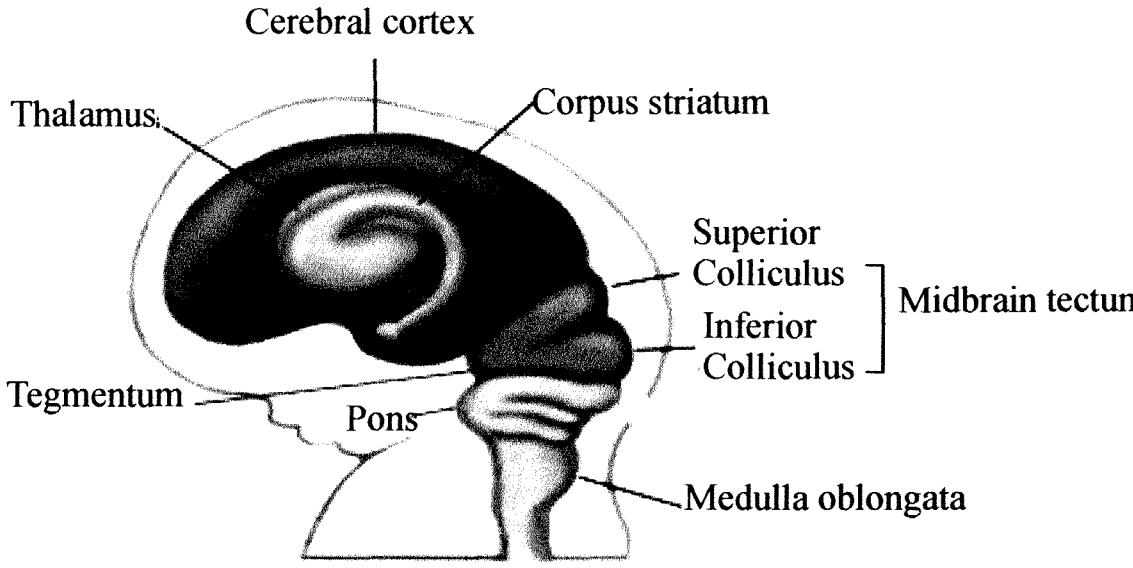
This is a general view of the brain of a 56-days (8 weeks, that is the last week of the embryonic stage) human embryo (the crown-rump length, or CRL, measured by ultrasound is 21 mm). The relative size of the forebrain, the midbrain, and the hindbrain is roughly equal. The flexion of the three respective components increases leading progressively to the burrowing of the midbrain underneath the forebrain. The olfactory bulb, the optic chiasma, and the infundibulum (future hypophysis) start their development.
(Adapted from http://courses.temple.edu/neuroanatomy/lab/embryo/images/dien 11.jpg and from Sadler 2000:426, Figure 19.17).

6. Figure 5. Schematic view of a frontal section through the brain of a 10-weeks human fetus.



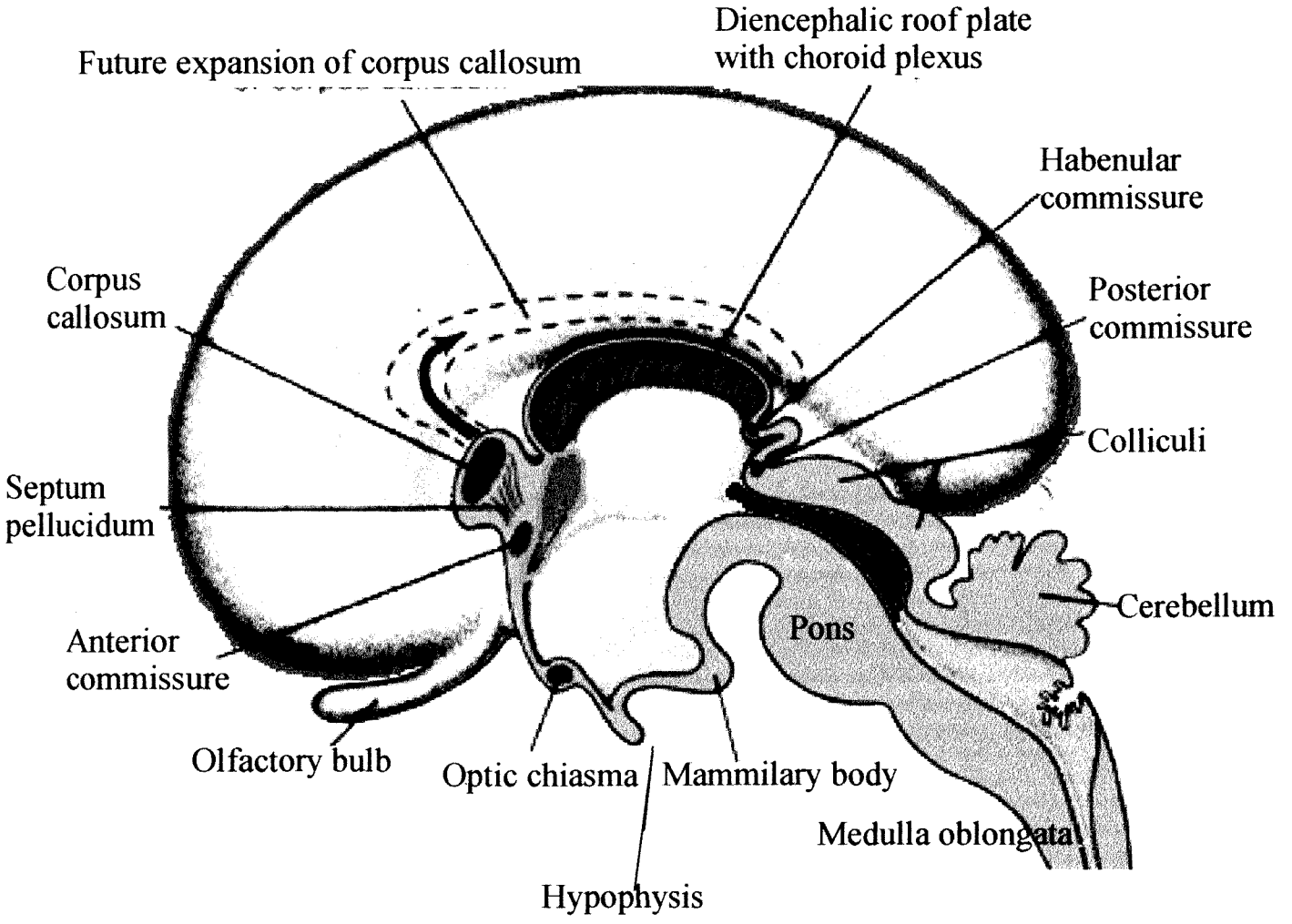
At ten weeks, the crown-rum length reaches between 3 and 4 cm. The fetal diencephalon exhibits two additional structures: the neostriatum (the caudate and lentiform nuclei) and the paleostriatum (the globus pallidus). Together they constitute the corpus striatum, a system involved in the connection of the motor neuron system with the cerebral cortex. The telencephalon or pallium (from the Latin, coat or mantle) is now subdivided into three parts: 1) the paleocortex at the base of the diencephalon (the future olfactory system); 2) the archicortex on the medial and lower aspect of the primitive cerebral hemisphere (the future hippocampus)(the archicortex will become composed of only three layers of neurones); and 3) the neocortex at the upper part of the cerebral hemispheres (this part of the brain will become composed of six layers of neurones). The hippocampus will gradually become the organ of integration of the optic, acoustic, tactile and visceral inputs that influence endocrine, visceral, and affective phenomena (Kahle et al. 1996:216).

7. Figure 6. Schematic view of a three months' fetal brain.



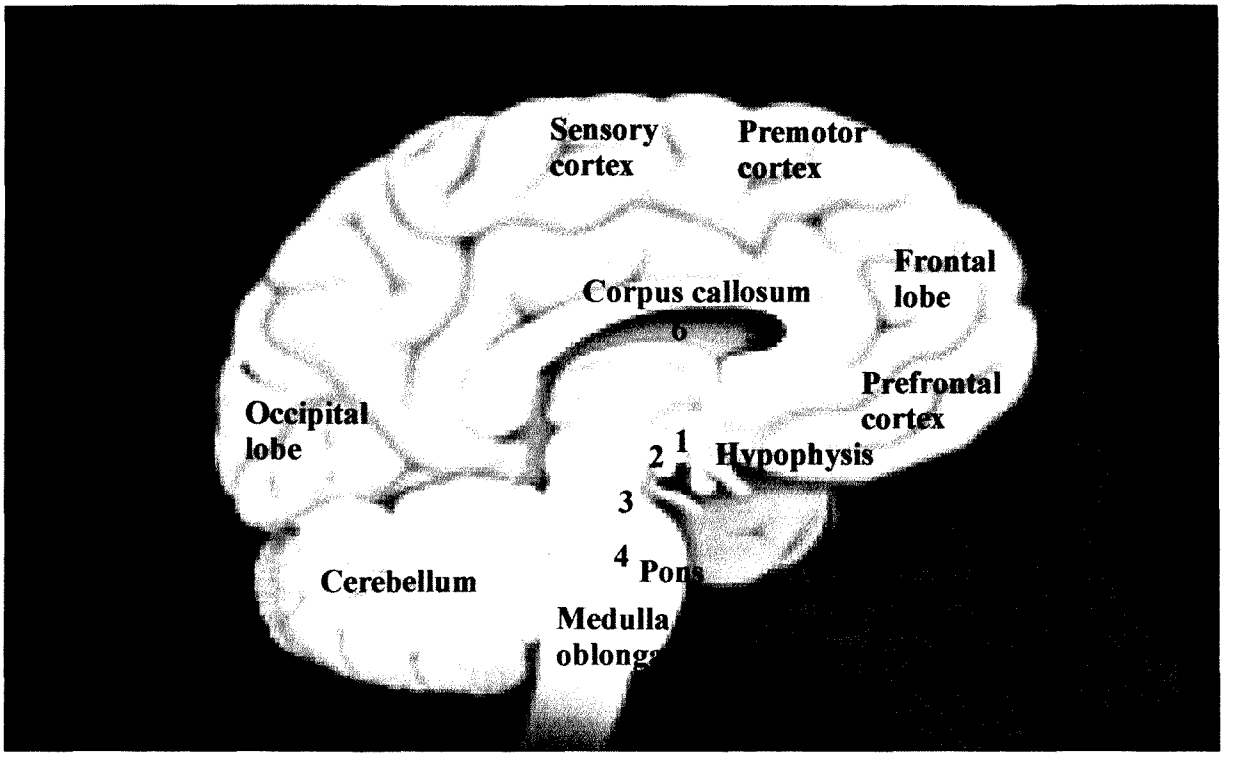
This view illustrates the anatomy of the central nervous system of a three months' fetus. It shows that the cerebral cortex is still flat (without sulci and gyri). The main structures are still rudimentary. As shown on figure 3, the thalamus is present (still relatively very large as compared to the size of the brain). The corpus striatum, composed of the nucleus caudatus and the putamen (see figure 10), is present. The colliculus superior (a relay involved in reflex eye movements and pupillary reflexes) and inferior (a relay involved in acoustic reflexes) are present. The pons, the site of origin of the cranial nerves and of their connections, is identified. The medulla oblongata, one of the three components of the truncus cerebri (together with the pons and the mesencephalon), connects the brain with the spinal cord. The rudimentary structures required for reflex neuro-vegetative functioning are in place. (Adapted from http://course.temple.edu.neuroanatomy/lab/embryo/images, and Kahle et al 1996).

8. Figure 7. Schematic view of the medial aspect of the brain of the 4-months' fetus.



The cerebral hemispheres have expanded. Their relative size, compared with the size of the diencephalon, is still small. The corpus callosum, which is covered by the cingulum of the limbic convolution, connects the two hemispheres. The outer surface of the cortex is still smooth - that is, devoid of sulci and gyri (therefore, named 'lissencephale' in French). The olfactory bulb is well developed. The hypophysis starts appearing (between the optic chiasma and the mammillary bodies).
The midbrain and the hindbrain (pons, medulla oblongata, and cerebellum), at this stage, are the most developed parts of the central nervous system.(Adapted from http://courses.temple.edu/neuroanatomy/lab/embryo/images, and from Sadler 2000: 439 Fig.19-29).

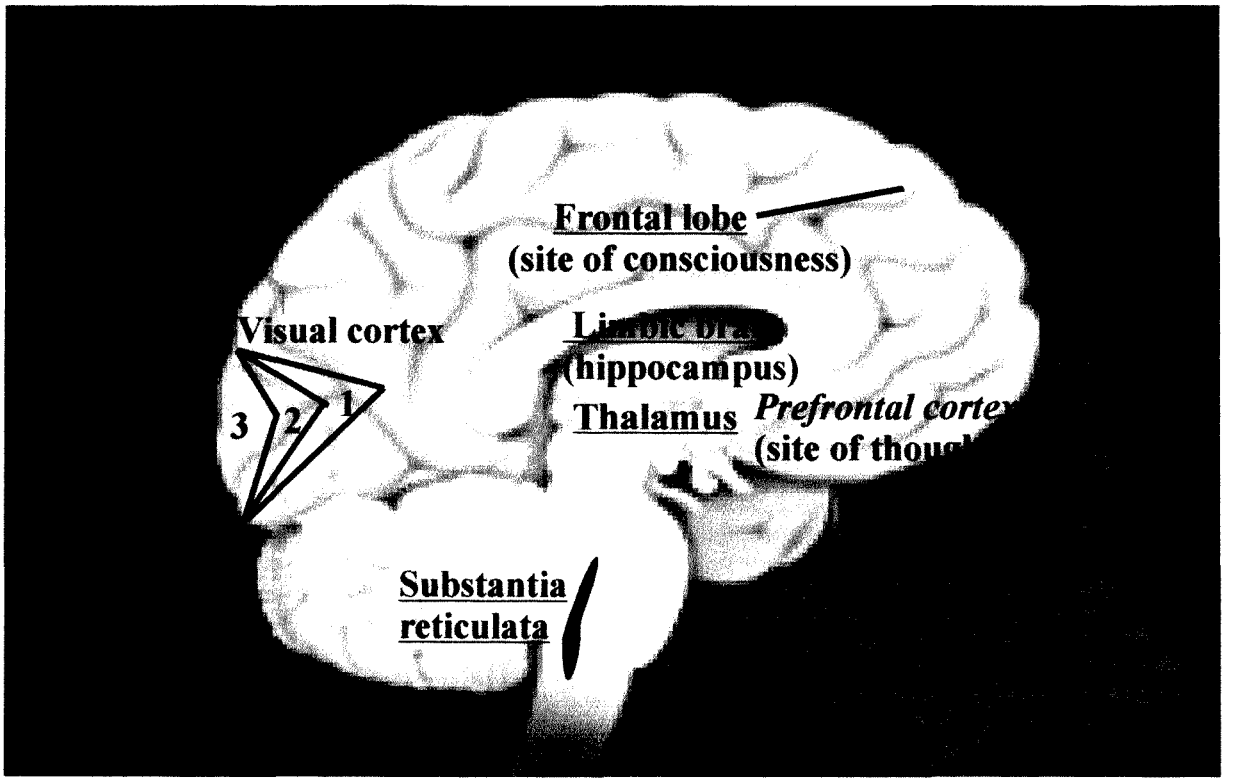
9. Figure 8. Schematic representation of the mature human brain.



Legend. 1. Substantia nigra. (dopaminergic).2. Ventral tegmental area (dopaminergic). 3. Locus ceruleus (noradrenergic). 4. Raphe nuclei and ponto-mesencephalo-tegmental complex (serotoninergic). 5.Meynert's nucleus. 6. Medial septal nuclei ('pleasure centre).

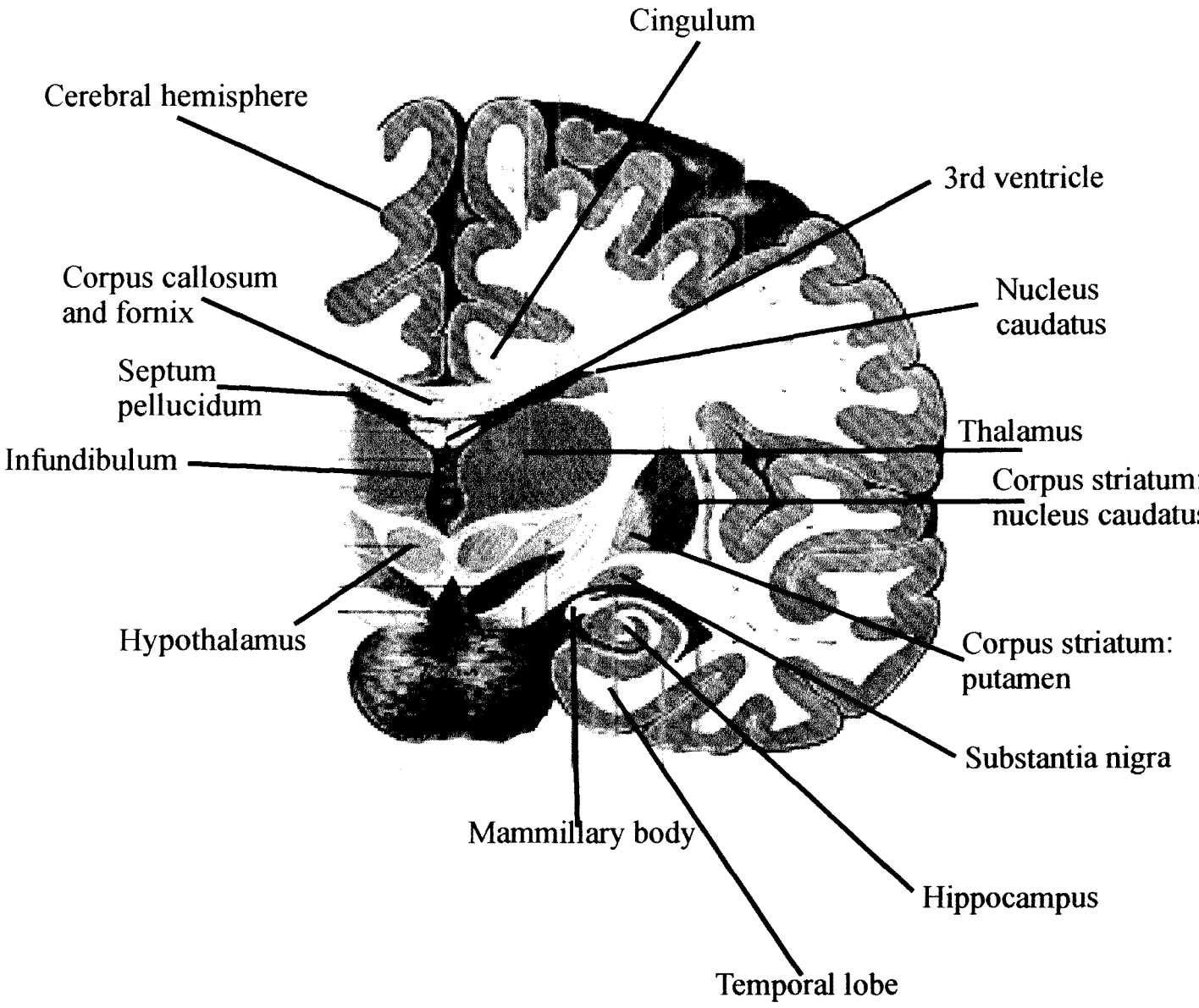
This figure shows the main structures involved in the neurotransmitter *Diffuse Modulatory System* (D.M.S.). The *dopaminergic* D.M.S. arises from the substantia nigra and from the ventral tegmental area; it fans out to the frontal lobe, the striatum, and the limbic cortex (situated behind the corpus callosum). The *norepinephrine* D.M.S. arises from the locus ceruleus ; it projects to the entire cortex, the thalamus, the cerebellum, and the spinal cord. The *serotonergic* D.M.S. arises from the raphe nuclei and projects to all levels of the central nervous system. Finally, the *cholinergic* D.M.S. arises from the medial septal nuclei, the basal nucleus of Meynert, and from the ponto-mesencephalo-tegmental complex; it fans out to the cortex, the hippocampus, and the thalamus (Adapted from Changeux 1998: figures 14 to 17).

10. Figure 9. How the brain functions according to AR Luria (1973).



On Luria's view, any mental act depends on the cooperation between three functional units. The **central unit** (bold and underlined on the picture) does the following: 1) the substantia reticulata keeps the cortex awake (or activated) and able to receive information; 2) the thalamus acts as an activator of the substantia reticulata; 3) the limbic brain activates the cortex when emotion-laden signals are perceived; and 4) the frontal lobes handle consciousness. The **second unit** (bold but not underlined) is composed of the specific areas that receive, analyse and store visual and auditory information. Each of them (e.g. the visual cortex) comprises three subareas: 1) the primary area receives its specific input (e.g. light); 2) the secondary area is associative in nature (i.e. operates connections with other systems); and 3) the tertiary area integrates the inputs. The *third unit* (in italics) is the program unit located in the prefrontal cortex: it regulates, checks out, and organises the thought process. (Adapted from Lazorthes 1999).

11. Figure 10. Frontal section through the diencephalon of the mature human brain.



This frontal section runs roughly through the level of Rolando's sulcus centralis (the demarcation between the motorcortex and the sensory cortex. The figure illustrates the topography of the main components of the diencephalon, which is wedged between the upper portions of the cerebral hemispheres (above) and the temporal lobes (below). The two-way connections (afferent and efferent) between the various nuclei and the various parts of the cerebral cortex are not illustrated.(Adapted from Grey's Anatomy on-line).

5 The birth of the brain

1. According to Lewin (1993), Darwin's view on evolution was gradualist and functionalist in nature. He was greatly influenced by Lamarck's belief that organisms respond to an innate drive to greater complexity, mediated by invisible fluids (146). As a gradualist, however, Darwin saw the Cambrian mass extinction as a failure. Moreover, in the same perspective, he denied the abrupt appearance of new multicellular animals in the Cambrian (74). Darwin's theory of "survival of the fittest" was strongly influenced by his friend's, Herbert Spencer, "law of evolution" – that is, the view that order evolves, or crystallises out of chaos. For Darwin, however, it is natural selection that produces complexity (149). The Science of Complexity sees the dynamics of complex systems as the driving force of evolution – a combination of self-organisation (the internal engine for change) and selection (the external engine for change). The success of one species, then, in evolutionary terms is dependent on what itself does and what the species do (Kauffman 1995).
2. The Turing machine is a mathematical device invented by English mathematician Alan Turing (1912-1954) in order to simulate the human mind. Turing's rationale was that the only way we have for deciding whether or not humans are thinking is to observe their behaviour (Casti 1994: 152). A Turing machine, the conceptual foundation of computer science, is completely determined by its program: you feed a program *P* into a universal Turing machine (or UTM for short) along with the input data. The machine passes the Turing test if it manages to be indistinguishable in its responses from a human brain (Cilliers 1998: 49): an input produces an output.
3. Canadian psychologist Donald O. Hebb postulated the following: "When an axon of cell A is near enough to excite a cell B and repeatedly or persistently takes part in firing it, some growth process or metabolic change takes place in one or both cells such that A's efficiency, as one of the cells firing B, is increased" (quoted in Carpenter 1996: 271). In other words, during learning co-active connections become strengthened and non-coactive ones weaker (Gazzaniga & Hutsler 1999: 131). Hebb's mental construct was later on shown to be a reality, now called Hebbian synapse, involved in the neural mechanism of memory and learning through weakening and strengthening of connections. Hebb's rule states that, after

it has been trained, the network will be able to perform the required task by itself (Cilliers 1998: 17). Hebb's concept explains how chemical substances are able to guide and regulate connectivity within the central nervous system, how genetic and epigenetic (that is, a product of activation and environment) contribute and complement each other (Gazzaniga & Hutsler ibid.). The state of the system is determined by the strength of synaptic interconnection or connection weights and the transfer function of in- and out-put at each neuron (Globus 1995: 87).

4. *See* Peter Singer's claim that similar looking cells make similar neuronal entities: "Even crustaceans have complex nervous systems and their nerve cells are very much like our own"(1993: 286).
5. *See* figure 1, appendix 3.
6. *See* figure 2, appendix 3.
7. *See* figure 4, appendix 3.
8. *See* figure 7, appendix 3.
9. *See* Chapter 3, *Encephalography*

6 Three moral philosophers on sentience

1. Cognitive neuroscientist and Nobel Prize laureate, Gerald Edelman's trilogy consists of *Neural Darwinism: The Theory of Neural Group Selection* (1987), *Topobiology: An Introduction to Molecular Embryology* (1988), and *The Remembered Present: A Biological Theory of Consciousness* (1989). In *Bright Air, Brilliant Fire. On the Matter of the Mind* (1992), Edelman provides a synthesis of his trilogy. His "fundamental position", he writes (1992: 7), is "that mind is a special kind of process depending on special arrangement of matter". In other words, "a particular kind of *biological* organisation gives rise to mental processes" (ibid.). His basic intention is "to describe the necessary bases for consciousness in a scientific fashion" (167). Edelman's thesis in *Topobiology* is that mechanical events leading to the topography and the specialisation of cells in the embryo must be coordinated with the sequential expression of the genes. The synapses are not precisely pre-specified in the genes. The brain maps are established through a mechanism of epigenetic (*viz.*, the fact that key events do occur only if specific events have occurred before) self-organisation. Edelman's thesis in *The Remembered Present* is that what in the brain's structure and function

lead to the emergence of consciousness is that it increased fitness. Consciousness should not be seen as an epiphenomenon, but rather as something efficacious. In *Neural Darwinism*, Edelman explains (i) how the anatomy of the brain is first set up during development; (ii) how patterns of responses are then selected from this anatomy during experience; and (iii) how reentry gives rise to behaviourally important functions (1992: 82).

2. In order to ensure proper and harmonious sensory-motor behaviour, the input from the outside world must be *categorised* to allow the creation of a *scene*. Responses are not specified in advance; categorisations on value result from a process of selection and not from instruction. Causal connections must be established in order to cope with familiar events and with new events. To do this a link is needed between cortical maps; this is the function of the thalamo-cortical system. It is through this primary consciousness that an individual entity is able to establish a link between the sensory input, its motor response, and past rewards. It is, however, "limited to a small memorial interval around a time chunk, the present" (Edelman 1992: 122). Even if it were true that thalamo-cortical connections are established during intra-uterine life, it still would only mean the ability to establish categories, and not the possession of higher-order consciousness/self-awareness. As Churchland put it:

> The perceptual world is largely an unintelligible confusion to a newborn infant, but its mind/brain sets about immediately to formulate a conceptual framework with which to apprehend, to explain, and to anticipate that world...It must set about to learn the structure and activities of its inner states no less than those of the external world (1999: 80).

3. Self-consciousness, Churchland writes (1999: 73) is "a kind of continuous apprehension of an inner reality, the reality of one's mental states and activities". In addition, this goes by degrees; it is a "learned component". Therefore, not everyone has the same degree of self-consciousness, for it requires a "cognitive advancement" (74).
4. What Edelman is saying is that a particular kind of biological organisation (not the mere possession of nerve cells) is needed for mental processes; a specific morphology is required for a specific function. What is special about the brain is

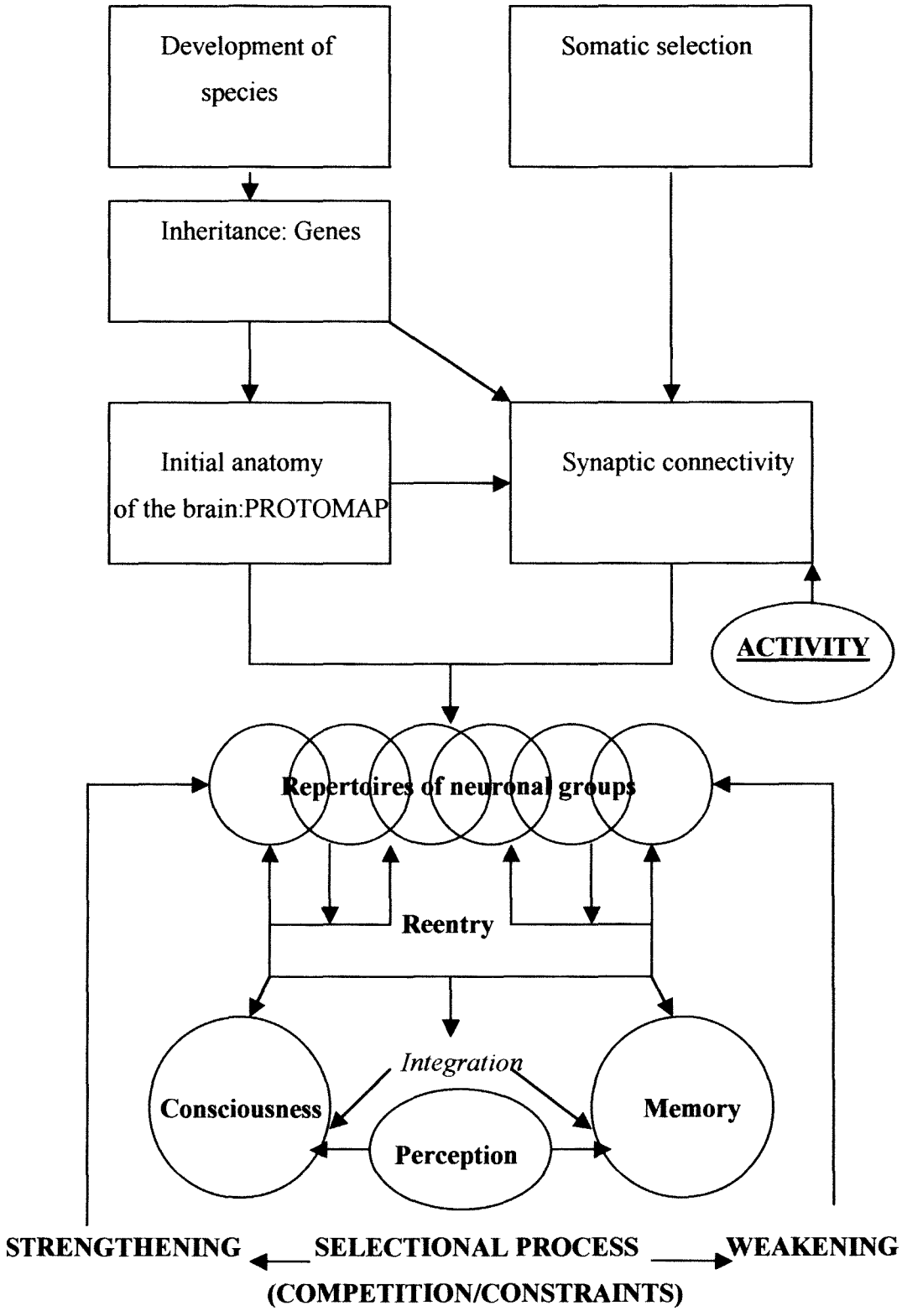
how it is organised. A brain with a primary and a secondary "repertoire" has limited categorical abilities and responses. The fine-tuning of a primary repertoire into a secondary repertoire depends on how signals manage to construct a structure able to self-organise continuously through global mapping. In order to arrive at a higher brain function, a higher-order consciousness, three functions need to be integrated: (i) perceptual categorisation (the ability to conceptualise, to attribute a meaning to a perception); (ii) memory (the ability to store concepts for a certain amount of time, a sense of time past and future); and (iii) learning (the ability to cope with new situations). Linguistic capacity (the ability to communicate) is also a feature that distinguishes being with higher-order consciousness from those with primary consciousness.

5. A being with primary consciousness is a being that lacks a concept of self, past and future; it lives in the *remembered present*. Such an entity needs a brain structure that satisfies the basic vegetative functions (the brain stem that regulates autonomous bodily functions) and a "value system" – that is, the limbic system that is involved in consummatory, sexual, and aggressive/defensive behaviour patterns. Primary consciousness and the concept of remembered present provide the entity with only a "picture of biological identity" (Edelman 1992: 133); and "it is what one may presume to be possessed by some nonlinguistic and nonsemantic animals" (112). According to Edelman, most mammals and some birds may have primary consciousness (122); chimpanzees "appear to have some elements of a higher-order consciousness – that is, some elements of a self-concept" (125).
6. Proprioception is the sense of one's body configuration. It is the awareness of the position of one's limbs in space. For Paul Churchland (1999: 119), proprioception "is one form of self-perception", and (arguably) "perhaps this already constitutes a primitive and isolated form of self-consciousness".
7. Nociception is the ability to perceive and transmit noxious, painful, harmful or injurious stimuli (from the Latin, *nocere, noceo*: to hurt, to injure, to inflict pain). Pain elicits two very different kinds of response. One is reflex *withdrawal*, as when touching a hot object; the other is *immobilisation*, protecting the affected part from being further injured by movement (Carpenter 1996: 84).
8. The tendon jerk response is an example of "monosynaptic reflex arc". A primary afferent fibre carries an impulse from stretch receptors in a muscle synapse excitatorily with a motor neuron in the ventral horn of the spinal cord, whose axon

returns to innervate the same muscle from which the afferent fibre came. Tapping the tendon of the muscle (the patellar tendon) causes a brief stretch of the sensory ending, firing an Ia fibre, which then excites the motor neuron and causes a reflex twitch of the muscle (Carpenter 1996: 57).

9. It is not clear what Sumner means by "first vertebrates". Is it *amphioxus*, the first known vertebrate and ancestor of the lower vertebrates (fishes, reptiles, amphibians) (*see* Chapter 4), or is it the class of lower vertebrates as we know them? Whatever the case may be, lower vertebrates do not possess a forebrain in the sense referred to by Sumner. The most primitive vertebrates possess an elongated central ganglion (a cluster of cells) running the length of the spine, and connected to the rest of the body by somatosensory and motor fibres (i.e. a primitive spinal cord). This, progressively, developed into a "primitive brain" where the forebrain is mainly involved in olfaction, the midbrain in vision and audition, and the hindbrain in coordination of motor activity. This is what the brain of a fish is like. In amphibians and reptiles, the forebrain starts dominating; more than mere olfaction, it serves to integrate all sensory modalities. It is only with early mammals that the cerebral hemispheres and the cerebellum become prominent (Churchland 1999: 127).
10. Edelman's concept of *reentry* plays a central role in the function of higher brains. It is "the ongoing recursive dynamic interchange of signals occurring in parallel between maps that continually interrelates these maps to each other in space and time" (1999: 72). Reentry is the concept that helps to understand how brain anatomy relates to brain physiology (71), or "how the selectional events of development and experience connect psychology to physiology" (1992: 84). Through reentry, perception and behaviour are integrated as a unity; it allows the signals to be integrated in a global mapping.

Simplified representation of Edelman's *Neural Darwinism.*



11. If "first vertebrates" are sentient (Sumner's claim), and if first vertebrates are in fact what we call lower vertebrates (fishes, reptiles, and amphibians), it seems inconsistent to claim that "early fetuses" are "pre-sentient". The human so-called pre-sentient embryo/fetus possesses a brain structure that easily compares with that of lower vertebrates. If the possession of sentience is a matter of brain structure/anatomy, it is inconsistent to deny sentience to one category (pre-sentient fetuses) and to attribute it to another category with a similar brain development.
12. The concept of viability has changed. Traditionally the limit was set at a gestational age of 28 weeks. Progress in neonatology, linked to progress in technology, has advanced viability to a gestational age of 24 weeks from conception. This, obviously, applies essentially to first-world conditions.
13. *See* chapter 3 Table 1: note 14.
14. "Mammals and birds have the basic nervous system" is quite a controversial statement. Furthermore, what is the meaning of "basic nervous system"? Although mammals and birds are vertebrates, it is likely that birds have evolved from the early reptiles and that their brains have commonalities. Mammals are defined as vertebrates whose females possess milk-secreting glands for the nourishment of the young – that is, humans, primates, rodents, whales, bats, porcupines, lemurs, marsupials, etc. On the other hand, mammals are to be separated into lower mammals (*e.g.*, porcupines) and higher mammals (primates). Only amongst mammals, the difference between brains is very conspicuous (Kahle *et al.*1996: 196-197; Churchland 1999: 128-129; Lazorthes 1999: 45).
15. Edelman's TNGS states that the brain results from neuronal group selection. In the process of the evolution of animals, differences in adaptation to the environment resulted in differences in reproductive processes leading to changes in the frequencies of genes in the population. Differential reproduction and heredity enhance the likelihood that the traits that increase fitness will be preserved (1992: 42). Neural Darwinism, he says, states that "evolutionarily selected value patterns help the brain and the body [to] maintain the conditions necessary to continue life" (94). This happens as follows: "a *small loop* consisting of the events of neural group selection leads to diverse phenotypic behaviour in different individuals of a species that provide the basis of ongoing natural selection in the *grand loop* of evolution" (97).

16. The "higher brain" is the brain that has the ability to carry out all the functions of the primary and secondary repertoire through interconnection or reentry. Higher brain functions include speech, thought, reasoning, complex movement patterns, planning, emotions, music, etc. (Edelman 1992: 17). This requires mapping of the cerebral cortex (19) through external stimuli (109). Edelman acknowledges that amongst nonhuman animals, apes and cetaceans may possess some degree of higher-order consciousness. Like Paul Chuchland (*see* note 2), he does not believe that fetuses and infants do possess self-consciousness (109).
17. *See* appendix 4.

7 Utilitarianism and moral theory on sentience revisited

1. Aristotle in the *Eudaimian Ethics*: 1216 a 11.
2. Cognitivist meta-ethics is the discussion of the nature of ethical concepts; it views ethical concepts as prescriptive. Non-cognitivist meta-ethics sees ethical commitments as an expression of the attitudes of the moral agent, a form of subjectivism. Or, in other words, our ethical principles depend on our attitudes and preferences; they are subjective, personal decisions (Smart & Williams 1973: 3).
3. A kind of blend of deontological and consequentialist moral theory like Beauchamp and Childress.
4. Another kind of blend of deontological and consequentialist moral theory, but with a fundamental difference that each case should be judged on its own merits. Amongst all variations on the theme of utilitarianism, I would be inclined to consider it as the best suited to deal with the abortion dilemma. The rule could be: respect life in all of its manifestations. In a particular case where a pregnancy was not the result of lightheadedness or negligence, and where the continuation of the pregnancy would result in serious emotional, physical, social, or economical consequences, it can be considered that abortion would not be a form of disrespect for a potential life. I am not sure whether this would be different from a virtue ethics approach, or from an ethics of care.
5. *See* Chapter 4 on sentience.
6. *See* Holmes Rolston III view on all living entities (e.g., respect for trees).
7. *See* Chapter 7 on pain vs. suffering

8. There are different techniques of sterilisation. With laparoscopic sterilisation, a ring or a clip is placed on each Fallopian tube. When a laparotomy is performed, a loop of tube is tied off and the loop is excised. Whatever the method there is a failure rate of 0.0 to 0.3%. Good medical practice requires that the woman be informed about this minimal but real risk.
9. Current statistics (Benagiano & Pera 2000) show that the legalisation of abortion does reduce the number of abortions, and that in countries where abortion is still illegal the number of illegal (or unsafe) abortion far outnumbers the legal abortion rates. For instance, Belgium (where abortion is legal since the early 90s) has one of the lowest numbers of abortions, i.e. 6 per 1000 women per year. Peru (with severely restrictive abortion laws) has almost ten times more (56/1000). As emphasised by the authors, "there is no question that contraception is the cornerstone of the fight to reduce abortion". In developing countries (where the number of abortions remains high), they argue, "education is the key". This requires a political commitment, training of providers of family planning services, and educational programs for consumers.
10. Abortion is either spontaneous or induced. Spontaneous abortions are classified clinically into threatened, inevitable, incomplete, and recurrent. Induced abortions (*viz.*, termination of pregnancy, TOP) result in complete or incomplete abortions. See also note 1 Chapter 1.
11. In Japan, abortion is widely practiced as a method of "family planning". It is customary that after an abortion, women hang an *ex voto* in shrines designated for that purpose.
12. *See* Abortion on Trial, Again. The Supreme Court will decide whether bans on some procedures threaten a woman's right to choose, by Viveca Novak. Time, May 1, 2000 p.25. See also note 3 Chapter 2.
13. According to Schenker & Cain (1999), half of pregnancies are unintended, and half of the unintended end in termination. Worldwide there are 50 million abortions per annum; half of them are unsafe and occur mostly in countries where abortion is illegal. At least 75 000 women die each year from unsafe abortion. The Fédération Internationale de Gynécologie Obstétrique (or FIGO) Committee for the Ethical Aspects of Human Reproduction and Women's Health recognises that the provision of termination of pregnancy services is justified by 1) a woman's right to autonomy; and 2) the need to prevent unsafe abortion. In its

recommendation 5.1.4, the Committee recognises that doctors' autonomy (*viz.*, the right to conscientious objection) should be respected, but emphasises the obligation to refer abortion seekers to an institution where the service would be rendered. According to Jonathan Glover (1990: 153), "Pursuit of personal ideals is a large but bounded part of morality, and in desperate cases the right action can be the one that most revolts you. The cultivation of your own character is something that should sometimes take second place to the plight of others". Cook and Dickens (1999) acknowledge that conscience is a right of individuals, but not of institutions such as hospitals. In countries where abortion is legal, they say, "legislation usually leaves implicit that institutions responsible for provision of health services on which inhabitants of their region rely must meet their duties by employing adequate staff to deliver them, while respecting individual's right of conscientious objection". They mention that the UN Committee on the Elimination of Discrimination against Women (CEDAW) has criticised countries that have allowed healthcare providers' conscientious objection to deny women timely access to legal abortion services. They further emphasise that "states proposing reduction in maternal mortality due to unsafe abortion by liberalising laws on access to safe services assume ethical and legal responsibilities to ensure that services are accessible in fact". In South Africa, the Act makes provision for penalties against whoever, in public health institutions, would obstruct the delivery of abortion services.

8 Poststructural neurophilosophy

1. Roger Lewin (1997: 133-134) writes: "The image of an ordered world, with organisms arranged from the 'lower' to the 'highest' is found in Plato and the Order of Creation in Genesis, and later in the 'Great Chain of Being' of pre-Darwinian times. But this is not biologically meaningful. It only reflects what in people's mind is an evolution of simple to complex forms". This view is also reflected in Darwin's gradualism. The classification of animals according to their similarities was the work of Carolus Linneaus' *Systema Naturae*. It is still used today. There are 32 phyla today; vertebrates are only one of them. It is estimated that today's earth harbours between 10 and 100 million species (Kauffman 1995: 199, 208). There is 40,000 species of vertebrates: 25,000 of

them are fishes, 8,000 are birds, and 6,000 mammals (Lewin 1997: 145). The concept of 'lower' and 'higher' animals reflects a "brain-centric" view of evolution. Nevertheless, we should acknowledge the reality of biology. The brain of an oyster, says Colin McGinn (quoted in Lewin 1997: 167), (this is to be taken as an allegory, since the oyster has no brain) is limited in what it can encompass, but so too is that of a rat, a monkey and a human. On the other hand, we don't hear ultrasounds nor see ultra-violet and infra-red light for simple biological reasons (167).

2. The concept of distributed representation is discussed in detail by Cilliers (1998: 69-74). Against the traditional view on representation of formal symbols in logical relationship, distributed representation involves the following main claims. Information is not stored but reconstructed each time it is activated (i.e. objects in the world are not represented in the brain). Training is a major component (i.e. the brain is not pre- and hard-wired). The system resists damage (i.e. no single node has any specific significance, it is the connectivity that supports the function of the network even when a specific node is damaged).
3. According to Paul Churchland (1999: 80), the perceptual world is largely an unintelligible confusion to a newborn infant. Against Thomas Nagel view that even the most advanced neurophysiological knowledge will never provide access to qualia, Churchland argues that young and unpractised ears hear music as "undivided wholes without structure". Only musical education will change this into "groups of discriminate notes" (65). In other words, our sense perception needs experience and education; the internalisation of our sense perceptions (the qualia) equally make progress. The way a music composer or interpreter hears music is of a different quality from the lay-person.
4. In Per Bak's (1991) sand pile, the size of the avalanche is not related to the size of the grains of sand. A single grain of sand may cause a small or a large avalanche – the theory of self-organised criticality.

Appendices

Appendix 1. The sequence of appearance in evolution of the encephalic and cortical structures.

Encephalic structure	Cortical structure
1.Centrencephalon: paleoencephalon (limbic brain)	1. Paleocortex: rhinencephalon
2.Archencephalon : -hypothalamus -hindbrain	2.Archicortex → hippocampus
3. Neoencephalon: forebrain	3. Neocortex

In the evolution of animal species (phylogenesis) as well as during the embryologic development (organogenesis), what appears first are the centrencephalon and the paleocortex. The centrencephalon is composed of the paleoencephalon (the limbic brain) and the archencephalon (the hindbrain or brain stem, and the hypothalamus, a component of the llimbic brain). The paleocortex is the origin of the olfactory system. The striatum is also composed of a more primitive portion, the paleostriatum (globus pallidus), and a more recent portion, the neostriatum (putamen, caudate and lentiform nuclei). Finally, Vogt's taxonomy is worth mentioning (even if no longer fully accepted)(Kahle *et al.* 1996). He subdivided the cerebral cortex into: 1) the isocortex (i.e. the homotopic or homogenic cortex, or neocortex, with six cell layers); 2) the allocortex (i.e. the heterotopic or primordial cortex, with less than six layers); and 3) the juxtallocortex (i.e. an intermediate between the neocortex and the primordial cortex, located in the ventral part of the cingulum, and the entorhinal area of the parahippocampal gyrus, called the periarchicortex)(Kahle *et al.* 1996: 228). The point is that we have to distinguish brain from brain, and cortex from cortex.

The class of the vertebrates (phylum Chordata) includes fishes, amphibians, reptiles, birds, and mammals. Lower vertebrates (fishes, reptiles, and amphibians) possess only an archencephalon. Lower mammals exhibit a paleoencephalon (its surface is smooth with no sulci or gyri). Only higher mammals have a neoencephalon and a neocortex (with convolutions). During intrauterine life of humans the same sequence is followed – that is, the development of the brain starts with the hindbrain. A relatively complete *structure* of the forebrain is not acquired before the fifth month of intrauterine life.

Appendix 2. Neurotransmitters

About fifty neurotransmitters have been identified in the human brain, either inhibitory or excitatory (Changeux 1998: 148). The main neurotransmitters are acetylcholine, the monoamines, the neuropeptides, and the amino acids. The *monoamines comprise dopamine, noradrenalin (or norepinephrin), and serotonin (or* 5-OH-tryptamine). They activate the monoaminergic (or cholinergic, or adrenergic) receptors of the sympathetic nervous system. The main neuropeptides are β-endorphins and enkephalins; their functions are not yet fully understood (Carpenter 1996: 87). Some of the opiate receptors are located in areas related to pain (centromedian nucleus), and othrs are not (striatum). Gamma-aminobutyric acid (GABA) is an amino acid and an inhibitory neurotransmitter (is decreased in epilepsy).

Each of the main neurotransmitters acts on what is called a diffuse modulatory system (DMS) – that is, an area within the central nervous system on which a neurotransmitter influences a preferential or predominant action. In this manner, neurotransmitters occupy central maps of positively (stimulation) or negatively (inhibition) reinforcing sites and projections to the midbrain and forebrain (Changeux 1998). Figure 8 (*see* appendix 3) illustrates the differents DMSs. The dopaminergic DMS, located in the substantia nigra and in the ventral tegmental area (*i.e.*, in the truncus cerebri, at the junction between the pons and the pedunculi cerebri), fans out to the frontal cortex, the limbic cortex, and the corpus striatum (*i.e.*, the nucleus caudatus and putamen of the telencephalon). The noradrenergic DMS, located in the nucleus locus ceruleus of the mesencephalon (midbrain), fans out to the entire cerebral cortex, the thalamus, the cerebellum, and the spinal cord. The serotonergic DMS, located in the raphe nuclei of the medulla oblongata, fans out to the entire central nervous system. Finally, the cholinergic DMS, located in the brain stem and the base of the forebrain, fans out to the entire cortex, the hippocampus, and the thalamus (Changeux 1998; Kahle *et al.* 1996).

A number of neurological and psychiatric diseases have been linked to dysfunctions in neurotransmission in the form of hyperactivity or hypoactivity. For instance, schizophrenia is attributed to an overactivity of the dopaminergic system that can be improved by antipsychotic drugs that decrease the levels of dopamine.

Globus (1995: 97), however, sees schizophrenia rather as a kind of hypofrontality, a decreased tuning of system constraint. Parkinson's disease, on the other hand, is a state of hypoactivity of the dopaminergic system that can be improved by drugs stimulating the production of dopamine. Alzheimer's disease is a condition of cholinergic hypoactivity. Serotonergic hypoactivity results in depression and sleep disturbances. Finally, serotonergic hyperactivity is said to be involved in autism (Berkow *et al.*, 1992: 2656; Lazorthes 1999: 157).

Appendix 3. *See* pictorials.

Appendix 4. The main role players in the central nervous system.

Brain (encephalon, or cerebrum) refers to the parts derived from the telencephalon; *brainstem* refers to the parts derived from the mesencephalon (midbrain) and rhombencephalon (hindbrain). The telencephalon (the anterior part of the prosencephalon) produces the olfactory bulbs, the cortex, the subcortical telencephalic nuclei, and the basal ganglia. The diencephalon (the posterior part of the prosencephalon) produces the thalamus and the hypothalamus.

4.1. The hypothalamus

The hypothalamus is one of the four components of the diencephalon (the three others are the epithalamus, the subthalamus, and the dorsal thalamus)(*see* figurs 8 and 9 of appendix 3). The hypothalamus is the lower part of the diencephalon where the hypophysis arises. It is composed of four nuclei: the nucleus supraopticus, the nucleus paraventricularis, the tuber cinereum (*i.e.*, the nucleus ventromedialis, dorsomedialis, and infundibularis), and the mammillary bodies (Kahle *et al.* 1996: 186). It receives afferents from the cerebellum, the limbic system, and the thalamus. It sends efferents to the same structures as well as to the hypophysis.

The hypothalamus serves as the control centre for vegetative functions (the autonomic nervous system), and it regulates the instinctive activities aimed at conservation that possess emotional overtones such as desire, denial, fear, and anger. Because of its connections with the hypophysis, the hypothalamus plays a role in the

regulation of the endocrine syse=tem. In Carpenter's (1996: 278) words, "the hypothalamus determines all we do". It is the place where the basic and fundamental inputs (those regulating the *milieu intérieur*) and outputs (control of the pituitary) come together since it is at the interface between the blood and the brain and so coordinates external stimuli and responses. It links internal and external stimuli to internal and external responses as a "need detector and a response generator". In humans, abnormalities of its function (congenital or acquired) result either in precocious puberty or gonadic atrophy, and in obesity or cachexy.

4.2. The Thalamus

The thalamus (from the Greek: *thalamos*, bedroom) is one of the four components of the diencephalon; the epithalamus, the subthalamus, and dorsal thalamus are the three others. It operates as a relay for sensory and motor afferents to the cortex; it also exhibits connections with the associative cortex – that is, parts of the cortex that are neither sensory nor motor, but make connections between the various cortical areas. The dorsal thalamus is the end-point of the sensory system of the cutaneous, taste, optic, and acoustic pathways. The anterior and the dorso-lateral thalamic nuclei connect with the limbic brain. The median nuclei connect with the frontal cortex. The lateral nuclei connect with the parietal lobe. Some of the venral nuclei connect with the motor and the sensory cortex, and others with the visual and auditory cortex.

It is through the ventral thalamic nuclei and the anterior thalamic fibres that somatic inputs are integrated and transmitted to the frontal cortex. This pathway is involved in how we are aware of our moods. (Moods are largely influenced by unconscious stimuli from the visceral and somatic sphere)(Kahle *et al.*, 1996: 170).

The electrical stimulation of the ventrobasal thalamus produces a pricking pain (also called first pain, which provokes withdrawal); the stimulation of the central thalamus provokes a sense of intense unpleasantness (Carpenter 1996: 85). Thalamotomy – the stereotaxic destruction of selective portions of the thalamus – is practised to relieve pain, or involutary movements, or epilepsy, or emotional disturbances (Stedman 1997: 876).

4.3. The Limbic System

The limbic (from the Latin: *limbus*, edge) system was identified as such only in 1953 (Rey 1995: 328). It has received a number of nicknames, such as *visceral brain, affective brain,* and *emotional brain.* These point to the view that this part of the brain is involved in the emotional overtones of animal behaviour. In evolutionary terms, the limbic brain is called the paleoencephalon; together with the archencephalon (the hypothalamus and the hindbrain), the limbic system belongs to the centrencephalon. Reptiles possess an archencephalon, but lower mammals (*e.g.*, the porcupine) possess a limbic brain. Only higher mammals are endowed with a neoencephalon (Lazorthes 1999: 65).

The limbic system is a heterogeneous array of brain structures situated at the edge of the medial wall of the cerebral hemispheres. It has telencephalic and diencephalic components. It is composed of nuclei, cortical areas, and fibre tracts. The limbic nuclei comprise the amygdala (corpora amygdaloidea), the septal nuclei (the so-called "pleasure centres"), the mammillary bodies, and the hypothalamus. The limbic cortical areas are the hippocampal (from the Greek: *hippocampus*, seahorse) gyrus, the cingulate (from the Latin: *cingulum*, girdle) gyrus, and (to some extent) some parts of the olfactory cortex. The limbic nuclei and limbic cortical areas are connected by fibre tracts (Carpenter 1996: 258). The limbic convolution, also called gyrus cinguli or cingulum, consists of an associative system that links up the different lobes of the brain. It has connections with the hypothalamus, the thalamus, the mammillary bodies (the posterior part of the hypothalamus), and the frontal cortex (Fig. 10). The limbic convolution connects with the hypothalamus through three pathways: 1) the fornix to the preoptic area and the tuber cinereum; 2) the stria terminalis to the tuber cinereum; and 3) ventral fibers of the corpora amydaloidea. The projection from the amygdala is involved in two types of emotion: conservation (withdrawal) and arousal (positive emotional drive) (281). The limbic system influences the primitive vital processes aimed at survival (hence, the emotional overtones) such as eating, digesting, and reproducing. The cingulum sends information to the hippocampus (involved in the process of memory) and to the amygdala (involved in emotions). The limbic system and its most important component, the hippocampus, activate the cortex through the reticulate substance whenever an emotional signal appears (Lazorthes 1999: 102). Broadly speeking, it can be said that the limbic system's main concerns are the integration of emotions, motivation, and the control of the *milieu intérieur* (Carpenter 1996: 259).

In animals, the selective electrical stimulation of specific areas of the cingulum produces anger, hyperphagia, micturition, defecation, or retreat. In humans, it produces relaxation. Cingulectomy (*i.e.*,the removal of the limbic system) significantly decreases aggressive behaviour; it also produces indifference to intractable pain. The stimulation of the septal nuclei (the "pleasure centres") produces euphoria (Kahle *et al.,1996: 306).* The electrical stimulation of some areas of the dorso-medial thalamus, hypothalamus, or amygdala evokes avoidance/withdrawal (perhaps this results from the production of pain, but it has not been ascertained)(Carpenter 1996: 282).

4.4. The Frontal Cortex

The brain hemispheres are subdivided into four cerebral lobes: frontal, parietal, temporal, and occipital. The frontal lobes extend from the frontal pole (*i.e.*, the most anterior part corresponding to the forehead) to the sulcus centralis of Rolando (or central sulcus). The pre-frontal cortex (*i.e.*, the anterior lower part of the frontal lobe) exists only in humans. It is constituted of associative cells that connect all the areas of the brain (Lazorthes 1999: 102). It receives afferents from the thalamic dorsomedialis nucleus that, in turn, receives fibres back from the frontal lobe and from the limbic system (Carpenter 1996: 249). The left prefrontal cortex is involved in planning and the right one in interpersonal relations. As Kinsbourne (1998: 238) put it: the prefrontal cortex is not a "general executive", it enables the individual "to overcome primitive preprogrammed responding when that would be maladaptative".

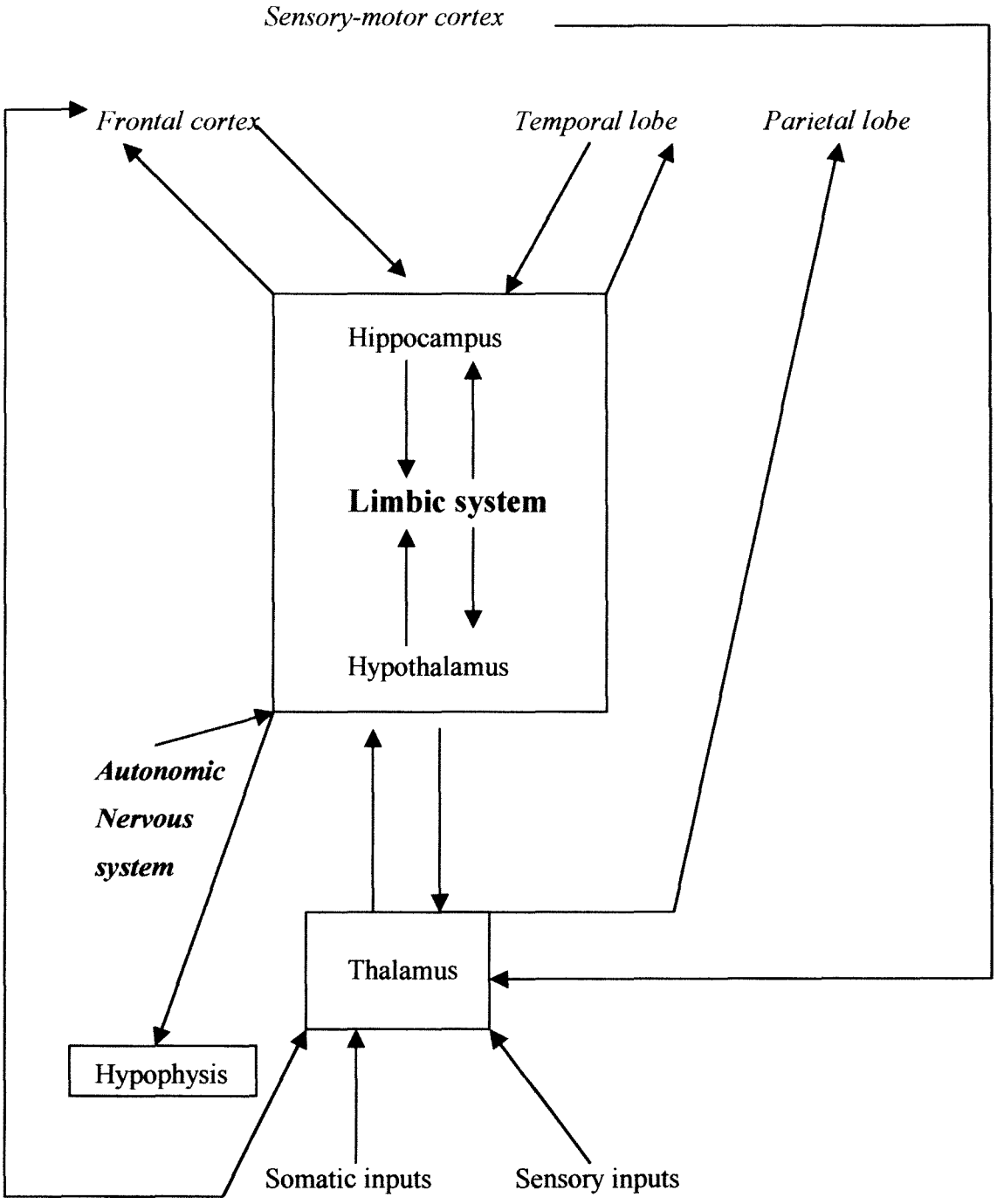
Catecholaminergic neurons, and more precisely the dopamine-mesocorticolimbic neurons from the ventral tegmental area of the midbrain, project in the prefrontal cortex and the nucleus accumbens of the limbic system. The latter contribute to and play a role in emotions, hedonic pleasure, and memory. The former contribute to motivation, planning, temporal organisation of behaviour, attention, and social behaviour. They are the "reward circuits in the brain" (Changeux 1998: 159).

The electrical stimulation of the amygdala provokes either anger and fear, or relaxation depending on the mood of the subject before the initiation of the stimulus (Kahle *et al.* 1996). The electrical stimulation of the somatosensory cortex (behind the central sulcus) in conscious human subjects rarely induces pain (Carpenter 1996: 84).

The first reported case of accidental frontal lobotomy or leukotomy is that of American mining engineer, Phineas Gage. Working in a mine, in 1848, he sufferend from a head injury when a crowbar perforated his skull. The most remarkable consequence was that Gage became generally indifferent, but mainly to pain. A similar case was that of Elliott VR who underwent the surgical resection of the ventromedial part of the frontal lobes. He became unable to plan for the long-term; he lost the sense of what is socially proper and the ability to defer instant gratification (Changeux & Ricoeur 2000: 196).

Gage's accident was at the origin of what became known as frontal lobotomy, first carried out surgically (by severing the connections between the prefrontal cortex and the rest of the brain) and eventually pharmacologically. It is practised especially for intractable pain. It results not so much in the loss of the knowledge of pain, but rather in the loss of its emotional aspect. This could perhaps be explained, as Carpenter (1996: 250) suggests: "by stripping pain of its meaning for the future, we also relieve its emotional threat". In experimental so-called "frontal" animals (*i.e.*, they do not possess the equivalent of the human prefrontal cortex), leukotomy results in the inability to store a program of action for deferred use.

Figure 11. Simplified schematic view of the afferents and efferents of the limbic system.



Appendix 5. Sensory modalities and sensory systems

According to RHS Carpenter, lecturer in neurophyioslogy at the University of Cambridge, "our cutaneous sensory world is vastly richer than the pathetic number of 'modalities' derived from studies of skin fibers" (1996: 74). The exteroceptive sense relates to the perception of stimulation by external agents. The skin may sense physical effects (*e.g.,* pain, tickle, and softness). Nociceptors belong to the poorly myelinated protopathic sensory system; they receive and transmit painful or injurious stimuli through the spinothalamic tract of the spinal cord to the sensory cortex. Proprioceptors perceive the movements and position of the body. They belong to the heavily myelinated epicritical sensory system that also senses tactile and vibratory stimuli. There are many different types of sensory receptors in the skin: the Pacinian corpuscles (respond to deformation, pressure), Meissner's corpuscles (respond to mechanical stimuli, Merckel's discs (respond to light touch)(appear around the 20th week of intrauterine life), Ruffini's endings (proprioreceptors), encapsulated endings (sensitive to cold), and free endings (sensitive to warmth, pain, and mechanical stimuli)(75).

The stimulus of Pacinian, Meissner, Merckel, and Ruffini receptors travels to the spinal cord through large (wit fast conduction speed) Aβ nerve fibers. The stimulation of the nociceptive receptors of the skin (free and encapsulated endings) travels through Aδ and C fibres. The Aδ fibres of first pain or immediate feeling are large and have a fast conduction; their stimulation is followed by withdrawal. The C fibres of second pain are slow; their stimulation is followed by immobilisation. Visceral pain is also conducted by C fibres (84). A sensation of pain may be caused by tissue damage (noxious stimulus) that is sensed by nociveptors; yet, many kinds of pain are not associated with tissue damage at all. In addition, says Carpenter,

> The sensation of pain is itself very complex...the degree of pain that is felt depends to a large extent on the emotional state and on the meaning that pain may have (e.g. frontal leucotomy). Sensing the pain is not the same as feeling the pain (85).

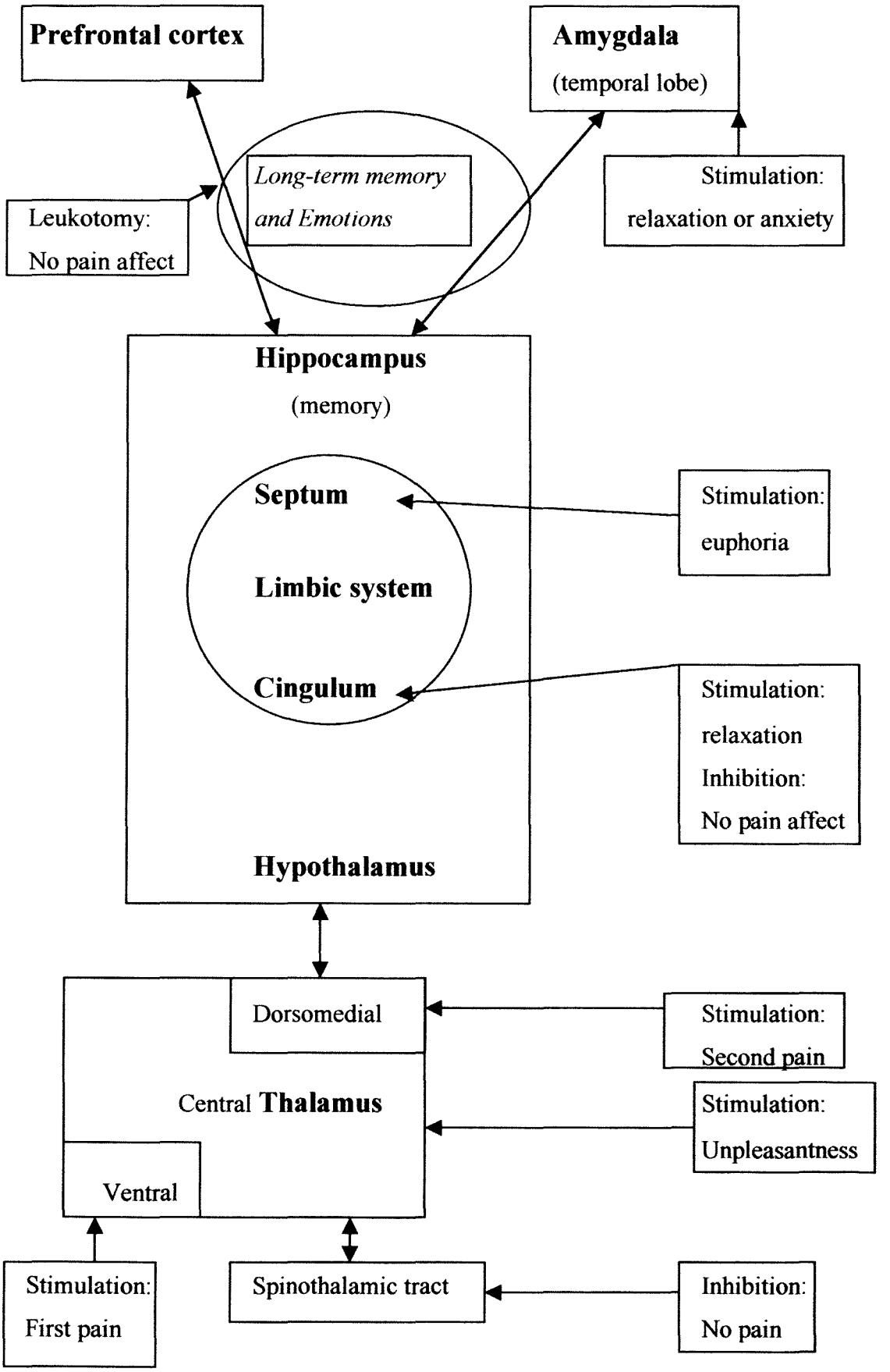
Appendix 6. The loci involved with pain in the central nervous system.

The following is known from animal experiments with stereotaxic electrical stimulation of specific areas, from congenital and acquired lesions of specific brain areas in humans, as well as from electrical destruction or stimulation of specific areas of the human brain (*e.g.*, electroconvulsive therapy).

1. Hypothalamus. Abnormalities result mainly in precocious puberty or gonadal atrophy, and/or in obesity or cachexy.
2. Thalamus. In humans, the stimulation of the ventral region evokes first pain (pricking pain). Stimulation of the central region evokes a feeling of intense unpleasantness. Stimulation of the dorso-medial region causes withdrawal (a reaction that usually follows the sensation of first pain). Mesencephalotomy (involving the section of the spinothalamic tract) relieves intractable pain.
3. Limbic system. Stimulation of the cingulum in humans produces relaxation. Cingulectomy for intractable pain results in indifference to pain; the pain persists though. Stimulation of the septal nuclei ("pleasure centre") produces euphoria. Stimulation of the amygdala induces either relaxation or anger and fear, depending on the mood of the subject prior to the stimulation. In animals, unlike humans, the stimulation of mentioned areas induces different and sometimes opposite reactions.
4. Prefrontal cortex. Leukotomy for intractable pain, like cingulectomy, results in indifference to pain. "Leukotomy" in animals (a misnomer since they have no prefrontal cortex) is followed by the loss of the ability for planning.

In sum, a sensation of pain can be evoked by stimulation of the thalamus. A present pain cannot be taken away by any procedure (with the exception of mesencephalotomy); only the emotional affect can. The prefrontal cortex plays a predominant role in the processing of pain affect (*see* Figure 12).

Figure 12. Diagrammatic brain 'map' of the loci involved in pain and emotions.



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