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Immortal Beloved and Beleaguered: Towards the Integration of the Law on Assisted Death and the Scientific Pursuit of Life Extension

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The self-existent Lord pierced the senses to turn outward. Thus we look to the world outside and see not the Self within us. A sage withdrew his senses from the world of change and, seeking immortality, looked within and beheld the deathless self.

The Katha Upanishad

I. INTRODUCTION

After years of fighting for her right to die and before she could hear that her arguments had failed to persuade, Sue Rodriguez was nudged into the quiet that we know as death. Make no mistake however, the debate on assisted suicide in Canada is far from being settled: the 1993 Supreme Court decision refusing to strike down the prohibition against assisted suicide in Sue Rodriguez v. British Columbia (A.G.) narrowly squeaked by as a 5-4 decision and made it abundantly clear that some form of parliamentary intervention was needed. Although the legalization of assisted suicide has been considered no less than eight (8) times at the House of Commons, it does not appear that comprehensive legislation on the matter will be passed in Canada any time soon due to the highly controversial nature of the subject matter. Furthermore, as demonstrated by the recent Manitoba case, Golubchuk v. Salvation Army Grace General Hospital, end-of-life medical dilemmas continue to challenge the courts understanding of the roles, rights and responsibilities of doctors, families and other caregivers and representatives participating in the dying process.

Back in the lab however, scientists have been busy searching for the keys to immortality or at the very least, exploring ways and means to significantly extend human lifespans. For example, at the Wake Forest Institute for Regenerative Medicine in North Carolina, scientists created the first fully laboratory-engineered organ — a bladder — which has been successfully implanted into human patients. Another American company A-Cell, Inc. has created and commercialized an extracellular matrix powder developed from pig urinary bladder which can "remodel" and grow back amputated human finger tips. Scientists have also made major progress in drawing the connections between nutrition and longevity, pointing to calorie restriction (CR) diets as another possible way to significantly increase human lifespans. Additionally, longevity compounds are continuing to be identified and sold as dietary supplements; the most recent and highly promising being the identification of Resveratrol by Harvard Medical School and the National Institute on Aging, a compound found in the skin of grapes which scientists have used to increase lifespan in obese mice, animals considered evolutionarily close to humans. Resveratrol is already available commercially.

• IMMORTAL BELOVED AND BELEAGUERED: TOWARDS THE INTEGRATION OF THE LAW ON ASSISTED DEATH AND THE SCIENTIFIC PURSUIT OF LIFE EXTENSION •

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What was once science fiction is quickly becoming reality — replacement organs grown in labs, tiny virus-sized injectable capsules that deliver drugs to targeted cells, ingestible supplements that slow down the aging process and so forth. Given the technological advances, many seemingly no less short of miraculous (take the regenerating finger tip for example), we are on the threshold of challenging new conceptual perspectives on human somatic existence and its counterpart, death. Life extension technologies are being pursued to delay or intervene in the natural senescence process which could make age-related death, optional. However, current technological pursuits suggest that the exercising of a death option will not always take the form of a technically straightforward withdrawal or withholding of treatment, arguably the only areas concerning the hastening of death where it might be said that the law has, for the most part, come to terms with.

Given the current technological trajectory, it is quite likely that bringing about the death event, after what might have once been considered the maximum life span of an individual, may require active intervention. To be sure, humans are on the threshold of being able to significantly increase their life expectancy yet, in Canada, we have still not come to any consensus as to how we are permitted to die.

This article sets out to explore the scientific pursuit of life extension in the context of current controversies surrounding death, specifically those that involve competent individuals who desire death but are unable to bring it about without the assistance of another individual, i.e., pursuit of life extension in the context of assisted death (assisted suicide and euthanasia).

Part II of this article summarizes the legal position in Canada on assisted death and explores other factors, trends and positions that identify that the debate in Canada is far from being settled and that in reality, the voice to decriminalize assisted suicide (and perhaps also euthanasia) is growing louder. This section also points out that there are inherent conflicts when certain court-identified policies behind maintaining the illegality of assisted death are contrasted with Canada’s health research agenda regarding biotechnology and medicine.

Part II continues with a summary of the law in other jurisdictions where assisted death is legal. In this section, end-of-life global trends are also explored. This includes an examination of attitudinal trends regarding assisted death for “tired of life” and the blurring of the distinction between somatic (physical) and non-somatic (non-physical) suffering. The section concludes that if autonomy is indeed replacing “life” as the most universally accepted legal guidepost, we are steadily moving towards the development of a fairly straightforward “protocol for
death”. It should be pointed out that the term “assisted death” is utilized in this article as opposed to the term “assisted dying” because of the changing perceptions of suffering to expand assisted suicide and/or euthanasia services to those who do not suffer from a terminal illness.

Part III provides an overview of the most-promising life extension and antiaging research being currently undertaken around the world. This section attempts to organize the research into different streams based on the degree of technological entanglement that occurs when an individual pursues a particular longevity intervention and what might ultimately be required in order to bring about death, should death be desired. These streams are then examined in the context of the current legal position on assisted death.

Part IV offers a summary of the discussion and concludes that it is not difficult to anticipate that there will be an increasing demand for assisted death services particularly during the lag/transition period for technology translation and exacerbated by the growth of an aging population worldwide. There is currently no coherent body of legal work connecting the areas of aging, state health policy and investment in life extension research with end-of-life law. It is the author’s position that the time for such work to be undertaken is now.

II. ASSISTED SUICIDE LAW
A. SUMMARY OF CANADIAN CASE LAW AND POLICY

In Canada, suicide and attempted suicide are not illegal, however counseling or aiding suicide is illegal under s. 241 of the Criminal Code regardless of whether the suicide attempt is successful or not. Thus, if a party assists the suicide, for example by providing “how-to” information or the substance (or both) that enables the person to commit suicide or attempt suicide, the maximum sentence is 14 years. There is, however, no mandatory minimum jail term which we shall see allows for flexibility in sentencing. On the other hand, if a party intentionally performs the act to bring about death at the request of the individual in order to relieve their suffering, for example by administering a lethal injection, the appropriate charge will be murder. Murder carries with it the consequence of life imprisonment without the possibility of parole for 25 years if first degree, or life imprisonment without the possibility of parole for 11-25 years if second degree.

Thus in Canadian law and in a number of other jurisdictions discussed below there is a distinction between assisted suicide — an act of intentionally killing oneself with the assistance of another — and euthanasia — compassionate killing by direct act of commission. In broader public discourse however, the terms “euthanasia” and “assisted suicide” can tend to be used interchangeably and indeed, many argue that the two concepts are not readily distinguishable from a public policy perspective. Notwithstanding the difficulty in conceptually distinguishing between the two acts, in Canada there is a distinction, with euthanasia appearing to be the less morally defensible as far as Canadian law is currently concerned.

For example, in R. v. Latimer, Robert Latimer was convicted of second-degree murder for asphyxiating his daughter Tracey in his truck. Tracey suffered from extreme cerebral palsy and Latimer believed it was the only way to relieve her suffering. After a mistrial for jury tampering and a sentencing appeal, Latimer was eventually sentenced to the mandatory minimum of ten-year imprisonment. Although there have been a number of additional cases where doctors or individuals have been charged for killing a patient or family member suffering from an incurable or terminal illness, many convictions have been on lesser offences such as manslaughter or administering a noxious thing. That said, Canadian euthanasia case law is of limited assistance in teasing out the policy or protocol surrounding the principles of autonomy and self-determination in relation to death because the discussion available has not fully canvassed the entreaties of the competent person wishing to die. Accordingly, it is the law surrounding assisted suicide in Canada that is more fully explored below.

The validity of s. 241(b) (aiding or abetting assisted suicide) under the Canadian Charter of Rights and Freedoms [the Charter] was tested in the early 1990s in the seminal case, Sue Rodrigues v British Columbia (A.G) Rodrigues which was appealed up to the Supreme Court of Canada in 1993. Ms. Rodriguez, who was suffering from amyotrophic lateral sclerosis or ALS, challenged the prohibition on assisted suicide arguing inter alia, that it deprived her of her right to “liberty and security of the person” under s. 7 of the Charter by denying her the right to be free from governmental interference in making fundamental personal decisions concerning the end stages of her life. Ms. Rodriguez also challenged the prohibition under s. 15 of the Charter arguing that s. 241(b) discriminated against persons unable to terminate their own life without assistance because they are effectively deprived of the right to commit suicide, a right available to non-disabled persons.

Mr. Justice Sopinka, speaking for the majority, held that while Ms. Rodriguez was indeed deprived of her rights under s. 7, the deprivation was in accordance with the “principles of fundamental justice”; from the perspective of consensus of reasonable people and societal concepts of justice, there
was no general consensus in support of assisted suicide. Furthermore, where consensus did exist, it was in favour of protecting and maintaining respect for human life. The blanket prohibition against assisted suicide upheld the consensus — it is necessary to protect life as well as protect the vulnerable in society against abuses which might occur if the law was liberalized.\textsuperscript{20} Mr. Justice Sopinka further agreed that Ms. Rodriguez's equality rights were also infringed. However, the infringement was justified on the basis that to grant an exception for certain groups would create an inequality and that prohibition without exception is again the best way to protect the vulnerable — no "halfway measure" would be sufficient to ensure that any exception would be limited to those who were terminally ill and who genuinely desired death.

There is no halfway measure that could be relied upon with assurance to fully achieve the legislation's purpose; first, because the purpose extends to the protection of the life of the terminally ill. Part of this purpose, as I have explained above, is to discourage the terminally ill from choosing death over life. Secondly, even if the latter consideration can be stripped from the legislative purpose, we have no assurance that the exception can be made to limit the taking of life to those who are terminally ill and genuinely desire death.\textsuperscript{31}

This slippery slope apprehension — that legalized assisted suicide could open the door to the abuse and manipulation of society's vulnerable — did not persuade the minority. According to Madame Justice McLachlin (as she then was) in dissent (with Madame Justice L'Heureux-Dubé concurring), the infringement did not accord with the principles of fundamental justice as required under s. 7 of the Charter and stated, "Sue Rodriguez is asked to bear the burden of the chance that other people in other situations may act criminally to kill others or improperly sway them to suicide. She is asked to serve as a scapegoat." Madame Justice McLachlin concluded that it was arbitrary to uphold the distinction between legal suicide and illegal assisted suicide because it prevented Ms. Rodriguez from exercising control over her body in a manner available to others. Chief Justice Lamer, focusing on s. 15(1) of the Charter, also concluded that the prohibition created inequality — physically disabled persons were not capable of ending their lives unassisted in accordance with the law, while those who were capable, could do so without contravening the law — the "slippery slope" argument did not justify the restriction on those who were not vulnerable. Mr. Justice Cory, also in dissent, agreed with the disposition of the appeal by Madame Justice McLachlin and Chief Justice Lamer. In short, the dissent found that the prohibition was unjustified and that it would be possible to put sufficient safeguards in place in order to protect legally permissible assisted death from being abused.\textsuperscript{32}

The result of the Rodriguez case is in stark contrast to the result in the 1992 case of Nancy B which concerned a woman who suffered from Guillain-Barré syndrome.\textsuperscript{33} In Nancy B, the Quebec Superior Court held that a patient had a right to refuse treatment (here, the discontinuation of life-sustaining equipment), even though death would result.\textsuperscript{34} While refusal or withdrawal of treatment (omission) is factually distinct from assisted suicide and euthanasia (commission), the law indicates generally that a patient's right to autonomy and self-determination must be respected. In other words, and at the risk of sounding trite, under these circumstances, the principle of respect for autonomy commands a higher legal value than respect for "life".\textsuperscript{35} Competent adults have a right to refuse treatment even if it is potentially life sustaining.\textsuperscript{36} It is important to note that a doctor who, at the request of the competent adult,\textsuperscript{37} does not provide treatment or withdraws treatment (including via an advance directive)\textsuperscript{38} and as a result, the death of the patient ensues, will not be found criminally liable.\textsuperscript{39}

Finally, it should be mentioned that in addition to voluntary refusal or withdrawal of treatment, the law also appears to have come to grips with the principle of "double effect".\textsuperscript{40} That is, in the administration of pain control medication in the case of palliative care, it is permissible for progressive increases in dosage to control pain to have the secondary effect of shortening the patient's life.\textsuperscript{41}

Accordingly, current Canadian rules on assisted suicide might be paraphrased as follows:

1. It is the state's objective to respect life, preserve life and protect the vulnerable. Therefore the state does not condone suicide.

2. If an individual is of sound mind and body and no longer wishes to live, the state will not render illegal their own act to bring about their own death because they have a paramount right to autonomy and liberty. Any party, including a physician, that assists an individual in this pursuit however will be committing a criminal offence because the state does not approve of suicide for the reasons already noted above.

3. If an individual is not of sound mind (for example, due to age, addiction, mental or psychological ailment) the state should do what it can to support and treat them in choosing life over death.\textsuperscript{42}

4. If however, an individual is of sound mind but not of sound body, the state will not sanction
their death regardless of their paramount right to autonomy and liberty when it requires the assistance or involvement of another party for the reasons noted above unless:

a) they are already receiving treatment, which if withdrawn at their request, will result in their death; or

b) they are refusing treatment that will sustain their life.

That is, a person may only die from the underlying disease or pathology because a physician must accept a patient’s instructions regarding no treatment.

5. The state justifies the subordination of an individual’s paramount rights and prohibits opportunities to end their suffering requiring the assistance of another because there exists a pervasive sentiment in society at large that the lives of persons with disabilities (physical, age-related or otherwise) have less value and consequently might lead to abuses and pressures to cause them to lose their lives involuntarily. The state acknowledges that this position infringes the individual’s additional paramount right to equality under the law but the state does not condone suicide, so nothing can be done.

Without speaking as to whether or not these rules are logically sound, the decision in the Rodriguez case has not, of course, resolved the assisted suicide debate in Canada.

First, as briefly noted earlier, a number of assisted suicide cases demonstrate that the law is not being applied to the fullest extent, thus calling into question both its objectives and ability to deter. For example, in cases where individuals have aided or abetted the suicide of their loved ones, sentencing has been consistently lenient, ranging from acquittal to three years probation to conditional sentences to be served in the community. Furthermore, it would appear that Canadian prosecutors are not inclined to prosecute when individuals accompany a family member to receive suicide assistance in another jurisdiction.

Second, there also does not even appear to be the will to prosecute euthanasia as murder under the Criminal Code. Because of the technical difficulties associated with proving cause of death in a terminal illness situation, jury attitudes, and the relief from suffering provided, charges have ranged from complete discharge, administering a noxious substance, aggravated assault, to manslaughter, and only occasionally, murder. Furthermore, provincial prosecutorial guidelines demonstrate that the case law is not an indicator of administration of the law in practice. For example in 1993, the British Columbia Ministry of the Attorney General issued prosecu-

tion guidelines to provide guidance to Crown Counsel for laying charges where there was evidence that the person who participated in causing another person’s death was motivated by compassion for that person. Third, failed legislative proposals, reports, books, articles, interest groups and interested parties continue to add to the body of public opinion on both sides of the debate. Again, falling on the side against decriminalization as identified above are i) the ideal of preservation of or respect for life, sometimes described as the “most universally accepted value in society” and ii) the concern over the “slippery slope” — that de-criminalization will lead to abuses against the aged, the weak, or persons with disabilities who are vulnerable to sentiments that their lives have less value and thus more subject to influences that death is the better option. On the side of decriminalization are: i) the loss of autonomy for individuals unable to end their pain and suffering; ii) the inequality of the law which permits suicide without penalty for those who are able; and iii) that, in reality, assisted suicide and active euthanasia are taking place despite the illegality, but without adequate safeguards or control measures.

Fourth, as noted earlier, Canadian society is fairly comfortable with respect to the legality of death through the withholding or withdrawing life-sustaining treatment when the patient (or substitute decision maker on their behalf) has expressed this desire. Furthermore, there is increasing voice to the position that making the distinction between withdrawing or withholding treatment and assisted suicide and euthanasia is undesirable and arbitrary.

Fifth, there is a large fraction of the debate that simply wishes to achieve consistency in Canadian law with respect to dying and is looking for legislative intervention on the matter.

Sixth, the position that an individual is not allowed to be assisted in death on the basis of the impact that it will have on how the vulnerable are perceived is possibly eclipsed by the impact of a burgeoning health law policy and agenda that can be said to embrace the “optimization of one’s corporeality.” We have come to a point in Canadian health research where we have accepted and are funding the broadest approach to advancing the life sciences. This carries with it an implicit philosophy or belief that ill health “springs primarily from distinct biological flaws, deviances or entities that may be fixed or removed in the individual body.” Of course, pre-emptive eradication or healing of defect does not carry with it the objective to remove whole persons from society, however, rightly or wrongly, it does send a powerful message to society at large that disability and frailty (howsoever arising) are undesirable and thus to a certain extent,
might be viewed as overshadowing similar messages that could arise out of legalized assisted suicide.\textsuperscript{72}

In addition to the above, the legal debate on assisted suicide and euthanasia has not been stagnant in other jurisdictions. Because of the nature of Canadian constitutional law and the requirement that infringements or deprivations of rights must be defensible based on what can be demonstrably justified in a free and democratic society,\textsuperscript{73} it is cogent to re-
view recent advances and stalemates in assisted suicide laws from the international arena.

B. RECENT INTERNATIONAL DEVELOPMENTS

To say that the floodgates to assisted suicide, and in particular, physician-assisted suicide, have been opened would be an understatement.

i. United States: PAS

In the United States, it is up to the individual states to determine the legality of assisted suicide.\textsuperscript{74} Currently, only two states have passed legislation legalizing physician-assisted-suicide or PAS. No state in the United States has legalized euthanasia.\textsuperscript{75} PAS is legal in Oregon and Washington via the \textit{Death with Dignity} acts passed in 1994 and 2008 respectively.\textsuperscript{76} Under these acts, a patient requesting medication to end their life must:

- be a state resident;
- make both an oral and written request, with a second oral request to be made 15 days later;
- be determined to have a terminal disease, is competent and is acting voluntarily by two physicians;
- be informed of risks and alternatives, such as pain control and hospice care;
- be able to administer the medication themselves;
- not be suffering from a psychiatric or psychological disorder or depression causing impaired judgment.\textsuperscript{77}

Both acts require that the respective health departments collect information and issue an annual report to the public.\textsuperscript{78} According to Oregon’s 2009 report, since 1998, when the law went into effect in Oregon, 460 patients have died from taking a lethal prescription under the act, with the number of these patients increasing from 15 per year in 1998 to 59 in 2009.\textsuperscript{79} The number of deaths from prescribed lethal medication in Washington in 2009 was slightly lower at 36.\textsuperscript{80}

In the recent past, initiatives have also been taken to pass similar legislation in a number of other states including Alabama, Arizona, Arkansas, California, Hawaii, Maine, Nebraska, New Hampshire, Pennsylvania, Rhode Island, Vermont and Wisconsin, but thus far, all have been defeated. Regardless, pro-assisted suicide initiatives and activism continue.\textsuperscript{81} Currently, a PAS bill is before the Massachusetts legislature.\textsuperscript{82} Furthermore, in Montana, for example, a recent 2010 state court decision has identified that in certain circumstances, it is not illegal for physicians to prescribe medication that will allow a patient to end their life (although there is no specific legislation providing physicians with specific guidance).\textsuperscript{83} On the other hand, a similar lawsuit filed by physicians in Connecticut was dismissed. The physicians sought clarification from the court regarding whether they are permitted to prescribe lethal medications to terminally ill patients. In dismissing the claim, the judge stated that this was a matter for the legislature, not the courts, to decide.\textsuperscript{84}

Similar to Canada, there is broad consensus in the United States regarding the validity of double-effect doctrine (pain treatment which may have the secondary effect of hastening death).\textsuperscript{85} As well, the withholding or withdrawal of life support/life sustaining treatment is legally permissible based on the principles of informed consent and informed refusal.\textsuperscript{86}

According to the U.S. Supreme Court, the liberty interest protected under the Fourteenth Amendment to the Constitution includes the right to decline treatment (including the right to refuse nutrition and hydration).\textsuperscript{87} It is however important to point out that although there generally appears to be wide consensus on this particular point, there is still variation from state to state.\textsuperscript{88}

Outside of North America, assisted suicide/euthanasia developments have progressed even further with deeper controversies percolating.

ii Switzerland: Assisted Suicide and “Suicide Tourism”

Along with withholding or withdrawal of life support/life sustaining treatment and pain treatment which may have the secondary effect of hastening death, assisted suicide is currently legal in Switzerland, The Netherlands, Belgium and Luxembourg. Switzerland is perhaps the most widely known for the reputation as the state with the most liberal perspective on assisted suicide. Article 115 of the Swiss Penal Code calls for up to five years imprisonment if someone persuades someone to commit suicide or assist suicide for selfish reasons.\textsuperscript{89} Accordingly, if assistance with suicide is provided for unselfish reasons, it is permissible.\textsuperscript{90} Euthanasia however remains illegal.\textsuperscript{91}

Widespread familiarity with Switzerland’s lenient assisted suicide law is likely attributable to the fact that Swiss law does not restrict suicide assistance to its residents nor does it limit its application to spe-
cific situations, such as terminal illness. Furthermore, the law does not specify who may be allowed to give suicide assistance, thus assistance can be provided with or without physician participation, unlike Oregon, Washington and Montana, as well as other jurisdictions to be discussed below. This gap has resulted in the establishment of right-to-die organizations like Dignitas and EXIT. Since it began providing assisted suicide services in 1998, Dignitas has helped at least 1041 people die (the majority from Germany, the United Kingdom and Switzerland) and EXIT, approximately 700. While the Swiss Academy of Medical Sciences ("SAMS") has emphasized in the past that neither assisted suicide or active euthanasia are an appropriate part of medical activity, recent SAMS guidelines regarding the care of patients at the end of life indicate that in certain cases, it is permissible for doctors to assist the suicide of a seriously ill patient. Furthermore, an anonymous survey of Swiss physicians in 2004 indicated that physicians have carried out voluntary active euthanasia in approximately 400 cases.

Recent concerns over the increase in "suicide tourism" to Switzerland and of possible abuses by assisted suicide organizations (including Dignitas) have prompted the Swiss government and politicians to reconsider how assisted suicide is regulated. Regulatory options being discussed include imposing clear duties of care on employees of assisted suicide organizations. This would include requiring organization employees to ascertain voluntariness and mental capacity as well as obtain certificates from two physicians identifying the presence of an incurable physical illness. A complete ban of organized assisted suicide altogether is also being considered. Reform consultations are currently ongoing.

III. The Netherlands: EAS and "Tired of Life"

In stark contrast to Switzerland, Oregon and Washington, the Netherlands does not legally distinguish between assisted suicide and euthanasia, utilizing instead the acronym "EAS" to refer to both. Netherlands law has permitted physicians to provide either service through its Euthanasia Legislation since 2002. Provided certain standard due care requirements are met (informed consent, voluntariness of request, unbearable suffering with no prospect of improvement, consultation with a second physician, reporting to the authorities and so forth), a physician is permitted to terminate the life of a patient or assist them with the means to allow them to terminate their own life. While Netherlands legislation does not expressly address whether EAS is available only to non-residents, the Ministry of Justice believes that suicide tourism to Netherlands is not possible because of the legislation's procedural requirements which require a physician "to know the patient very well." One of the most controversial aspects of the Netherlands scheme is that it appears to allow assisted suicide or euthanasia when no physical illness is present that is, for non-somatic suffering such as emotional or mental suffering, provided it is assessed by the physician as being lasting and unbearable.

One of the earliest considerations of assisted suicide for non-somatic suffering was the Chabot case, a 1994 decision of the Supreme Court of the Netherlands involving a physician who provided his 50-year-old patient with the means to die because she had intense psychic suffering with no prospect for improvement. The Supreme Court held that, "assisted suicide could be justifiable in cases where, although no physical illness was present, the patient was experiencing intense emotional or mental suffering." The Court qualified this by also indicating that such cases required extreme caution but nonetheless refused to impose a penalty on Dr. Chabot.

A second case in 2000 pushed the Dutch boundaries even further when a physician, Dr. Sutorius aided the suicide of 86-year-old Edward Bronersma, a former senator, who had no serious physical or mental illness but rather was "tired of life". Dr. Sutorius was first acquitted but then later found guilty by the Amsterdam Court of Appeal. The Court kept "hopeless suffering" to the narrow circumstances of where there was a classifiable medical cause, either somatic or psychiatric. The Court however, imposed no punishment on Dr. Sutorius recognizing that he had acted out of "great concern for his patient." The notion of "tired of life" also described as "weary of life" and "life fatigue", falls into the broader categories of suffering described as "non-somatic" or "existential suffering". While Dutch legal officials have been requesting courts to "set a principled boundary" to prohibit these types of activities, they are failing, in large part due to one of the major underlying justifications of assisted suicide/euthanasia, that is, the notion of autonomy. The pursuit of assisted death has progressed far beyond the idea of relief of hopeless and unbearable suffering, whether somatic or non-somatic. Indeed, the principle of autonomy has now arrived front and center in the Netherlands assisted suicide/euthanasia debate — euthanasia is now being pursued to permit lethal injection for elderly people who "consider their lives complete" and want to die. A citizen's action group, known as "Out of Free Will" has pushed this debate into the Dutch Parliament by the collection of over 100,000 signatures in support of assistance in dying for being "weary of life." Although the Netherlands currently stands alone in its consideration of expanding assisted suicide/euthanasia for "tired of life", nascent perturba-
tions of this contemporary argument are surfaced elsewhere including in the United States, United Kingdom and Australia.  

iv. Belgium: PAS and Euthanasia

Euthanasia was legalized in Belgium in 2002 with the passing of the Law on Euthanasia116 which is largely patterned after the Netherlands legislation. The act does not regulate "assisted suicide" but rather defines euthanasia as an "intentional termination of another person's life at his request." It does not define the act or method of "termination" but is understood to include both physician-assisted suicide and euthanasia. Similar to the Netherlands, the legislation requires that strict conditions must be met before a patient will be assisted. These include that: euthanasia be administered by a physician; there be more than one request for euthanasia; the existence of a terminal medical condition; constant suffering (either physically or psychologically). Reporting obligations are also imposed on the physician. A recent report has indicated that two per cent of all deaths in the Flanders region of Belgium are due to euthanasia (approximately 118 cases) and that assisted death practices are on the rise.117

v. Luxembourg: PAS and Euthanasia

In March 2009, Luxembourg's law permitting both physician-assisted suicide and euthanasia came into force, making it the third European country to enact such assisted suicide legislation. Under the act, safeguards similar to the Oregon and Washington and The Netherlands legislation have been put in place:

- the request to die must be repeated, with at least one written request;
- the patient must be informed of risks and alternatives;
- suffering must be persistent and the condition incurable;
- a second physician must be consulted to ensure the condition is "incurable"; and
- deaths under the act must be reported.

Distinct from the American legislation, but similar to the Netherlands, suffering can be physical or mental/psychological.118

vi. The United Kingdom: Prosecutorial Guidelines

Similar to Canada, assisted suicide is illegal in England and Wales122 with euthanasia constituting murder and carrying a life sentence123 regardless of any consent by the victim. Pain control to the point of potentially hastening death is permissible124 and a competent patient has the right to refuse medical treatment.125

The first significant challenge to the prohibition on assisted suicide was the 2001 case of Diane Pretty who was suffering from a motor neuron disease causing her to be paralyzed from the neck down.127 Ms. Pretty argued that the prohibition infringed her rights under the Convention for the Protection of Human Rights and Fundamental Freedoms when she was unable to obtain assurances from the Director of Public Prosecutions that her husband would not be prosecuted if he assisted her in ending her life.128 After her appeal was rejected by the House of Lords,129 she took her argument to the European Court of Human Rights ("ECHR"). The ECHR also rejected her application, refusing to acknowledge that Article 2(1) of the Convention protected a right to die.130 The ECHR did however acknowledge that "in an era of growing medical sophistication combined with longer life expectancies, many people are concerned that they should not be forced to linger on in old age or in states of advanced physical or mental decrepitude."131

In the more recent case of Debbie Purdy, the House of Lords in 2009 agreed that aspects of Great Britain's assisted suicide laws required clarification.132 Ms. Purdy, who suffers from a progressive form of multiple sclerosis, wanted to know if her husband would face criminal charges in Britain if he accompanied her to a euthanasia clinic in Switzerland. She argued that the prosecution policy was unclear and requested clarification of the factors to be considered in prosecution decisions on cases of encouraging or assisting suicide. In July 2009, the House of Lords agreed that the law prohibiting assisted suicide was unclear133 and ordered that the Director of Public Prosecutions ("DPP") identify the criteria to be taken into account when deciding whether or not to prosecute under these circumstances.134 In September 2009, the DPP issued an Interim Policy135, setting out the requested criteria and in February 2010 published its Policy for Prosecutors in Respect of Cases of Encouraging or Assisting Suicide.136 Under the policy, public interest criteria against prosecution include:

- a voluntary, clear, settled and informed decision to commit suicide;
- assistor is wholly motivated by compassion and actions were of only minor encouragement or assistance;
- assistor sought to dissuade the "victim";
- assistor reported the suicide to police.

In describing the policy, Keir Starmer, the DPP, stated:

The policy is now more focused on the motivation of the suspect rather than the characteristics of the victim. The policy does not change the law on assisted suicide. It does not open the door for eutha-
nasia. It does not override the will of Parliament. What it does is to provide a clear framework for prosecutors to decide which cases should proceed to court and which should not.137

Responses to this development have been mixed, with critics (and supporters) arguing that the DPP is effectively legalizing suicide.138 Additionally, in a newspaper article released the day before the publication of the policy, the British Prime Minister, Gordon Brown, stated:

The law — together with the values and standards of our caring professions — supports good care, including palliative care for the most difficult of conditions; and also protects the most vulnerable in our society. For let us be clear: death as an option and an entitlement, via whatever bureaucratic processes a change in the law might devise, would fundamentally change the way we think about mortality.139

Proponents of the right-to-die movement on the other hand welcome the guidelines and are now calling for legislative reform.140 The Purdy decision and resultant prosecutorial guidelines are in keeping with what appears to be a louder voice in favour of legalizing assisted suicide in the UK.141 According to a February 2010 Angus Reid poll of 2,001 British adults, “the push to legalize euthanasia is supported by a majority of people in Britain” with seven out of ten people polled in support of the practice.142 On the other hand, the British Medical Association is opposed to any change in the law.143

One further development in the Britain should also be mentioned. A trickle of literature advocating the idea that suicide services should become available to anyone at anytime for any reason is emerging out of this jurisdiction. For example, Steven Edwards of Swansea University recently wrote an article in support of establishing a network of suicide centers and the provision of assisted suicide when the person seeking assistance does not have an accompanying health problem.144 Edwards supports this proposition on the basis of autonomy, relief of suffering and respect for the “life-plan” of the person. In a 2010 interview with the Sunday Times, British novelist, Martin Amis, controversially called for euthanasia “booths” to be established at street corners to permit the elderly to end their lives.145 He stated “There should be a way out for rational people who’ve decided they’re in the negative. That should be available, and it should be quite easy. … Medical science has again over-vaulted itself so most of us have to live through the death of our talent.”146

Intriguingly, this expansive notion of suffering, i.e. that human suffering to the point of desire for death can arise out of physical or psychological/ emotional/intellectual reasons, is being directly explored in the field of palliative care. There is a growing recognition in this field, that dignity-conserving palliative care must treat all forms of patient suffering, including the psychosocial, existential and spiritual aspects of the dying experience.147 This research on suffering and the blurring of somatic and non-somatic suffering that it imitates, stands to inform the justifications for and against assisted suicide in addition to informing social obligations and objectives (like palliative care) based on the nature and significance of suffering.

vii. Summary

Although assisted suicide and euthanasia remain illegal in certain jurisdictions, including Canada, primarily on the basis of i) sandity or inviolability of life and ii) the slippery slope dangers that might arise if legalized,148 the debate is fierce and shows no signs of waning. While some argue that in reality, there is “no groundswell of support to legalize euthanasia” in most jurisdictions,149 and furthermore, that a complete ban on organized assisted suicide is now being considered in Switzerland because of the materialization of slippery slope concerns,150 there is nonetheless an overall inclination towards leniency in prosecution for compassionate killing.

As death becomes increasingly bureaucratized and globally consumerized, there is an obvious need for clearer legal guidance. One remarkable result of the global participation in the assisted suicide and euthanasia debate is an increasing awareness that intractable suffering is not necessarily restricted to physical suffering and that indeed suffering occurs at both somatic and non-somatic levels. Of particular interest here, is the idea that a “patient” can possess competency and voluntariness in decision-making even though they are experiencing mental anguish to the extent that they wish to die.151 As described above, not all jurisdictions where assisted suicide and/or euthanasia are legal are in agreement on this point however. Oregon, Washington, and Montana currently stand apart from The Netherlands, Belgium and Luxembourg in requiring the diagnosis of a terminal physical illness. Switzerland may also impose this requirement.152 Currently, Switzerland appears to be the only state to permit assisted suicide by a non-physician, although this may change in the future.153

Based on the foregoing review, in respect of a competent patient who has requested death, this section concludes by proposing the following spectrum of assisted death options based on the least to the most controversial.154
Figure 1: Spectrum of Assisted Death

**Grouping 1: Generally Accepted Medical Practices**
- Withdrawal or withholding of life-saving or life-sustaining treatment upon request with or without terminal or incurable illness. (justified primarily on principles of autonomy, informed refusal and right to direct treatment)
- Aggressive pain management for terminal illness that might have the effect of hastening death (justified primarily on the principles of “double-effect”, beneficence and mercy/compassion)

**Grouping 2: Intractable Suffering and Terminal Illness**
(justified primarily on principles of autonomy and mercy/compassion)
- Physician-assisted-suicide for patient with intractable suffering and terminal illness
- Euthanasia by physician for patient with intractable suffering and terminal illness

**Grouping 3: Intractable Suffering and Incurable Physical Condition**
(justified primarily on principles of autonomy and mercy/compassion)
- Physician-assisted-suicide for patient with intractable suffering and incurable physical condition
- Euthanasia by physician for patient with intractable suffering and incurable physical condition

**Grouping 4: Intractable Suffering and Incurable Emotional/Psychological Condition**
(justified primarily on principles of autonomy and mercy/compassion)
- Physician-assisted-suicide for patient with intractable suffering and incurable emotional/psychological condition
- Euthanasia by physician for patient with intractable suffering and incurable emotional/psychological condition

**Grouping 5: Other Forms of Suffering**
- Physician-assisted-suicide for patient with life fatigue/existential suffering (justified primarily on principles of autonomy and mercy/compassion)
- Euthanasia by physician for patient with life fatigue/existential suffering (justified primarily on principles of autonomy and mercy/compassion)
- Euthanasia by non-physician for patient with life fatigue/existential suffering (justified primarily on principles of autonomy and mercy/compassion)
- Euthanasia by non-physician for any reason (justified primarily on principles of autonomy and mercy/compassion)

**Grouping 6: Euthanasia by Non-Physician**
- Euthanasia by non-physician for patient with intractable suffering and terminal illness (justified primarily on principles of autonomy and mercy/compassion)
- Euthanasia by non-physician for patient with intractable suffering and incurable physical condition (justified primarily on principles of autonomy and mercy/compassion)
- Euthanasia by non-physician for patient with intractable suffering and incurable emotional/psychological condition (justified primarily on principles of autonomy and mercy/compassion)
- Euthanasia by non-physician for patient with life fatigue/existential suffering (justified primarily on principles of autonomy and mercy/compassion)
- Euthanasia by non-physician for any reason (justified primarily on principle of autonomy)
III. LIFE EXTENSION, DYING AND THE LAW

... how we deal with death is at least as important as how we deal with life ...

Captain Kirk, The Wrath of Khan

A. ETHICAL CONCERNS AND “EXTRA-LONG LIFE” SCENARIOS

Biogerontology involves the study of the biological process of aging.\(^{155}\) The goal of biogerontology for \textit{immortalists} and \textit{transhumanists}\(^{156}\) is to increase not only the average healthy life span but also the average total lifespan.\(^{157}\) According to inventor, entrepreneur and author, Ray Kurzweil in 2008, “15 years from now we’ll be adding more than a year each year to our remaining life expectancy.”\(^{158}\) Even more intriguing is the position of Aubrey de Grey, a Cambridge University researcher, biogerontologist and founder of the SENS Project (Strategies for Engineered Negligible Senescence)\(^{159}\) who believes that it will be possible for a person to oscillate between the biological age of 20 and 25 years for thousands of years if not indefinitely.\(^{160}\) While it cannot be said that there is consensus in the biogerontological community,\(^{161}\) it has been observed that “most biogerontologists believe that our rapidly expanding scientific knowledge holds the promise that means may eventually be discovered to slow the rate of aging.”\(^{162}\)

Countering immortalist optimism however, is a cynicism that any increase in longevity will be capped by the maximum human lifespan of 125-150 years\(^{163}\) and that longevity advances, in any event, will only be realized by some future generation many years from now. Accompanying this cynicism is an abundance of criticism that challenges the direction of life extension and antiaging research and points out the reasons why the pursuit of life extension is undesirable.\(^{164}\) For example, philosophical, spiritual and psychological camps argue that the essence, meaning and enjoyment of life exist only because of human mortality. A loss of human finitude will lead to a loss of urgency and in turn a loss of meaning and pleasure in life.\(^{165}\) Ethical, economic, institutional and social justice camps contend the creation and intensifying of problems related to overpopulation, increased health care costs due to an aging population, intergenerational inequity and increasing burdens being placed on the younger generation to look after the older, a medical system unresponsive to the actual needs of patients and society, lack of access to basic health care, inequitable access to and distribution of antiaging medicine, the creation of class differences due to enhanced and non-enhanced humans, loss of choice and protections for future generations, loss of human dignity, lack of turnover in politics, society and academia, and so forth.\(^{165-167}\)

Margaret Pabst Bardin, a leading American philosopher in the area of death and dying who has considered life extension, questions the significance of these projections and hypothetical concerns, given that they are all premised on one common assumption, that is, “If extra-long life becomes possible, people will actually live it.”\(^{168}\) Bardin challenges this assumption by pointing out that its validity is dependent on future life-span scenarios that are “unlikely”. Bardin thus re-orient the focus of the hypothetical concerns to explore three particular scenarios that she describes as being the most likely to arise from “extra-long life”. These are: the \textit{longer-health} scenario, the \textit{longer-dying} scenario, and the \textit{longer-decline} scenario.\(^{169}\)

The \textit{longer-health} scenario entails an extended period of good health with the decline to death being the same or shorter as it is currently. The \textit{longer-dying} scenario entails an extended period of life but most or all of the extension gained will involve the dying process with extended period of physical disintegration and debility. The \textit{longer-decline} scenario entails an extended period of life with a concurrent extension of the descent from good health to bad health.\(^{170}\)

Bardin examines the central assumption in the context of these three scenarios to identify that if life extension sets up the \textit{longer-health} scenario then people will likely choose to live longer. Examples of treatments/interventions that might indicate \textit{longer-health} include improved nutrition or better understanding of impacts of exercise and stress.\(^{171}\) If, on the other hand, life extension translates into a \textit{longer-dying} scenario, then people will not choose to live longer. Examples of treatments that might achieve the \textit{longer-dying} scenario would be the use of drugs with serious side effects\(^{172}\) or aggressive interventions toward the end of life.\(^{173}\) Bardin identifies that under this scenario, people will utilize the same mechanisms currently available to avoid overly-prolonging their lives such as advance directives, pain control measures that have life-shortening effect, physician-assisted suicide and euthanasia.\(^{174}\) While this scenario would not necessarily be an objective of life extension therapies, Alexander M. Capron\(^{175}\) argues that a lengthening of the dying process could arise inadvertently as a result of separate interventions, “each of which, viewed individually, seemed to be an appropriate response” to the patient’s medical conditions.\(^{176}\) Thus, it should not be assumed that the \textit{longer-dying} scenario will arise as a distinct choice easily avoided.

Given mixed technological advances along with environmental factors, which Bardin states will result in an offsetting of advantages and disadvantages of the three scenarios, Bardin predicts the \textit{longer-decline} scenario as the most likely.\(^{177}\) Capron agrees, arguing that slowing down the process of decline is the most likely to play out because it could be the
result of various medical interventions taken throughout life for a variety of chronic and acute conditions. If life extension means longer decline, Battin states that it is not possible to predict whether people will choose to live longer or not and further that it "bodes an uncertain democratic future." 179

It is not entirely clear whether Battin’s framework fully acknowledges the possibility that longevity gains might be achieved at discrete stages in the life phase or contemplates the distinction between increases to life expectancy (i.e. improving survival rates towards a human maximum) 180 or actual increases to overall life span by slowing down the normal aging process itself. Based on the latter idea, Capron offers a fourth alternative “life curve” — clock slowing — which would result in an overall extension of the various stages of life, proportionately or disproportionately. 181 Thus extension could possibly occur at any stage of life, resulting in, for example, a greatly extended period of youth or a greatly extended senescence 182 or both. It is important to observe that Capron’s fourth alternative is not strictly limited to the overall qualitative end result of treatment which is what Battin appears to be identifying. Rather, Capron’s fourth alternative appears to point out a finer, perhaps quantitative, distinction with respect to the nature of the treatment and thus could possibly include Battin’s three outcomes but also potentially contemplate others.

These four scenarios — longer-health, longer-dying, longer-decline and clock-slowing — are also reflected, at least in part, by four possible outcomes of biogerontological advances identified by the biogerontologist community. These are: prolonged senescence, compressed morbidity, decelerated aging and arrested aging. 183

Prolonged Senescence, also coined the “national nursing home scenario”, 184 is the extension of the aging phase of life along with a resultant increasing dependency on others. Thus, prolonged senescence could be considered the worst-case scenario under Capron’s clock-slowing model 185 and likely also contemplates both Battin’s longer-dying and longer-decline scenarios.

Compressed morbidity is the idea of a longer life of good health, free of disease, pathology and debility followed by a short death process. 186 Compressed morbidity of aging would connect with Battin’s longer-health scenario and possibly also to Capron’s clock-slowing model.

Decelerated aging would see the movement through all life phases occur at a slower pace possibly improving both life expectancy and extending life span. It is therefore equivalent to Capron’s clock-slowing model and could also accommodate Battin’s longer-health or longer-decline scenarios.

Arrested aging involves the complete control of the aging process itself. More modest conceptions of arrested aging perceive achieving an age of 140 years old with severely compressed morbidity while others envision pushing that boundary even further. As noted above, it is Aubrey de Grey’s goal to extend life by achieving something akin to a perpetual state of youth. Thus, similar to decelerated aging, arrested aging has elements in common with Capron’s clock-slowing life curve and Battin’s longer-health scenario.

B “TECHNOLOGICAL ENTANGLEMENT”

The conceptual difficulty in connecting or indeed delineating between therapeutic outcomes (prolonged senescence, compressed morbidity), therapeutic objectives (clock-slowing, decelerated aging, arrested aging) and overall general qualitative impact (longer-health, longer-dying, longer-decline) is apparent. One possible reason for this organizational difficulty is that technologies are rarely neutral, that is, they can rarely be designed to produce static outcomes upon which moral decisions can be readily made. 187 As described by Mireille Hildebrandt, it is perhaps more accurate to view a technology as a sort of “non-human actor” that demands interaction from the human actor by, for example, inviting, inhibiting, prohibiting or enforcing certain behaviour or activities. 188 This is what is understood as the “normative impact” of a technology. 189 This is not to say that a technology determines human action, rather, human action arises as a result of the interaction — a form of technological entanglement — which in turn shapes outcomes, some that will be unforeseen as well as some that will require further action. This perspective is described as a “pluralist” view of technology. 190

Technological entanglement is also likely to exist at increasing degrees of intricacy or convolution. 191 Factors that could impact on the level or degree of technological entanglement might include: the technology’s complexity or novelty; the level of embeddedness or user attachment to the technology; 192 possible courses of action disclosed by the technology; 193 and outcomes which could be stable or unstable (requiring further action).

Thus, as compelling as Battin’s framework is in terms of encapsulating the life extension scenarios most likely to arise, it raises additional questions. For example, is it indeed the case that these three scenarios will be mutually exclusive, particularly given the plurality of technology? Do these scenarios actually superimpose over current theories of aging and where longevity increases are expected to occur? Furthermore, does current life extension research demonstrate intersections with the Battin framework or does it implicate different or wider dimensions in light of technological entanglement?
Accordingly, the next section reviews some of the higher-profile life extension/antiaging research being currently undertaken and organizes it into streams based on the degree of technological entanglement (applying complexity/novelty, embeddedness/attachment and outcomes factors), how or where the potential treatment might intervene in the natural aging process, and in turn, how the dying process might be impacted or altered, if at all. The identified streams are then examined against the state of the law on assisted death to determine where the law is situated in addressing them.

Battin's framework is considered throughout this analysis as it is imperative to specifically contemplate whether life extension interventions could increase the "time spent in illness and debility."194 Certainly, that is not the objective of biogerontologists. If, however, the answer is yes, then it is clear, as noted earlier in this article, that the law in its current state is not ready to address what is likely to be increasing incidences of conflict in dying. If the answer is no, it is imperative that the law gather itself up and provide clarity on assisted death as we head into uncharted scientific waters accompanied by increasing vocal demands for greater autonomy in the life course. As put by Capron, "Would such technology exert too much control over the dying process, thereby denying people a natural death?"195

B CURRENT TECHNOLOGICAL PURSUITS

i. Aging and Age-Associated Pathology: An Important Distinction

"The greatest leading cause of death is old age."196 This statement does more than simply state the obvious; it provides an illustration helpful to understanding the distinction between aging and age-associated pathology or disease. The study of biogerontology concerns itself with understanding the fundamental aging process at the molecular level. The study of age-associated diseases on the other hand involves the study of diseases that increase in frequency as age increases. That being said, it is important to note that the aging process is in "rough synchrony" to the many diseases and disabilities of aging.197 Indeed, aging is considered the "greatest risk factor" for every age-associated pathology;198 aging is the "underlying cause of almost all major human diseases, such as atherosclerosis, cancer, cardiovascular defects, cataract, diabetes-2, dementia, macular degeneration, neurodegeneration, osteoporosis and excessive muscle loss leading to sarcopenia."199 Because of this linkage, many biogerontologists assert that understanding the basic biology of aging itself is "likely to be the most efficient and economic way to address the rise in chronic age-related diseases".200

Accordingly, on this distinction alone, a preliminary observation might be made. Increases in longevity based on cures or repairs to age-associated pathologies possess a lesser ability to extend life beyond the perceived maximum human lifespan and thus theoretically should have a lesser impact on the dying process as society currently experiences it. On the other hand, advances in solving the "aging problem", that is, gains in understanding the fundamental changes in molecular structure in the manifestation of aging201 and the underlying role played by the genome,202 stand to challenge maximum human lifespan and thus, if realized, will have a greater impact on the "natural" dying process, that is, as society has currently come to understand it.

ii. Current Life Extension/Antiaging Research

The field of life extension/antiaging can be described as being in its infancy with respect to the practical applications of life extension therapies. Nonetheless, according to many medical experts, major improvements in medical care, based on advances in molecular biology in particular, are expected to extend life expectancy to 100 or above by the second half of the 21st century, 2030.203

The vast field of life extension/antiaging research can be subdivided into five main categories of traditional,204 biomedicine, nanotechnology, robotics & digitalization and cryonics, although some degree of overlap is inevitable. What follows is only a brief summary of the more significant developments and remarkable objectives of these fields.

1. Traditional Approaches

Physical Activity

Many studies in the area of physical activity have investigated the beneficial effects of physical activity on aging and longevity.205 Dr. R.S. Paffenbarger of University of Stanford for example, has concluded that increased activity, be it light, moderate, or vigorous, increases longevity.206 Dr. Paffenbarger and others continue to advocate for health professionals to emphasize daily physical activity in order to extend lifespan and mitigate all-cause mortality in their patients.207

Caloric Restriction

Caloric Restriction ("CR") is one of the most basic medical treatments designed to provoke longevity gains.208 The treatment involves decreasing energy (caloric intake). The main theory behind this treatment is the free radical theory of aging, which holds that "free radicals produced by normal aerobic metabolism ... impair cellular function and proliferative capacity and accordingly, aging is the result of the failure of various protective mechanisms to
keep pace with the radical induced damage.” In other words, if caloric intake is reduced, metabolism slows down, leading to a decrease in the number of free radicals and the damage caused by these species. While CR may induce longevity, other research indicates that reduced caloric intake, particularly when it is associated with weight loss, may increase bone loss. Additionally, it is important to note that CR theory has been criticized due to the differences in physiology and life history between humans and the model organisms used in the lab and furthermore, that life extending gains are fairly immediate and reversible upon resumption of a normal diet.

Nutritional Supplements

Also premised on the free radical theory of aging is the study of nutritional supplements, in particular, the potential benefits of antioxidant intake. The goal here is to neutralize free radicals via antioxidants. In some studies, antioxidants have been shown to inhibit the development of cancer, thus extending lifetime. Resveratrol, which has been found to increase the lifespan of certain species, is a naturally occurring phytoalexin occurring in grapes and other foods. Resveratrol as a supplement may trigger the same pathways as those activated by caloric restriction diets. It is also found to act as an antioxidant and an antitumor agent with cancer chemopreventive activity. On the whole however, the use of antioxidants as effective antiaging agents is still controversial.

The ZINCAGE project is a multinational project currently funded by the European Union which is in the process of investigating zinc (Zn) on aging. Research indicates that “during aging, the intake of Zn decreases ... contributing to frailty, general disability and increased incidence of age-related degenerative diseases (cancer, infections and atherosclerosis).”

Hormone Replacement Therapy

As we age, we experience a decline in certain hormones resulting in the expression of a senescence phenotype because of decreases in certain growth factors and the ability to synthesize proteins. Hormone Replacement Therapy (“HRT”) was developed to address this decline. The theory is that hormone supplementation can significantly reduce certain age-related diseases. Hormones being investigated for replacement therapy include dehydroepiandrosterone (“DHEA”), estrogen, testosterone and growth hormone. Thus far, the evidence on this type of therapy is conflicting and has not provided any definite conclusions regarding its efficacy in treating age-related diseases such as memory loss, Alzheimer’s disease, Parkinson’s disease or age-related osteoporosis. The use of hormones has been questioned as certain studies have indicated that HRTs might actually increase the risk of cancers as was the case of estrogen plus progestin therapy, fuel tumour growth in the case of testosterone therapy, and possibly shorten lifespan in the case of growth hormone.

2. Biomedicine

Biomedicine involves a molecular approach to therapy. It is, for the most part, dominated by research in the field of genetics.

Personalized Genomics

Personalized genomics involves the sequencing of an individual’s genome so that their specific genetic vulnerabilities can be identified. By tailoring drugs specific to that individual’s genetics, the prospects of success for preventative interventions are improved, including the ability to prevent adverse drug reactions (“ADRs”) — i.e. “the delivery of the right treatment for the right patient at the right time.”

Gene Therapy

“Genes are the fundamental units of information for biological processes” thus there is a connection between genes and disease susceptibility. Many diseases or conditions occur either as a result of specific gene mutations or the combined effect of genetic variation with environmental factors. “Gene therapy uses genetic engineering — the introduction or elimination of specific genes by using molecular biology techniques to physically manipulate genetic material — to alter or supplement the function of an abnormal gene by providing a copy of a normal gene, to directly repair such a gene, or to provide a gene that adds new functions or regulates the activity of other genes.” Healthy or new genes are typically transferred into cells by way of a vector, commonly a virus, although non-viral options are being explored. Gene therapy is being developed to address specific age-related diseases, such as Parkinsson’s, osteoporosis, osteoarthritis, arterial disease and certain cancers. Successful gene therapy hinges on the ability to safely deliver the genes and have the genes actually work to produce the correct amount of protein for the correct amount of time. Underproduction for a limited amount of time would be ineffective in certain diseases that require permanent production. Similarly, overproduction, even for a short amount of time could cause serious harm. Gene therapy is still very controversial and at its experimental stages. Experiments on humans in the past have provided mixed as well as lethal results. For example, in a 1999 clinical study for a rare genetic-based metabolic disorder, 18-year-old Jesse Gelsinger died from multiple organ failure four
days after being injected by a viral vector containing corrective genes. The organ failure is attributed to a severe immune response.262

Stem cells are also being examined for their clinical potential for gene therapy. Stem cells are self-renewing progenitor cells that have the capacity to generate different cell types.263 Embryonic stem ("ES") cells can generate all the differentiated cell types that comprise the body (pluripotent) and are thus believed to hold the greatest therapeutic potential.264 Adult stem cells are organ/tissue-specific cells (somatic) meaning they are able to generate the major cell types that make up the particular tissues of origin (multipotent).265 Because of the ability of a stem cell to differentiate into different cell types, stem cells can overcome the limits of delivering only specific genes.266 Stem cells are also proliferative and self-renewing267 and thus may "reduce or eliminate the need for repeated administrations of the gene therapy."268 Stem cell applications in regenerative medicine are discussed further below.

In addition to gene therapy to address specific age-related diseases, gene therapy research is also being undertaken to explore its potential applications for modulating the aging process.269 As mentioned, scientists to a lesser or greater extent believe that there is a connection between genetics and the aging process itself.270 Research involving roundworms, yeast, flies and rodents has generated the discovery of a connection between longevity and certain genetic mutations271 and gene expression.272 Specific research that has been of particular interest, is examining the role that telomeres (regions of repetitive DNA at the end of chromosomes) play in the central aging process.273 It has been reported that these regions shorten at similar rates in normal human somatic cells as aging proceeds.274 It has also been demonstrated that even stem cells, which are believed to be self-renewing, are prone to the loss of telomere sequence.275 A very recent study has identified two genes associated with shortened telomeres.276 Another very important discovery here is that the expression of telomerase (the enzyme which maintains telomeric DNA) at the appropriate time can serve to immortalize human cells277 and extend their replicative potential.278

Because longevity gains in these studies involve a "switching off" of genes (partially or completely) or the overexpression of certain genes, concerns in human application respectively include negative impacts on other metabolic processes necessary for normal development, growth and survival as well as the potential triggering of carcinogenesis and other physiological trade-offs that could result in a possible reduction of overall vigor.279

The connection between longevity and humans specifically has primarily arisen out of research on centenarians and their families. Epidemiological studies have demonstrated that there is a familial predisposition to longevity. Many of these centenarians are in good health and remain functionally independent until the very last years, demonstrating the validity of the compressed morbidity theory in these groups.280 The question here though is whether longevity in these groups indicates the lack of certain gene variations that increase the chances of early death or whether it actually indicates, more controversially, the possible existence of longevity gene(s) that protect against aging and age-related diseases.281 According to Perls, reaching the age of 100+ very much depends on a "complex combination of genetics, environment, lifestyle, and luck."282 Rattan and Singh estimate the value of the genetic determinant at around 25 per cent.283 However, Rattan and Singh also point out that in the opposite scenario, extreme accelerated aging (such as in Werner's syndrome and progeria) has been linked to single gene mutations.284 Additional research for specifically human longevity-genes or "gerontogenes"285 involves examining polymorphisms in candidate genes associated with human longevity in various populations, although to date no reproducible association has been found.286

The "next level of complexity" for gene therapy with respect to aging involves epigenetic interventions including stem cells.287 Epigenetics looks at the "sum total of interactions of genes and the milieu in which the genes happen to operate."288 In other words, external factors and interactions can trigger alterations in genes and the success of a gene action. Thus ideal strategies to increase the extended healthy life span ("healthspan") would move beyond short-term treatments of specific age-related pathologies towards genetic and epigenetic interventions aimed at prevention or modulation of aging.289

Regenerative Medicine

Regenerative medicine involves the replacement, repair or regeneration of cells, tissues or organs to restore function impaired by any cause, including, congenital defect, disease, trauma and aging.290 The work here is interdisciplinary involving, among other things, developmental biology, bioengineering, biomaterials science, stem cell biology and clinical medicine.291 Stem cell biology and novel biomaterials research in particular continue to stimulate this area towards improving functional response and reducing immune rejection by delivering patient-compatible cells and tissues.292 Scientific research is exploring the construction of a range of tissues including "skeletal muscle, bone, heart, blood vessels, complex functional limb structures, and even the central nervous system."293 Cell-based regenerative therapies involve inducing or reprogramming somatic cells resident in particular
tissues to differentiate and reconstruct the damaged or lost tissue. The regenerating finger tip example used pig bladder derived extra-cellular matrix to induce cells at the injured site to reconstruct the lost tissue as opposed to forming scar tissue.275 Gene therapy is also implicated here as another way to switch on the genes to recapitulate stem cell expression by the somatic cell.276 Therapeutic cloning or somatic cell nuclear transfer ("SCNT") involves creating patient-specific pluripotent stem cells by replacing the nucleus (containing the DNA) of an oocyte (egg cell) with the nucleus from a cell derived from the patient (such as a skin cell). After division, pluripotent stem cells can be harvested and introduced into damaged tissues either to induce the resident cells to reprogram (as above) or "differentiate directly into mature replacement tissue."277 SCNT is still highly controversial.278 The processes for human regeneration are not well understood and will likely require better understanding of resident cell behaviour and the environmental cues required to activate them.279

A notable recent discovery by a team from Harvard Stem Cell Institute researchers at Massachusetts General Hospital is the identification of a human cardiac master stem cell from which they have been able to create a functioning strip of ventricular muscle. Two potential therapeutic avenues exist — deliver the cells to the damaged heart muscle (via a gel or injection) to provoke repair or creation of new muscle or rely on tissue engineering.280

Tissue engineering ("TE") is the bioengineering of tissues and organs as an alternative to harvested tissues, implants, and prostheses.281 In order to generate three-dimensional tissues and organs, some form of scaffolding282 is required upon which human cells, including stem cells, are seeded and which guides the growth of the cells into a particular tissue architecture.283 Therapeutic successes here already include simple tissues, such as skin, cartilage and urinary bladders.284 Progress is now being made towards developing methods that will allow the generation of more complex tissue architectures that require vascular networks, such as livers and kidneys.285

Cancer Research

Research in cancer involves trying to understand why and how cells become cancerous286 for the purposes of prevention of cancer as well as for the purposes of increasing the lifespan of cells. The sheer volume of cancer research makes it impossible to review it in any detail. However it should be noted that scientists have already used gene therapy to successfully treat certain cancers in humans.287 Additional research here includes oxidation and resistance to oxidative stress which decreases the likelihood of cancer.288

Other studies involve the investigation of "tumour suppressor genes (and their products) which lengthen the proliferative lifespan of human cells. Scientists believe that if they can understand how these regulators exert their effects in cells and interact with other regulator molecules there is a possibility of not only being able to reduce cancer tumours but also be able to increase the "proliferative life span of key cell types in older persons", including cell types that are involved in healing and immune responses.299

3. Nanotechnology290

Research into the use of nanotechnology for the purpose of life extension is flourishing, particularly with respect to "developing new and innovative ways to detect and treat disease."290 In addition to nanoparticle applications in gene therapy, nanotechnology is also being explored to:

- target "delivery of drugs in a cell/tissue-specific manner",293
- develop surfactants, polymers and biopolymers for use at the fluid-fluid and fluid-solid interface with possible therapeutic application in treating common lung diseases such as asthma and emphysema,294
- improve interactions between implant materials and bone. Applications here would include prosthetic dentistry, treatment of bone cysts, tumours, skeletal deformities and improving implant load bearing,295
- create nano-membranes to encapsulate cells to improve transplantation success and to decrease formation of blood clots for example;296
- develop systems for enhancing and guiding nerve regeneration with the end goal of incorporating these means into a device which can be used clinically in vivo;297
- develop new techniques to improve molecular imaging for identifying disease, disorder and defect.298

Nanotechnology is also being used in the development of nanomaterials in medical devices. It has already been demonstrated that microbial cellulose nanofibers can be used in vascular prosthetic devices such as replacement arteries.299

4. Robotic & Digitalization

Also referred to as "bionics" in the popular media, the main focus area of robotic technology research as it pertains to life extension, is that of neuroprosthetics. Neuroprosthetics involves replacing damaged or lost body parts with bioelectronic
devices that connect to nerves. Breakthroughs here include: development of a full prosthetic arm that requires minimal mental effort to control; implanted microelectrodes around the eye to give functional vision to the blind; cochlear implants to give functional hearing to the deaf; and the use of nanotechnology to engineer bionic skin in order to give temperature and touch sensitivity to artificial limbs.

Perhaps the most fantastic conception of extreme life extension is the dream of “digitalization”. Digitalization involves mind reading either through detailed mapping of the structure of the human brain (through scanning and reconstruction) or through functional personality capture (involving connecting personal meaning to data). The mind is then temporarily “cached” and transferred to a new cloned brain or other form of less vulnerable information system. The ultimate vision here is “identity diffusion”. A person’s lifetime is extended by connecting it to the durability of machine, wirelessly linking the personality to specialized robots designed to perform different activities, such as swimming or flying. One step further is the connecting of the personality to a cybergrid in order to achieve dynamic distribution across the information network, with the potential of becoming “ubiquitous.”

While these visions are far from being realized any time in the near future, it does implicate the incorporation of Artificial Intelligence (“AI”) to supplement human intelligence as opposed to supplanting it. Indeed, research in brain-computer interfaces is advancing. The first brain prosthetic to be developed was the artificial hippocampus, an area of the brain that is essential for learning and memory. Beyond simply stimulating the brain like a cochlear implant, for example, the neural-silicon chip is designed to perform the same processes carried on by that part of the brain. Clinical testing on humans is anticipated to take place in 2010. In 2003, Sony took out a patent on a theoretical technology which uses an ultrasonic system to stimulate parts of the brain to induce touch, taste and smell. This year Hitachi announced that it has developed a brain-machine interface which uses brain signals to operate a remote control to do various activities.

5. Cryonics

Cryonics technology involves freezing the head or the entire body of a person for the purposes of later resuscitation when the cure or technology to address their cause of death becomes available along with the means of resuscitation. Currently in the United States, there are at least 180 “patients” housed at cryonics facilities in Michigan and Arizona. While these numbers are still fairly low, recourse to cryopreservation has been steadily increasing over the years.

Legally, a person must be dead before undergoing cryopreservation and thus procedures must occur soon after the person’s death in order to limit cellular damage including the brain. Procedures include restoring bloodflow and oxygen supply to the body after the heart stops, intravenous infusion of protective medications, cooling, replacement of blood with preservation solution, perfusion of solution to prevent ice crystals and final cooling. In order to better facilitate the process, cryonic companies offer hospice care near their facilities or may send out teams to patients in remote locations.

iii. Levels or Degrees of Entanglement

Low-Level Entanglement

The traditional approaches of physical activity, CR, nutritional supplementation including antioxidants and zinc and possibly HRTs, all represent examples of treatments of moderate complexity which can be easily commenced or halted. Implementation of these therapies is not likely to significantly interfere with the normal aging process, except insofar as to increase healthspan within the range of the maximum human lifespan. These therapies thus implicate the longer-health scenario possibly accompanied by a shortened decline or compressed morbidity. The modest impact on overall longevity should also theoretically correlate to a minimal impact on the dying process as we currently experience it; age-related pathologies will just be reduced in number or shortened in duration.

On the other hand, it can also be observed that as a result of the therapy, some individuals will develop unforeseen late-life pathologies (such as cancer) either because the intervention is still largely experimental (as is the case of HRT or CR) or because of the individual’s own specific metabolic or genetic makeup. Under the pluralist view of technology, unforeseen outcomes are not to be only perceived as “side-effects”, because that diverts attention away from the “different ways in which a specific technological design can entangle itself with human interaction.” Thus, unforeseen outcomes from these therapies potentially provoke the need for additional medical treatments and decision-making. Over time though, the level of entanglement should decline as the particular therapies are disseminated, assimilated and further refined, possibly with regard to the genome and in the form of more personalized treatment. During the lag time for therapeutic/clinical translation however (as is the case with many novel medical treatments), it is likely that there will be at least some increase in pathology or substitution of pathology,
possibly resulting in an increase of time spent in illness or disability.

On balance, these therapies appear to offer the lowest potential degree of technological entanglement, given that they are not particularly complex or embedded and project the least amount of impact on the aging process or control over the dying process.

High-Level Entanglement

Currently, gene therapy and other genetic interventions appear to portend the highest degree of technological entanglement for a number of reasons. The first and most obvious reason is the fact that research in this area is incredibly complex and still very much experimental with a wider range of unstable outcomes. Genetic interference has the potential to trigger numerous unforeseen "side effects", many of them negative, ranging from adverse immune responses, to metabolic or physiological damage and cancers. Furthermore, despite awareness in the biomedical/scientific community at large that epigenetic interventions are being called for to improve chances of actually obtaining a successful outcome, clinical trials have been going ahead to a greater or lesser extent.

A second reason is that genetic-based therapies become more significantly embedded in the individual and therefore carry with them a greater likelihood for ongoing medical interactions or positive intervention. For example, research seeking to modulate (decelerate or arrest) the aging process is well underway. Much, though not all, of this research involves the search for a genetic basis for the aging process, whether in the form of complex genetic interactions or in the form of a longevity gene. There are at least two possibilities for treatment approaches that could slow/reverse the aging process to keep the individual biologically young or that could significantly extend overall lifespan. The first, and the more likely, will involve periodic repeat therapies; the second and less likely, will involve a "one-off" genetic intervention that bestows upon the individual the ability to live significantly longer.

In the first case, a longer-health scenario with a lesser degree of permanent control over the aging and dying processes at first appears to be implicated. Should a person wish to die for whatever reason, they have the options of withdrawal or withholding treatment in order to prompt the natural senescence process (or some form of it) to resume. As discussed in Part II, the law is generally comfortable with these options regardless of patient outcome. However, depending on the impact of the withheld/withdrawn treatment on the senescence process, any of compressed morbidity, longer-decline, or longer-dying could possibly ensue, thus in turn prompting additional responses from the individual, including the possibility of request for assisted suicide, should longer-dying be the result. Furthermore, if the treatment involved a more enduring genetic alteration, additional genetic therapy might be required to restore the original genetic state thereby setting off another chain of entanglement. In that case, perhaps an intervention in the form of assisted death would be considered preferable, arguably being a less complex substitution for the original ability to undergo a dying process.

The second situation demonstrates potential for the highest degree of interference with the aging process because it is permanently embedded in the individual. As described immediately above, enduring genetic alteration cannot be easily withdrawn, prompting the need for alternative legal solutions with more predictable medical outcomes, should a request to halt treatment be made. As described by Capron,

...many of the most powerful methods that may be found to extend life—particularly those that involve genetic manipulation—cannot be halted because they are incorporated into the body. Thus patients offered such treatments may be loathe to accept them unless they can be assured that should the result prove unacceptable they will be able to get free of their situation. ...the only way to provide the relevant assurance would be to allow active termination of life, either through assisted suicide or euthanasia.

This observation illuminates the idea that user attachment to the technology will be low, unless the loss of control that comes with its implementation can be regained. Clearly, the law on assisted death has not yet contemplated this possibility. Interestingly, Capron’s observation serves as an illustration of a further concern that arises out of an awareness of the normative impacts and plurality of technology—that in one way or another, the law becomes embedded in it.

Mid-Level Entanglement

Between the two extremes of low/high-level entanglement, lie the other potential life extending approaches of cell-based regeneration, tissue engineering and robotics. All of these technologies aim to regenerate, repair or replace parts of the body as it ages, becomes worn out or is injured through disease or accident. Because medical practice has already been carrying out medical transplants for many years, the novelty factor for these therapies starts out slightly lower and increases dependent on the specific therapy implemented. These therapies appear to coincide with the longer-decline picture advanced by Capron and Battrin—interventions likely to occur throughout a life in order to address
varying chronic and acute conditions. They also hold the potential to increase the overall healthspan and possibly also achieve *compressed morbidity*.

Accordingly, these treatments should have little negative impact on the aging process or the normal dying process, unless, as noted by Capron, piecemeal implementation inadvertently culminates in the *longer-dying* scenario, or stimulates undesirable, unforeseen side-effects/entanglements. Additionally, if the regenerative treatment involves, *in situ* genetic manipulation, the level of embeddness increases and shifts the entanglement to the higher level of the mid-range. As discussed, genetic interventions increase the possibility of requiring further positive interventions to cease treatment.

**D. POTENTIAL IMPACTS ON DEATH AND DYING**

To summarize, life extension/antiaging treatments that suggest low-level entanglement, should not impact too significantly on the death and the dying process as we currently experience it. Treatment can be withheld or withdrawn in a technically straightforward manner and the law is currently positioned to accept those particular actions, even if such actions result in the individual's physical decline and death.

Life extension/antiaging treatments that impose a high level of entanglement are those that are more significantly embedded in the individual and thus exert a greater degree of control over natural aging and dying processes. Therapies that fall into this category involve complex genetic-based therapies which have the potential for numerous unforeseen consequences and are difficult to withdraw. Therapies included here also have as their aim, decelerated or arrested aging with significant increases to life-span. In these scenarios, interference with the natural aging process is significant and positive interventions to permit the decline or death of the individual are implicated thus triggering increased potential for conflicts in dying.

Life extension/antiaging treatments aimed at reducing age-related pathologies as opposed to altering the aging process itself suggest mid-level entanglement. Increase in healthspan will likely be achieved but in exchange for experiencing an overall *longer-decline* with the added possible risk of inducing *longer-dying* due to piecemeal therapeutic applications.

Therefore, under current research objectives and trajectories, it can be observed that life extension/antiaging technology has the potential to broaden the circumstances where assisted suicide or euthanasia will be requested as a result of *inter alia*:

- increased debility and suffering during experimental phases caused by increase or substitution of pathology;
- increased debility and suffering as clinical treatments are developed in the absence of epigenetics;
- longer debility, suffering and dying as a result of piecemeal interventions;
- interventions that cannot be stopped by simple withdrawal or withholding of treatment; and
- increases in longevity that provoke the "tired" or "weary of life" state.

As discussed in Part II, Canadian law currently only permits assisted death in the form of withdrawal or withholding of treatment. This is clearly not sufficient to address the impending impacts of life extension/antiaging therapies, particularly those that suggest mid/high-level entanglements. While suicide without assistance remains an option, it hardly seems appropriate for government to allow the advance of medical treatments that could create circumstances where unsanctioned suicide was the only way to cease treatment. Even an incremental change to Canadian assisted suicide law to address the plight of individuals suffering from a terminal illness, arguably the central Canadian debate, would not be sufficient. As alluded to above, life extension/antiaging interventions are poised to create situations of increased suffering or debility (physical, emotional, mental or existential) in the absence of a terminal illness *per se*. Thus, at minimum, Canadian law will be challenged to consider what options ought to be available to address assisted suicide for incurable but non-terminal conditions. As discussed earlier, consideration and implementation of this option is already taking place in other jurisdictions.

Furthermore, international trends are also demonstrating the emergence of the principle of autonomy as the most straightforward way to address the difficulty in assessing the level of suffering required to justify assisted death. Autonomy has been asserted to the extent that it is the foundation for arguments to permit assisted suicide or euthanasia for being "tired" or "weary" of life. Regardless of whether the principle of autonomy will also eventually become the preferred Canadian solution, a further observation can be drawn from these events. Clearly, some long-lived individuals have already experienced a life that is long enough, providing direct evidence that "what makes life worth living" is a critical corollary to the development of life extension/antiaging treatments. Additionally, it should also be noted that public and private promotion of life extension/antiaging therapies could increase demand for assisted death in the elderly because of its negative
impact on self-worth through the "pathologizing" of aging.  

Overall, reflecting back to the law on assisted death covered in Part II of this article, one might make the general observation that the law, as it currently stands, very much pivots around conceptions of suffering, equality and autonomy arising out of rudimentary factual paradigms with which we as a global society still have not come to terms. Because of technological advances and objectives of life extension/antiaging research, these factual paradigms are set to explode open, with very little substantive law in place to assist.

IV. CONCLUSION

Science imitates Art. Life imitates Science.
Law imitates Life ... ?

MJS

There is no question that the above assessment is largely speculative but, speculation is necessary given that most of the life extension/antiaging therapies described are still very much at the research and development phase. This should not however render the above exploratory exercise a waste of time or dissuade others from doing the same. Indeed, scientific breakthroughs often come as a surprise. Take the "focusing event" of Dolly the Sheep, for example, which left law- and policymakers scrambling, ex-post facto, to address moral concerns and risk allocation. The reality is that "enabling technologies are being diffused as we speak, preparing a technological infrastructure which will change the way we live" and, quite frankly, the way we die. Once in play, it will not be possible to simply "undo" many of these therapies, even if they result in undesired effects. Thus, if one accepts that scientific developments can be targeted or designed to generate specific consequences, or indeed a range of acceptable consequences, then, one can see that a "speculative assessment is a precondition for informed decisions about the introduction and design of emerging technologies."  

The critical and speculative voice on life extension and antiaging research is emerging from many different disciplines including philosophy, ethics, economics, medicine and the social sciences. Numerous reasons are cited for why such research is not a beneficial or appropriate pursuit. A dystopian future is predicted where such technology is only available to the wealthy few, where the non-productive elderly make up a disproportionate amount of the population, and where there is an increasing burden on the young to carry the old and so forth. It is somewhat difficult to buy into these visions because they hinge on technological advances that have not yet reached, and may never reach, clinical application. However, to ignore this emergent dialogue would be to overlook the very essence of technology that provides us with the greatest opportunity for achieving the best possible outcomes — its ability to shape society.

Without doubt, science is intensively pursuing life extension and antiaging therapies and these therapies, as discussed, will impact our aging and dying experiences, in turn transforming the society in which we live. Exactly how, one cannot say for certain, because future outcomes are the product of a dynamic human-technological interaction or entanglement. The greater the entanglement, the more significant the impact and the less predictable the outcome. However, technology can be designed and directed to optimize the beneficial and minimize the detrimental. Although developers will rarely be able to achieve a closed system that provides the perfect "dividend", the chances of doing so can be improved by taking a systemic approach, one that "integrates across multiple scales of structures and organizations."  

In other words, in order to improve the chances that life extension research will generate the best vision of a healthful society, it must be developed not only in reference to its interactions but also the environment within which it operates. The law with respect to assisted death is a significant part of that environment and vice versa.

In Canada, the regulation of assisted death exists primarily in the form of a prohibition, with certain limited exceptions. Concurrently, scientific developments are proceeding with the aim of extending life in a number of different ways that could very well increase the incidences of conflict in dying and the desire for death. The impact of these advances is also likely to intensify because of the expanding aging population in Canada and around the world. The law is not well-positioned to address these conflicts. The only legal principle currently available that has the requisite scope is the principle of autonomy, which, as discussed, is being used to justify assisted death, even in the absence of physical illness or suffering. If law and policymakers do not become engaged in the technological pursuit of life extension, a very simplistic, piecemeal "protocol for death" will be forged in response to antiaging advances as they are unrolled. On the other hand, if law and policy is engaged at the earlier stages of development, then there is better chance that we can get closer to that "dividend" — maximizing benefits, minimizing detriments and shaping the healthful society so desired. Although some form of protocol will no doubt be necessary to address the increasing control over the natural dying process that antiaging advances are likely to have, it can be developed in light of desired social
policy objectives and play a role in the direction of technology. Law does not have to “imitate” life.

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2. Criminal Code of Canada, R.S.C. 1985, c. C-46, s. 241(b) [Criminal Code].


6. See Wake Forest University Institute for Regenerative Medicine, online: <http://www.wfirma.com/AboutUs/ >.

7. See A-Cell: Healing through Regenerative Medicine, online: <http://www.acell.com/> for data and video documentation.


12. See Wake Forest University Institute for Regenerative Medicine, supra note 6.

Resveratrol, supra note 11.

In the case of the competent adult, see for example, Nancy B. v. Hôtel-Dieu de Québec, [1992] J.Q. No 1, 86 D.L.R. (4th) 385 (QC S.C.) [Nancy B.]. In the case of a mature minor see the trilogy of cases which seem to suggest a mature minor rule, but also see the more recent case of A.C. v. Manitoba (Director of Child and Family Services), 2009 SCC 30, [2009] 2 S.C.R. 181 [A.C.]. See also discussion in Jocelyn Downie, Dying Justice: A Case for Decriminalizing Euthanasia and Assisted Suicide in Canada (Toronto: University of Toronto Press, 2004); Also see discussion in Barney Snederman, John C. Irvine & Philip H. Osborne, Canadian Medical Law: An Introduction for Physicians, Nurses and Other Health Care Professionals (Scarborough, ON: Carswell, 2003).

Maximum human lifespan defined as the maximum observed lifespan is believed to be around 125 years. The world’s oldest living person recorded was Jeanne Calment who lived to be 122.5 years old. See Byung Mook Weon & Jung Ho Je, “Theoretical estimation of maximum human lifespan” (2009) 10 Biogerontology 65 (Springerlink), online: <http://www.springerlink.com/content/67v64908434v072t/fulltext.pdf>; On the other hand, the average human life expectancy in Canada is currently estimated at 80.7 years old. See Statistics Canada, Deaths (23 February 2010), online: The Daily <http://www.statcan.gc.ca/daily-quodien/1002233/dq1002233a-eng.htm>.


The term “assisted death” is used in this article in its broadest sense to include both “assisted suicide” (an act of intentionally killing oneself with the assistance of another) and “euthanasia” (compassionate killing by intentional and direct act of commission). In some jurisdictions, as is the case with Canada, the terms “assisted suicide” and “euthanasia” maintain distinct technical meanings and are treated differently by the criminal law. In other jurisdictions, such as the Netherlands, the distinction is not maintained. Accordingly, attention to this distinction is maintained where appropriate.


Suicide as a crime was removed from the criminal code in 1972. Snederman, Irvine & Osborne, supra note 15 at 416.

Criminal Code, supra note 2, s. 241. This section reads: “Every one who (a) counsels a person to commit suicide, or (b) aids or abets a person to commit suicide, whether suicide ensues or not, is guilty of an indictable offence and liable to imprison for a term not exceeding fourteen years.”.

Euthanasia is also sometimes referred to as “active euthanasia”. For further discussion on terminology see Downie, supra note 15 at 5-6.

Criminal Code, supra note 2, s. 745: Consent to death is not a defence to a murder charge because under s. 14 of the Criminal Code, persons are not entitled to consent to having death inflicted upon them. Additional provisions in the Criminal Code that may also be relevant include: s. 45 (Surgical operations); s. 215 (Duty of persons to provide necessities of life); s. 216 (Duty of person undertaking acts dangerous to life); s. 217 (Duty of persons undertaking acts); s. 219 (Duty of person under threat of life); s. 220 (Duty of person under threat of serious bodily harm); s. 221 (Duty of person under threat of serious bodily harm); s. 222 (Duty of person under threat of serious bodily harm); s. 229 (Manslaughter); s. 231 (Classification of murder); s. 234 (Manslaughter); s. 245 (Administering poison or other destructive or noxious thing); and various assault and harm to the person provisions.

See for example, Canada, Special Senate Committee on Euthanasia and Assisted Suicide, Of Life and Death (1st Sess., 35th Parl., 1995), online: <http://www.parl.gc.ca/35/1/parlbus/commbus/senate /Com-e/euth-e/rep-e/LAD-TC-
tubes into their stomach for feeding and tracheotomy tubes for breathing. Eventually, breathing machines or respirators are required. There is no cure for this disease. The average duration of life is about three years from the onset of the disease.” Rodríguez v. British Columbia (Attorney General), [1993] B.C.J. No. 461, [1993] 3 W.W.R. 553 (B.C.C.A.) at paras. 4-7, McEachern J.J.B.C., dissenting.

“This consensus finds legal expression in our legal system which prohibits capital punishment. This prohibition is supported, in part, on the basis that allowing the state to kill will cheapen the value of human life and thus the state will serve in a sense as a role model for individuals in society. The prohibition against assisted suicide serves a similar purpose. In upholding the respect for life, it may discourage those who consider that life is unbearable at a particular moment, or who perceive themselves to be a burden upon others, from committing suicide. To permit a physician to lawfully participate in taking life would send a signal that there are circumstances in which the state approves of suicide.” Rodríguez, supra note 3 at para. 174.

In my view, the existing provisions in the Criminal Code go a considerable distance to meeting the concerns of lack of consent and improperly obtained consent. … These provisions may be supplemented, by way of a remedy on this appeal, by a further stipulation requiring court orders to permit the assistance of suicide in a particular case. The judge must be satisfied that the consent is freely given with a full appreciation of all the circumstances. This will ensure that only those who truly desire to bring their lives to an end obtain assistance.” Ibid., at paras. 221-222.

Nancy B., supra note 15.

This particular hierarchy is also reflected in the Canadian legal resolution of the debate over abortion and other maternal/fetal conflicts. See for example Winnipeg Child and Family Services (Northwest Area) v. G.D.F., [1997] S.C.J. No. 96, [1997] 3 S.C.R. 925; See also discussion in Edward Keyserlingk, “Fetal Surgery: Establishing the Boundaries of the Unborn Child’s Right to Prenatal Care” in Carl Nimrod and Glenn Griener G. eds., Biomedical Ethics and Fetal Therapy (Waterloo, Ont.: Wilfred Laurier University Press, 1989) at 81; See also Proceed with Care: Final Report of the Royal Commission on New Reproductive Technologies, vol. 2 (Ottawa: Canadian Government Publishing for the Commission on New Reproductive Technologies, 1993) at 957-958; For further additional examples of limits on “life” as a value, see Downie, supra note 15 at Chapter 6.

ALS is a disease of the motor neurons of the brain and spinal cord. Motor neurons are nerve cells which control the different muscles which operate our bodies. In ALS, these nerve cells die in an inexorably progressive fashion. … There is quick and extensive wasting of the muscles of the head, neck and throat which leads to increasing difficulties with speech, chewing and swallowing. The muscles used in breathing also become weak which leads to difficulty in coughing and clearing secretions. … Terminally, these patients are likely to be completely paralyzed in all of their limbs, and they become unable to support even the weight of their head. … Often, they require

I am restricting this discussion largely to adults, because the "mature minor" doctrine has its own particular and peculiar considerations outside the scope of this discussion. For further discussion on the mature minor principle see A.C., supra note 15 at 44, where the Supreme Court has ruled that Children under age 16, if deemed capable of "mature, independent" judgment about their health, may make life-and-death decisions about their medical treatment.

An advance directive, sometimes also described as a living will (although advance directive is technically broader), is a document in which a mentally competent person anticipates decisions regarding refusal or withdrawal of treatment including rejection of life support in the event of future incompetency. An advance directive focuses on treatment preferences generally and can also include requests as well as refusals of treatment. See Sneiderman, Irvine & Osborne, supra note 15 at 504.


“Double effect, traced historically to Thomas Aquinas, proposes that under certain circumstances, it is permissible unintentionally to cause foreseen ‘evil’ effects that would not be permissible to cause intentionally.” Edward C. Lyons, “In Incognito: The Principle of Double Effect in American Constitutional Law” (2005) 57:3 Florida Law Review 471.

Rodriguez, supra note 3 at 607, per Justice Sopinka: “The administration of drugs designed for pain control in dosages which the physician knows will hasten death constitutes active contribution to death by any standard. However, the distinction drawn here is one based upon intention ... in any case of palliative care the intention is to ease pain, which has the effect of hastening death ... In my view, distinctions based upon intent are important, and in fact, form the bases of our criminal law. While factually the distinction may, at times, be difficult to draw, legally it is clear.”; See also Law Reform Commission of Canada. Euthanasia, aiding suicide and cessation of treatment. Working Paper 28. (Ottawa, Ont: Law Reform Commission of Canada, 1982); See also discussion in Sneiderman, Irvine & Osborne, supra note 15 at 549 and discussion in Downie, supra note 15 at 30-32. Downie describes that although the provision of potentially life-shortening treatment will not fall afoul of the law when it does not demonstrate wanton and reckless disregard for life, it is nonetheless being conducted under “the shadow of possible criminal liability”.

Suicide prevention is still very much an objective of Canadian government. See for example, Health Canada, Suicide Prevention, online: <http://www.hc-sc.gc.ca/hlvs/lhy-svs/diseases-maladies/suicide-eng.php>.

See discussion in Tiedemann & Valiquet, supra note 4. See case of Evelyn Martens who was acquitted by a jury in a British Columbia Supreme Court in 2002, R. v. Martens, [2004] B.C.J. No. 2300, 2004 BCSC 1450; see also the case of Stephan Dufour, the first Canadian to stand trial by jury for assisted suicide was acquitted December 12, 2008 (unreported decision). Dufour admitted to installing a chain, rope and dog collar into a closet which was used by his uncle to kill himself.


See R. v. Ramesh Kumar Sharma (unreported decision) who prescribed a lethal amount of prescription drugs to a 93-year-old woman.

See the case of Eric MacDonald who accompanied his wife in traveling to Switzerland where she died with the assistance of Dignitas, an assisted suicide organization. The RCMP did not lay any charges stating, “There was no one that actively participated in getting her to the clinic in Switzerland or were instrumental in orchestrating that whole thing ... It would appear that this was done through her insistence and primarily through her own wishes.” See “No charges in assisted suicide case” CBC News (3 July 2007), online: CBC News <http://www.cbc.ca/canada/novascotia/story/2007/07/03/crpc-macdonald.html>; See also Douglas Todd, “Death with dignity ... and deceit” Winnipeg Free Press (20 February 2010), online: Winnipeg Free Press <http://www.winnipegfreepress.com/breakingnews/death-with-dignity-and-deceit-84838012.html>.

See endnote 27; See also discussion on Downie, supra note 15 at 3-6; See also Sneiderman, Irvine & Osborne, supra note 15 at 558-561.

See Tiedemann & Valiquet, supra note 4 at 5.

See Morrison, supra note 27.

See Maaya, supra note 27; See also the case of R. v. de la Rocha, supra note 27.

See for example the case of R. v. Bergeron, [2006] J.Q. no 11329, 2006 QCQ 10156, [2006] R.J.Q. 3000. Mr. Bergeron attempted to kill his wife who was suffering from Friedreich’s ataxia, a progressive nervous system disease. Bergeron placed magnets on his wife’s pacemaker and increased the dosage of her medication. The wife died four days later in the hospital.

See Brush, supra note 27.

See Latimer, supra note 26.


The Criminal Code, *supra* note 2, has not been amended despite the tabling of legislation in Parliament on a number of occasions since the Rodriguez case, *supra* note 3.


61 "Of Life and Death", *supra* note 24.


63 See for example, minority position in “Of Life and Death”, *supra* note 24; a recent Angus Reid poll shows that 2/3rds of the 1,003 Canadians polled, support Euthanasia with most support coming from British Columbia and Quebec. Angus Reid, “Two-Thirds of Canadians Express Support for Legalizing Euthanasia” (15 February 2010), online: <http://www.visioncritical.com/wp-content/uploads/2010/02/2010.02.15_Euthanasia_CAN.pdf>.

64 McLachlin J. (as she then was) dissenting in Rodriguez, *supra* note 3 at 624; Downie, *supra* note 15 at Ch. 8.


68 Kerr and Wishart, *ibid*, at para. 38.


70 “The decision(s) to allocate significant funding and research expertise within Canada’s health research agenda to R&D that focuses so heavily on radical biotechnological interventions and enhancements risks a certain kind of ought-ism: namely, that anything which can be ‘fixed’ through the discoveries of these research programs ought to be ‘fixed’.” Kerr & Wishart, *supra* note 68 at para. 35; “Concerns about the potential disabilities associated with biological aging drive life extension research. The aged may also fear the social stigma that is increasingly placed on them. Over-emphasis on youth and the lack of meaningful occupation for elderly women and men lead to psychological difficulties.” Jennifer Marshall, “Life Extension Research: An Analysis of Contemporary Biological Theories and Ethical Issues” (2006) 9 Medicine, Health Care and Philosophy 87 at 94; See


Recent polls show that there is no clear consensus on euthanasia in the United States and doctors are against it by a margin of approximately two to one. Angus Reid, "Americans Split on Legalizing Euthanasia" (11 February 2010), online: <http://www.angus-reid.com/polls/view/35037/americans_split_on_legalizing_euthanasia>; Talha Burki, "European Laws on Assisted Suicide Move in Opposite Directions" (2009) 10:5 The Lancet 447.

The Oregon Death with Dignity Act, O.R.S. Chapter 127, §127.800; and The Washington Death with Dignity Act, Chapter 70.245 RCW; See also Gonzales v. Oregon (formerly Oregon v. Ashcroft), 368 F.3d 1118 (9th Cir. 2004), cert. granted, 125 S. Ct. 1299 (2005) where the U.S. Supreme Court held that the Controlled Substances Act could not be used against physicians who had prescribed drugs to the terminally ill for assisted suicide purposes as lawfully permitted under Oregon law.

Ibid.

The Oregon Death with Dignity Act §127.865; Washington Death with Dignity Acts, §70.245.150.


Ibid. at 2029; Cruzan v. Director, Missouri Department of Health, 497 US 261, 110 S Ct 2841 (1990). See also seminal cases: In re Quinlan, 755 A2A 647 (NJ), cert denied, 429 70 N.J. 10, 355 A2d 647 (1976); Barber v. Superior Court, 147 Cal App 3d 1006. See also Washington v. Glucksberg, supra note 74; and Vacco v. Quill, supra note 74.

For further discussion, see Luce & Alpers, supra note 86 at 2029-2030.


Tiedeman & Valiquet, supra note 4.

Swiss Penal Code (SR 311.0), 21 December 1937, in force since 1 January 1942; the section on homicide was amended by Federal Law of 23 June 1989, in force since 1 January 1990 Article 114; For further discussion see Tiedeman & Valiquet, supra note 4 at 16.


DIGNITAS, online:


There are five right-to-die societies in Switzerland: Dignitas, EXIT Deutsche Schweiz, EXIT ADMID Suisse romande, Ex-International and SuizilHilfe. Elke M. Baezner-Sailer, supra note 89.


Swiss Academy of Medical Sciences, Medical-Ethical Guidelines for the Medical Care of Dying Persons and Severely Brain-Damaged Patients (Basel: SAMS, 1995).
sarily having to obtain the agreement of a parent or guardian. Children 12–16 years old can also request and receive euthanasia although the parent or guardian must also be in agreement.


Tiedeman & Valiquet, supra note 4.


who is "hopelessly ill" which included "illness" that (b) that seriously and irreversibly impairs the person's quality of life so that life has become intolerable to that person." See also the case of retired professor, Lisette Nigot who was featured in a documentary, "Machineries and the Doctor" addressing assisted suicide in Australia. In a note left to Dr. Nitschke, a right-to-die activist based in Australia and known for his do-it-yourself euthanasia workshops, Professor Nigot thanked him for his support, stating "A full 80 years of a good life. I have [had] enough of it. I want to stop it before it gets bad". Physician-assisted-sucide and euthanasia was for a brief time legal in the Northern Territory under the Rights of the Terminally Ill Act 1993 (NT). The Act was overturned in 1997 by the National Parliament under its plenary power to pass legislation for the territory. Four people had used the act prior to its being overruled. In February 2007, The Australian Territories Rights of the Terminally Ill Bill 2007 was introduced into the Commonwealth Parliament but did not pass second reading. In June 2008, The Medical Treatment (Physician-Assisted Dying) Bill 2008, was introduced into the Parliament of the State of Victoria. The bill was defeated in Legislative Council on 10 September 2008.

116 Loi relative à l'euthanasie. F. 2002-2141 [C-2002/0950].


118 Ibid. at 79.


122 Suicide Act, 1961 (U.K.), 9 & 10 Eliz 2 c.60 at s. 2(1): "A person who aids, abets, counsels or procures the suicide of another, or an attempt by another to commit suicide, shall be liable on conviction on indictment to imprisonment for a term not exceeding fourteen years."; In 2004, Lord Joffe introduced the Assisted Dying for the Terminally Ill Bill which allowed both physician-assisted suicide and euthanasia. After a Committee Report was released on the Bill, it was determined that there was insufficient time to proceed with the Bill in that session. Lord Joffe introduced a second bill in 2006, but was subsequently defeated; Karen Dyer, "Raising Our Heads above the Parapet? Societal attitudes to assisted suicide and consideration of the need for law reform in England and Wales" (2009) 21 The Denning Law Journal 27 at 29.


128 Ibid.

129 R. (Pretty) v Director of Public Prosecutions (Secretary of State for the Home Department Intervening) [2001] UKHL 61, [2002] 1 A.C. 800. Mrs. Pretty argued that the assisted suicide prohibition infringed her rights under Articles 2, 3, 8, 9, and 14 of the European Convention for the Protection of Human Rights and Fundamental Freedoms.


131 1. Everyone's right to life shall be protected by law. No one shall be deprived of his life intentionally save in the execution of a sentence of a court following his conviction of a crime for which this penalty is provided by law.

132 Pretty v. United Kingdom, supra note 127 at para 65. R. (on the application of Purdy) v. DPP, [2009] UKHL 45 [Purdy]. Debbie Purdy's claim involved the prohibition against assisted suicide under s. 2 of the Suicide Act, 1961 (U.K.), 9 & 10 Eliz 2, c. 60 at s. 2(1). Prosecution under this section can only take place at the discretion of the Director of Public Prosecutions. See Purdy at para. 102.

133 The House of Lords agreed that the lack of clarity in the law regarding how the Director of Public Prosecution determines whether or not to prosecute in this situation is a breach of rights under Article 8 of the European Code of Human Rights.

134 Purdy, supra note 132.


136 U.K., The Crown Prosecution Service, Policy for Prosecutors in Respect of Cases of Encouraging or Assisting Suicide (The Director of Public Prosecutions, February 2010), online.


See for example, screening of a documentary showing the assisted suicide of American Craig Ewert in Switzerland on SkyTV. Thomas Moore, “Death was his Logical Choice” SkyTV (10 December 2008), online: <http://news.sky.com/skynews/Home/UK-News/Sky-Real-Lives-Shows-Craig-Ewert-Suicide-Death-On-Day-Daniel-James-Assisted-Suicide-Inquest-Opens/Article/20081225176021>; See recent case of Bridget Gilderdale who was found not guilty by a jury for attempted murder for trying to give her daughter an air embolism in order to end her life. The daughter had died of a morphine overdose, the morphine of which was also provided by Ms. Gilderdale. Ms. Gilderdale pled guilty to aiding and abetting suicide and was given a 12-month conditional discharge: “Mother cleared of ME daughter’s attempted murder” BBC News (25 January 2010), online: BBC News <http://news.bbc.co.uk/2/hi/uk_news/england/sussex/8479211.stm>; also recent Daniel James case, supra note 92. Angus Reid, Polls and Research, “Seven-in-Ten Britons Want Legal Euthanasia” (3 February 2010), online: <http://www.angus-reid.com/polls/view/34986/seven_in_ten_britons_want_legal_euthanasia>.

British Medical Association, “Chapter 11 — Euthanasia and physician assisted suicide” in Medical Ethics Today (2nd Edition) Update 2009, online: <http://www.bma.org.uk/images/metupdate2009/chapter11_tcm41-188894.pdf>; See also British Medical Association, “BMA comment on Director of Public Prosecutions’ final guidance on assisted dying”, (1 March 2010) online,


Maurice Chittenden, “Martin Amis calls for euthanasia booths on street corners” The Sydney Times (24 January 2010), online: The Sydney Times <http://www.timesonline.co.uk/tol/life_and_style/health/article6999873.ece>.


That is, increasing the vulnerability of those who are already vulnerable and undermining the care of dying patients. R. A. Burt, “The Supreme Court Speaks — Not Assisted Suicide but a Constitutional Right to Palliative Care” (1997) 337:17 New Eng. J. Med. 1234.

Burki, supra note 75 at 447.

See supra note 100 and accompanying text.


See supra note 100 and accompanying text.

Ibid.

See also list of “last resorts” was developed in 1997 by Timothy E. Quill of the Hastings Center based on the “doctrine of double effect, the active/passive distinction, patient voluntariness, proportionality between risks and benefits, and the physician’s potential conflict of duties”. T.E. Quill, B. Lo & D.W. Brock, “Palliative Options of Last Resort: A Comparison of Voluntary Stopping Eating and Drinking, Terminal Sedation, Physician-Assisted Suicide, and Voluntary Active Euthanasia” (1997) 278 Journal of the American Medical Association 1099; See also his more recent work Timothy E. Quill, “Physician-Assisted Death in the United States: Are the Existing “Last Resorts” Enough?” (2008) 38:5 The Hastings Center Report 17.

Jungst, Binstock, Mehlman, Post & Whitehouse, supra note 71 at 21; Biogerontology has also been described as the scientific study of slowing, preventing and reversing the aging process. See Richard A. Settersten Jr., Michael A. Flatt & Roselle Ponsaran, “From the Lab to the Front Line: How Individual Biogerontologists Navigate their Contested Field” (2008) 22:4 Journal of Aging Studies 304.
An immoralist is one who challenges the notion of human mortality. Similar to immortalist is a transhumanist who is committed to the idea that technology should be used to alter the human condition. A “transhuman” equates to a “transitional human” who is somewhere between humans and “posthumans”, which includes “future beings whose basic capacities so radically exceed those of present humans as to be no longer ambiguously human by our current standards.” Kerr & Wishart, supra note 68 at para 9.


See Ray Kurzweil, “Making the world a billion times better” Washington Post (13 April 2008); See also Ray Kurzweil, The Singularity is Near: When Humans Transcend Biology (Toronto, Ont.: Penguin Group, 2005).

SENS is defined as “an integrated set of medical techniques designed to restore youthful molecular and cellular structure to aged tissues and organs. Essentially, this involves the application of regenerative medicine to the problem of age-related ill-health.” SENS Foundation, “SENS & SENS Research”, online: SENS & SENS Research <http://www.sens.org/sens-research>.


Supra note 16; See also Carnes, Olshansky & Grahn, supra note 161 at 31; See also Sherin Nuland, “Do You Want to Live Forever?” (2003) 108:2Technology Review 37, online: <http://www.technologyreview.com/Genomics/2003/11/14/47312>.

The terms life extension (LE) and antiaging are used interchangeably throughout this discussion.


Battin, ibid. at 269.

Ibid. at 270.

Ibid.

Capron, supra note 169 at 210.

Ibid. at 272-276.

Director of Ethics, Trade, Human Rights and Health Law at the World Health Organization, Geneva, Switzerland.

Capron, supra note 169 at 210.

Ibid.

Ibid.

Ibid. at 276.
Supra note 16.

Capron, supra note 169 at 211.

Senescence is the positive correlation between age and risk of death per unit time. Aubrey de Grey, "The War on Aging" in Essays on Infinite Lifespans (Libros en red, 2004) at 33 [de Grey].

Juengst, Binstock, Mehman, Post & Whitehouse, supra note 71 at 24.

A scenario, whereby people do not “remain physically and mentally vigorous throughout ... lengthening life spans” and “in which people routinely live to be 150 but spend the last fifty years in a state of childlike dependence on caretakers.” Francis Fukuyama, supra note 166 at 67 and 69.

Capron, supra note 169 at 211.

Juengst, Binstock, Mehman, Post & Whitehouse, supra note 71 at 25; Capron draws an analogy to Oliver Wendell Holmes’ “the wonderful one-hoss show” which ran one hundred years and a day and then fell apart in a single day.” Capron, ibid at 212. The compression of morbidity hypothesis is attributed to J. F. Fries. J.F. Fries, "Aging, natural death, and the compression of morbidity" (1980) 303 N Engl J Med 130.


Hildebrandt, ibid. at 451-453. Hildebrandt’s discussion here refers to the work of Bruno Latour who has also advanced the idea of “scripts”: a technology embodies scripts or a built-in set of prescriptions (intentionally embedded by the developer) that impose certain behaviours on users, inviting (or inhibiting) one choice of action in favour of another, while keeping alternative actions open. Regardless of the embedded script, interactions between technology and the user can often produce unforeseen patterns of use, thus illuminating further scripts that were not intentionally embedded. Thus, the actions of a technology should never be taken for granted. See Hildebrandt, ibid at 453; See also B. Latour, “Nous n’avons jamais été modernes. Essai d’anthropologie symétrique (Paris: La Découverte, 1991) and B. Latour, “La Clef de Berlin et autres leçons d’un amateur de sciences (Paris: La Découverte, 1993).

Hildebrandt, ibid. at 451.

Hildebrandt, ibid. at 453.

Ibid. The term technological entanglement and concept of degrees of technological entanglement are extensions of Mireille Hildebrandt’s work regarding “ambient intelligence” (AI) and the possible end of law as an instrument for “constitutional democracy” unless law is intelligently embedded into a technology. In describing “technological normativity” Hildebrandt explains the non-neutrality of technology, the concept of patterns of use (seen and unforeseen) that arise as a result of human interaction with technology. The idea central to her discussion of AI is the notion of the “different ways in which a specific technological design can entangle itself with human interaction.” Hildebrandt, ibid. at 453.

... human intention does not define the normative impact of a technology, because this will depend on the possible courses of actions that are disclosed by a new technology and the actual way in which users attach themselves with the technology. Hildebrandt, ibid at 453.

Ibid.

Capron, supra note 169 at 210.

Ibid. at 218.

Hayflick, Biological Aging, supra note 17 at 2.


Hayflick, Biological Aging, supra note 17; See also L. Hayflick, “Anarchy in Gerontological Terminology” (2002) 42:2 The Gerontologist at 416-421.


Accordingly to Leonard Hayflick, “Aging is an increase in molecular disorder. It is a stochastic process that occurs systemically after reproductive maturity in animals that reach a fixed size in adulthood. This escalating loss of molecular fidelity ultimately exceeds repair and turnover capacity and increases vulnerability to pathology or age associated diseases.” Hayflick, Biological Aging, supra note 17 at 3-4.


Coping with Methuselah: The Impact of Molecular Biology on Medicine and Society, supra note 169.

The author uses this term broadly to describe therapies that have more conventional acceptance, though not necessarily devoid of controversy.


I.M. Lee & R.S. Paffenbarger, ibid.
and tissue-specific genic and physiologic responses to caloric restriction and altered IGF1 signaling in mitotic and postmitotic tissues" (2007) 27 Am J Nutr. 193 respectively; Another criticism is that calorie restriction in overweight individuals reduces other longevity biomarkers such as fasting insulin level and body temperature. L.K. Heilbronn et al., “Effect of 6-month calorie restriction on biomarkers of longevity, metabolic adaptation, and oxidative stress in overweight individuals: a randomized controlled trial” (2006) 295 JAMA 1539; Barzilai & Bariske, supra note 208.


218 “[T]he only robust finding that a pharmacological antioxidant can extend longevity in an animal model system is the report that EUK-134, a compound with both catalase and superoxide dismutase activities, significantly extends longevity in nematodes.” Butler, supra note 162; High doses of antioxidant supplements may increase DNA damage. Tao-Sheng Li and Eduardo Marbán, “Physiological Levels of Reactive Oxygen Species are Required to Maintain Genomic Stability in Stem Cells”, (2010) 9999-9999 A Stem Cells, online:

(http://www.stemcells.org/view/0/index.html>.

219 Eugenio Mocchegiani, Alexander Burke & Tomas Fulop, “Zinc and ageing (ZINCAGE Project)” (2008) 43 Experimental Gerontology 361; Canada: Dr. Tomas Fulop, one of the leaders on the project also runs the Biogerontology laboratory at the Research Center on Aging at the University of Sherbrooke, Quebec.

220 Ibid.

221 Fulop Jr., supra note 9 at 279.


223 Marshall, supra note 71 at 91.

224 Ibid.

225 Barbara Sibbald, “Fallout from JAMA’s HRT Study Continuing to Land in MDs’ Offices” (2002) 167:4 CMAJ 387.

226 “The Uses and Misuses of Testosterone Therapy” Johns Hopkins Health Alerts (2009), online:


Rattan & Singh, supra note 199 at 3.

Ibid. at 20.


Because of information limitations of viral vectors as well as side effects, scientists are seeking out other non-viral alternatives including the use of liposomes and nanoparticles. The use of living cells, like stem cells and lymphocytes, are also being explored for their ability to deliver therapeutic transgenes. See Potts & Schwartz, supra note 228 at 23; See also J.P. Magalhaes, “The Dream of Elixir Vita in The Scientific Conquest of Death” (Buenos Aires:1 libroenred, 2004); See also “Nano-treatment to Torpedo Cancer” BBC News (10 March 2009), online: <http://news.bbc.co.uk/go/pr/1/hi/health/7593592.stm>.


Potts & Schwartz, supra note 228 at 22-23.

Ibid.

J.A. Goldner, “Dealing with Conflicts of Interest in Biomedical Research: IRB Oversight as the Next Best Solution to the Abolitionist Approach” (2000) 28 J.L. Med. & Ethics 379; In another experiment, 11 French children suffering from a severe immunodeficiency disease were apparently cured. However 2 of the children later developed a form of leukemia.

Potts & Schwartz, supra note 228 at 22.


“The prototypic example of this second group is the hematopoietic stem cell, which generates all of the cell types of the blood and immune system.” These stem cells reside in the bone marrow. Gage & Verma, ibid. Recently, however, scientists have been working at “reprogramming” adult stem cells to convert them into cells similar to embryonic stem cells (induced pluripotent stem cells). See N.E. Sharpless & Schatten, supra note 243 at 202.

de Magalhaes, supra note 202 at 52.

Examples of tissues that have a significant degree of renewal are the skin, liver, small intestine and bone marrow. Each of these tissues contains a “small subset of primitive stem cells that are capable of self-renewal and can give rise to mature, differentiated adult cells of multiple lineages. Geoffrey C. Gumten, M.J. Callaghan & M.T. Longaker, “Progress and Potential for Regenerative Medicine”, (2007) Annual Review of Medicine 299 at 303.


Rattan & Singh, supra note 199 at 33.


Rattan and Singh, supra note 199 at 5-8; See also discussion in Miller, supra note 197 at 159.


Perl, ibid. at 485S.

Ibid. at 484S.

Rattan & Singh, supra note 199 at 7;

Ibid. at 7. Werner’s syndrome and progeria, cause early onset of age-related pathologies and shortened life span.

Ibid.

Perl, supra note 2610 at 485S-486S.

Ibid.

Perl.

Rattan & Singh, supra note 199 at 8.

Ibid.

Ibid.

Gurtner, Callaghan & Longaker, supra note 247 at 299.


Gurtner, Callaghan & Longaker, supra note 247 at 300.

Badyrak & Nerem, supra note 272 at 3285.

For an epimorphic regeneration study done in mice see Vincent Agrawal et al., “Regenerative Medicine Special Feature: Epimorphic regeneration approach to tissue replacement in adult mammals” (2010) 107:8 PNAS 3351. The ability to regrow the distal fingertip is maintained in the human until approximately age 2. Furthermore, studies have also shown that the human fetus during the first two trimesters has the capacity to regenerate wounded tissue including the replacement of appendages. This capacity is lost by the beginning of the third trimester. Gurtner, Callaghan & Longaker, supra note 247 at 300-301. Gurtner, Callaghan & Longaker, ibid. at 306.

Ibid. at 306.


Gurtner, Callaghan & Longaker, supra note 247 at 301.


Techniques developed here include “organ-printing,” which uses a modified computer printer, to print cells onto a gel in successive layers, and more recently, “micromasonry” which uses a gel-like material to bind cells together, which can then be arranged on a scaffold, solidified and then removed from the template. Javier G. Fernandez & Al Khademhosseini, “Micro-Masonry: Construction of 3D Structures by Microscale Self-Assembly” (2010) 22 Advanced Materials 1.

Fulop Jr., supra note 9 at 276.


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derived mice is associated with peroxidation-resistant membranes” (2006) 127 Mech Ageing Dev. 653.


250 Nanotechnology “is the art of manipulating materials at the molecular scale.” Gregor Wolbring, “Solutions follow perceptions: NBIC and the Concept of Health, Medicine, Disability and Disease (2004) 12:3 Health L. Rev. 41 at 41; “Nanomedicine” might be defined broadly as “the preservation and improvement of human health using molecular tools and molecular knowledge of the human body. Kerr & Wishart, supra note 68 citing Robert A Freitas.


252 See footnote 234 and accompanying text.


256 Canada: M.V. Sefton, “Institute of Biomaterials and Biomedical Engineering: M.V. Sefton”, online: <http://www.ibme.utoronto.ca/faculty/core/sefton.htm>.


263 Siao, supra note 300 at 48.


267 Ibid. at 107.; Aubrey de Grey envisions similar methods as “non-invasive static uploading” or “backing up our cognitive state.” de Grey, supra note 182 at 39.

268 Bainsbridge, supra note 306 at 118.

269 Ibid. at 113.


274 Cynrics Institute – Member Statistic Details, online: <http://www.cynrics.org/statistics_details.html>; Alc or Membership Statistics, online: <http://www.alcor.org/AboutAlcor/membershipstats.html>.

275 See Alcor: FAQ, online: <http://www.alcor.org/FAQs/faq01.html>.

276 Ibid.

277 Miller, supra note 197.

“... human intention does not define the normative impact of a technology, because this will depend on the possible courses of actions that are disclosed by a new technology and the actual way in which users attach themselves with the technology. Hildebrandt, supra note 187 at 453.

279 Rattan & Singh, supra note 199 at 8.

280 Capron, supra note 169 at 229.

281 For further discussion on the pros and cons of technologically embodied law see generally Hildebrandt, supra note 187.

282 Development and application of these treatments (and others) are being facilitated by nanotechnology. Digitalization, while arguably the most extreme form of pos-
sible enhancement, does not, in the author's opinion, directly connect to the aging process, the dying process or the ability to die. It is thus excluded from this part of the discussion. For further reading, see Bainbridge, supra note 306; Similarly, with access to them by some, possibly improved by cryonics, at least in theory.


324 See discussions in Marshall, supra note 71 and Juengst, Binstock, Mehliam, Post & Whitehouse, supra note 71.


326 Hildebrandt, supra note 187 at 447.

327 Ibid.

328 Borrowing from the "systems biology" approach, this view recognizes that the multiple levels of organization ranging from molecular and subcellular scales through the organismal, ecological, and societal to the evolutionary are not independent, decoupled systems and that there is a compelling need to provide a systematic framework for understanding the underlying science connecting the various levels. Geoffrey B. West & Aviv Bergman, "Toward a System Biology Framework for Understanding Aging and Health Span", (2009) 64A:20 Journal of Gerontology: Biological Sciences 205.