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# The Fountain

**"The key to repairing and restoring function exists within every one of your cells ... we propose that every part of your body can be recreated."**

## The Science

A host of scientific advancements were discussed at the Aging Symposium—everything from stem-cell therapy to a vaccine for Alzheimer's disease. Among the numerous scientific advances brought to the table were caloric restriction, virus therapy for cancer and mammalian regeneration.

## Caloric Restriction

As the old saying goes, less is more. It's generally accepted that obesity and intake of excessive calories is detrimental to our bodies, but new evidence suggests that even an average diet isn't ideal. Recent studies have revealed that caloric restriction therapies may even be more beneficial than exercise in preventing cancer, cardiovascular disease and age-related inflammation, and that such a method will reduce muscle loss and extend lifespan.

Laboratory experiments of caloric restriction in flies, mice and a variety of other animal models have revealed a consistent increase in mean and maximal life span by up to 60 per cent.

A study conducted on *C elegans* (a commonly used invertebrate) combined caloric restriction with insulin signalling and found a 6–7 fold increase in longevity. In humans, this increase would equate to a 500-year-old person.

Dr Luigi Fontana, a scientist at Washington University, presented a seven-year longitudinal study in humans that supported these results. In this study, a calorie restricted diet consisted of 1700 calories per day. This is fairly limited when you consider that the average Canadian consumes about 2600 per day. A correlation was found between caloric restriction and a reduced incidence of cardiovascular disease, as well as an increase in lifespan. The study also contained an exercise group that consumed roughly 2600 calories per day but burned enough calories that their body fat and body mass index matched that of the caloric restriction group. This exercise group showed a reduction in cholesterol, blood pressure and tissue inflammation and an increase in overall longevity when compared to the control group. However, caloric restriction was shown to be more effective than exercise at reducing blood pressure and expanding lifespan.

So even if you hit the gym and work off those donuts from CramDunk, you might not be as well off as if you had just resisted that guilty pleasure in the first place.

## Virus Therapy for Cancer

Dr Patrick Lee, a professor of microbiology and immunology at Dalhousie University, discussed a novel and counterintuitive approach to battling cancer: virus therapy.

"Most of us don't think of viruses as good guys, we associate these with diseases such as SARS, AIDS, HPV ... [but] in recent years scientists have found that we can actually use these as anti-cancer agents," he contends.

Viruses, unlike bacteria, must be in a viable host to divide. Certain biologically "benign" viruses, such as Reovirus, aren't supported in normal human cells, and are therefore unable to divide or have an effect on their host. However, cancer cells show an increased expression of certain factors that leave these cells susceptible to invasion by Reovirus. This virus is therefore able to divide and kill the cancer cells, while leaving the surrounding normal cells untouched. In a mouse model, one injection of Reovirus completely eliminated a brain tumor, and was also found to be highly effective in breast cancer cells.

"The tumor regression [with this approach] is absolutely remarkable," Lee enthuses.

Other viruses are also making the cut for this new approach to cancer therapy; an attenuated version of the Herpes simplex virus is currently undergoing clinical trials as a novel brain cancer therapy.

## Mammalian Regeneration

Most of us remember learning that some organisms (such as worms and salamanders) can lose an arm or a tail and just grow it right back, whereas the same just isn't true for humans. Contrary to what you learned in grade school, this capacity may soon be extended to non-regenerators, like humans.

A strain of mouse called the MRL has recently shown an ability regenerate tissue in a way previously thought impossible for mammals.

Dr Ellen Herber-Katz, of the Wistar Institute in Philadelphia, has unveiled this strain's amazing ability to regenerate damaged and lost tissue in the ears, heart and digits. She and others in this field are optimistic that studies of this gene line will uncover the secrets of regeneration and open up the possibility for regeneration in humans.

"We have positive results, and we're working hard to turn a non-regenerator into a regenerator, and I'm very confident [that this will be achieved]," Herber-Katz conveys.

## Biological Challenges of Aging

### Muscle Loss

Age-related muscle loss (Sarcopenia) is one of the most important risk factors for frailty, and can lead to slips and falls that create secondary injuries (like a broken hip) while also taking a general toll on mobility and independence. Moreover, muscle is the source of metabolites needed in trauma, leaving seniors at risk in surgery. The loss of muscle seen with aging is largely genetic, but also results partially from inactivity, and varies across individuals but can be as substantial as two thirds total muscle mass.

### Cancer

Age is the number-one risk factor for cancer, and researchers predict that cancer will be one of the biggest barriers to lifespan extension.

### Cardiovascular Disease

Cardiovascular disease is the leading cause of death in North America and outweighs all other major causes of death combined. Some of the major risk factors for cardiovascular disease include weight, type II diabetes, cholesterol levels and blood pressure.

### Other

A host of other age-related genetic disorders including, but not limited to, Parkinson's Disease, Alzheimer's Disease and Huntington's Disease, lead to reduced health and vitality in old age.

## The Future of Aging

Events like the Edmonton Aging Symposium, sponsored in part by the City of Edmonton and the Government of Alberta, provide evidence that the science of aging is becoming a topic of concern for scientists and policymakers alike.

The aging of the baby boomers is creating economic and social hurdles that societies will need to address in order to lessen the impact of this demographic shift. Regardless of the way we chose to address this, scientists at this conference were eager to express that amazing potentials are here.

"The key to repairing and restoring function exists within every one of your cells ... we propose that every part of your body can be recreated," Platika said.

# of Youth

## Extending the Human Lifespan

Would you like to live until you're 1000? Until recently, biological degeneration was thought to be an inescapable consequence of human aging. However, scientists are now beginning to question the inevitability of this deterioration of the body, foreseeing a future where science has overcome the biological constraints of the human lifespan.

Written by Sarah Treit



The Edmonton Aging Symposium, held at the University of Alberta last weekend, brought together 37 top scientists, academics and theorists from around the world to take a look at the science and ethics of aging. This conference explored the possibility that the detriments of aging are no longer unavoidable, and that technologies capable of drastically extending the human lifespan are almost within reach.

Dr Aubry de Grey of Cambridge University is the chief scientist of the Methuselah Foundation, a non-profit organization seeking to conduct research and raise awareness for aging interventions. He proposes a far-reaching government-funded initiative aimed at understanding the mechanisms of aging and accelerating therapies to combat it. Under such an initiative, he feels that life-extending technology will be marked by exponential advances.

"It's very probable that the first person to live to 1000 will be less than 20 years younger than the first person to live to 150," de Grey suggests.

Although this claim may seem surprising, speaker Dr Doros Platika of the Pittsburgh Life Sciences Greenhouse, and leader of the SuperCentenarian Research Foundation, reminded the audience that the feat of doubling life expectancy has already been accomplished in one lifetime.

"At the turn of the century average life expectancy was somewhere around 39 ... now it is much older, [around 80 years old]" Platika comments.

Additionally, he points out that social constructs based largely on life expectancy, such as mandatory retirement at 65, are beginning to change. The University of Alberta has just abolished mandatory retirement—a decision that may reflect a changing attitude about vitality later in life.

Although many of the speakers expressed enthusiasm for the pursuit of anti-aging science, the ethics surrounding the issue were also discussed in a head-to-head debate between two of the speakers.

Dr Daniel Callahan, a renowned bioethicist from the Hastings Centre for bioethics, argues that focusing economic resources on aging science would be negligent for a society that's faced with so many other pressing problems.

"Are there any present problems in society that would be helped by longer life? Global warming? Terrorism?" he urges, adding that "individual desire [for a longer life] is not legitimate."

Callahan further speculates that although we may be able to extend life, we are unable to predict what the quality of that longer life would be. He suggests that there are other means to pursuing health in old age, and that pouring money into radical life-extending science might not be the answer.

"Most of the improvement in the health of the elderly is coming from the background socio-economic conditions ... something like 60 per cent of the improvements have come from that directive, rather than from medical care or medical research. It seems to me that there would be a fundamentally greater value of putting money into improving our understanding of prevention, lifestyle and behaviour issues," he asserts.

His opponent, Dr Greg Stock, director of the program Medicine Technology and Society at UCLA, predicts exactly the opposite economic situation. He contends that the economic gains achieved by eliminating the diseases and detriments of aging would outweigh the costs of research.

"The savings in [medicare and social security] of extending the human health-span would be ... so immense that that they would justify the rather modest amount of money that would be spent on research," Stock states.

De Grey contends that whether or not an international initiative is undertaken, advances in specific areas of aging research will sum up to produce advancements in the human lifespan.

"The logic of the longevity-escape philosophy is actually much more certain and much more incontrovertible than any of the more near-term stuff that I talk about—which is, after all, the nuts and bolts of how to get there in the first place—and yet it's the discussion of four-digit lifespans that really gets people upset," he says.



KRYSTINA SULATYCKI

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