THE SPECIALIST

THE UNDOING OF AGING

CAN REGENERATIVE MEDICINE BECOME THE ROUTE TO ETERNAL YOUTH?

BY DR. AUBREY DE GREY, PH.D.

Space may be the final frontier; for one reason above all: most interesting things in space will always take a really long time to get to. Those with extraterrestrial ambitions thus have a penultimate frontier: the undoing of aging.

The desire to defeat aging is surely even more long-standing than the quest to reach the stars. Unfortunately, the idea that we will crumble and die is so crippling that most people evidently need to convince themselves, by whichever means, that it is not such a bad thing after all. Whether it's the existence of a joyful afterlife, or the presumption that a post-aging world would be unimaginably overpopulated, or the fear of immortal dictators, a conversation with nearly anyone about the idea of developing medicine to prevent age-related ill-health is almost certain to be derailed into arguments about whether such medicine would be a good thing at all.

A key pillar of many people's thinking about the topic is the misconception that "aging itself" is somehow a different sort of thing than the diseases of old age. There is actually no such distinction. Age-related diseases spare young adults simply because they take a long time to develop; and they affect everyone who lives long enough because they are side-effects of the body's normal operation rather than being caused by external factors such as infections. In other words, aging is simply the collection of early stages of the diseases and disabilities of old age, and treatment of aging is a simple preventive medicine for those conditions — preventative geriatrics. It is thus logically incoherent to support medicine for the elderly but not medicine for aging.

I claim no originality for the above: it has long been the virtually universal view of those who study the biology of aging. I believe it is not debated in the wider world, despite those experts' energetic efforts, overwhelmingly because people don't believe there is much chance of significant progress in their or even their children's lifetimes and they don't want to get their hopes up. But in recent years, the justification for such pessimism has evaporated.

It has done so above all because of progress in regenerative medicine, which colloquially but see below is context of stem cells and tissue engineering. Regenerative medicine can be defined as the restoration of bodily function by restoration of structure. We may replace entire organs (tissue engineering), or we may repair organs by replacing their constituent cells (stem cell therapy). In a sense, regenerative medicine is maintenance for the human body. As such, it should in principle be capable of combating preventative maintenance for the chronic, slowly progressive, initially harmless but eventually life-threatening processes that jointly make up aging and the diseases of old age.

Regenerative medicine has only recently, however, become recognized as a promising avenue for postponing age-related ill-health. This is for two reasons. Firstly, it was originally conceived and pursued for its potential to treat acute injury, such as spinal cord trauma, rather than chronic damage; thus, regenerative medicine pioneer and biologists of aging simply didn't talk to each other very much; with the result that those studying aging were improperly informed about progress in regenerative medicine to appreciate its potential. The second reason was equally important: in order to be plausible applicable to aging, regenerative medicine must be broadened into a host of other areas, over and above stem cells and tissue engineering, and those areas are mostly as considerably earlier stages of development.

But not fancifully early. In the decade since I first laid out a positively comprehensive classification of the various types of molecular and cellular "damage" that must be periodically repaired in order to stave off the decline of old age, and the specifics of how we might do it, progress has been grudgingly rapid though I estimate it could at least three times faster if the potential of this approach were more widely understood and funding for it correspondingly elevated). Furthermore, that plan has abnormally stood the test of time, undergoing only minor adjustments.

In this short, general-audience piece I can only hint at the advances over the past year or two achieved by researchers worldwide in this space: SENS Research Foundation was created for this purpose, and alongside numerous other institutes and organizations, both commercial and non-profit, we have achieved not only the retardation of aging but its actual repair, restoring youthful health to animals that were suffering widespread age-related decline. Much remains to be done to extend these results, before they can realistically be applied in the clinic. However, the removal of toxic metabolites by products shows clear promise of completely eliminating cardiovascular disease, the Western world's foremost killer, and also molecular degeneration, the leading cause of blindness in the elderly. Similarly, removing cells that have become dysregulated and toxic to the body was recently shown, in multiple models, to restore function to sick animals. Advances like these, in combination with traditional regenerative medicine, may in the next few decades deliver a truly comprehensive and dramatic postponement of age-related ill-health.