In the Year 2020, Part II: Biotechnology and Genetics

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Live to 149, program your nerves for pleasure, and eat entrail-fed meat machines, all by 2020.

Check out Part I of our series about life in the year 2020.

Nobody delivers profanity better than Bruce Willis. Nobody. Perhaps that's why he's seen so much of it in practically every script he's tackled during the last 20-odd years. We don't have a final count on the number of F-bombs our man Bruce dropped in his latest flick, *Surrogates*, but we can say with some authority that a world filled with robotic avatars gone amok would drive anyone to repeated vulgarity.

But 2017? *Surrogates* would have us believe that just eight short years from now, we'll have retreated to our homes and left the "real" world to synthetically pimped-up alter-egos? Is it conceivable that we, as naturally exploratory human beings, would want to do that? Is it conceivable that such technology would even exist just 3,000 days from now?

Welcome to Part II in our three-part series on life in the year 2020. In Part I, we took a gander at cloud computing and the immediate future of the amazing, shrinking computer. In Part III, we'll get the down and dirty on transportation, urban planning, and our changing cities. But today, we'll go all *Surrogates* on you.

Well, not really, but we *will* explore forecasts for the branch of science and technology that might one day, in perhaps 2075 or so, take us to the level of quasi-surrogates – biotech. That umbrella covers genetics, genetic engineering, nanotech, and essentially anything that helps us live appreciably longer and better. And that includes what we eat. Many futurists speculate that food, the production of food, and the very design of food

will most assuredly see some pretty drastic changes over the next decade – all through the aid of sci-tech.

And although we can tell you right now that a Surrogate-filled world is highly unlikely just 10 years hence – never mind eight – we *are* pretty sure that folks lucky enough to be born into developed countries will, through technology, reap some rather interesting, rather exciting rewards in the coming century.

Live Forever!

S. Jay Olshansky

In 2001, biodemographer S. Jay Olshansky of the University of Illinois at Chicago School of Public Health and Steven Austad, a gerontologist at the University of Idaho, made a little wager. Austad contended that, through biomedical advancements and cloning technology, one or more people already on the planet would live to see the year 2150 – a lifespan of at least 149 years. Whether he himself would live to collect or pay out on that bet is another question all together.

In 2004, celebrated University of Cambridge biogerentologist Aubrey de Grey, a devout anti-aging proponent and believer that aging is merely a disease – and a curable one at that – claimed the first person to live to 1,000 (that's one thousand) had *already been born*.

Ray Kurzweil

In 2007, Ray Kurzweil, a futurist noted for nailing his prognostications, declared that we'd all better start caring for ourselves a bit better. Why? Because, Kurzweil asserted, those who managed to survive even a few more years would witness a massive elongation of lifespans – to the tune of one extra year for every year that passes. Moreover, said Kurzweil, our species would likely achieve immortality before 2030.

With these mind-boggling conjectures in mind, we took the question of human longevity and life betterment in the year 2020 to a panel of three learned men – all of whom are well-versed not only in the concepts of modern science as it applies to the human condition, but also in foretelling what the future might bring because of it.

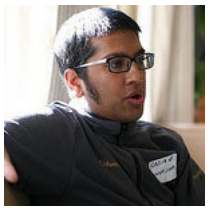
Aubrey de Grey

The changes they predicted were somewhat more conservative than Kurzweil, de Gray and even Austad predicted. Though each of our experts concedes we're well on the way to something much better, they aren't quite so optimistic on the subject of immediate, large-scale

lifespan gains. It would appear that just because nanotechnology is currently so big and busy, just because President Barack Obama is a strong believer in stem cell research, and just because bio- and nanotechnology researchers are now fiddling around with DNA faster than an Itzhak Perlman solo, we're not going to be truly Godlike for a few years yet.

Ian Pearson is quite succinct. A Chartered Fellow with the Institute of Nanotechnology, founder of Futurizon (www.futurizon.com), and for seventeen years a futurologist with British Telecommunications, Pearson is a believer in infinite life – but certainly not before 2020. "We're already able to alter genetic codes. We can make tiny, nano-sized machines. And within fifty years, we may be living with a body that's part machine, a synthetic body. But there are enormous problems with durability at the molecular scale that we've yet to conquer," Pearson says. "My feeling is that we should see two or three years added on in the next decade, and two to three more every decade after that. And most of that will be caused through breakthroughs in cancer research, heart disease, and other common stuff."

Red Tape



Razib Khan

Razib Khan, biology and biochemistry degree-holder, regular contributor to ScienceBlogs (http://scienceblogs.com), and founder of the weblog Gene Expression (www.gnxp.com), agrees that a true nano revolution is still some time away. "Many poor countries have life expectancies which are rather high, so it seems that there are diminishing returns on dollars spent on healthcare," Khan says. "What we need is a paradigm shift. There is, I think, a minority probability that such a shift will happen, and that anti-aging research will achieve a breakthrough and lifespan will go up considerably." How small is a minority probability? Khan puts a five percent chance on a breakthrough by 2020 that would increase life expectancy by 20 years, and a 95 percent chance that we're stalled at current life expectancy. His expectation: a one-year gain by then.

Red tape in the biotech industry can also pose a problem, according to Thomas Frey, publisher of the blog FuturistSpeaker.com and executive director and senior futurist at Colorado think-tank The DaVinci Institute. "Advances in the physical world – atoms – are happening at a vastly different pace than advances in the digital world of electrons. Medicine and biotech advances are happening at the slowest pace of all, primarily because of rigorous safety standards."

Thomas Frey

Frey blames a lack of seed capital and income tax for the caustic environment that kills many fledgling technologies in America. "We currently do not have a good system for channeling funding into early

stage companies in the U.S. The vast majority of new technologies die before they ever have a chance to evolve, and virtually all new technologies evolve before they reach the marketplace," says Frey. "As for income tax, our current tax code is the mother of all boat anchors hanging around our necks. It occupies entirely too much intellectual bandwidth and is placing us at a severe competitive disadvantage in the emerging global marketplace. Yet in spite of these two glaring system problems, advances are still being made"

And many of those advances are in the rejuvenation and repair of the human body. Though our experts feel that we may not be able to birth an immortal man or immortalize a previously mortal man in 2020, we certainly should be able to fix much of what ails him.

Active Skin: Pleasurable *and* Practical

One of the most promising game-changing technologies on the horizon might be the concept of "active skin," According to Pearson, active skin is essentially an interface to the human nervous system, allowing users to have electronics "printed" on skin surfaces and even through the skin, to capillaries and nerve endings.

Ian Pearson

"You could monitor the bloodstream, checking for cholesterol, diabetes, and other diseases – sort of an early warning system," says Pearson. "My thought was that the big drug companies would love it, because they could personalize medicine delivery. But I think now that they'd rather just use it to monitor the body. They – and we – know a lot about the unhealthy body. They don't know that much yet about the *healthy* body."

And beyond curing diseases or improving health, active skin could be used purely recreationally to elicit pleasure. According to Pearson, active skin could "pick up nerve signals from the nerves and record them, and perhaps re-inject them at a later date, so that we can effectively record and replay a sensation such as cuddling your partner while you're away."

Can Our Planet Handle It?

Whether we're each living two, ten, or twenty years longer in 2020, there *will* be a lot more people, ignoring for the moment the possibility of catastrophes. The real question, then, may be whether this little blue planet, third from the sun, can support a growing, longer-living population.

Pearson says that shouldn't be a concern. "If you populated the entire planet to the density of the UK, you'd have 75 billion people," says Pearson. That's 10 times that of current global numbers, and approximately seven times that of current estimates for 2020.

“Yet there are plenty of open spaces in the UK, and lots of spots where you feel quite alone. So space shouldn’t be a problem.”

Khan contends the Earth’s population may never become large enough to worry about, in part because of genetic and nanotech advancements. “If people live longer, they would put off having kids. Many of them would die in accidents of course, even if we become really risk-averse, which we would. I suspect that we would space out the number of children we have a lot more as well, perhaps having a child early in life, and having another child if the first dies accidentally.”

Khan adds that population forecasts have been overblown for decades. “The world population is already slowing in its growth to the point where it will peak somewhat north of 10 billion. I think our current tech could support that easily.” British scholar Thomas Malthus contends that societal improvements inevitably result in population growth, but Khan disagrees. “I generally reject the Malthusian arguments because they’ve been falsified so well over the past two generations. Additionally, United Nations population estimates have routinely overestimated growth since the 1950s. Projections for the year 2000 kept getting revised downward because the fertility crash was not anticipated.”

But what about pollution? Energy? Oil at $500 a barrel? Plagues? Locusts? We’ll deal with at least some of that in Part III of our series, when we focus on transportation and energy, though Pearson has a few words for us now.

“I truly believe oil will be at $30 a barrel by 2030. The extraction costs will be far too high by then, and we simply won’t need it like we do today. And I’m a great believer in solar power. Over a period of six months, one 1-meter square solar panel in the Sahara will be able to generate the equivalent power of one barrel of oil. The Sahara Desert alone could produce forty times more energy than the entire planet requires.”

How Offal!

Food is, of course, a major issue. Yet our experts agree – through advances in genetic crop engineering, more efficient farming, and also a reduced reliance on meat, hunger likely won’t become a global epidemic. Indeed, food production systems might actually benefit the most, at least in the near future, from biotech and genetics research.

Without the red tape and ethical dilemmas surrounding experimentation on humans, the production of meat may benefit from advancements before humans do. “Different organisms process input calories toward different efficiencies. Can you imagine if there was an animal as efficient at getting calories into meat as a chicken, but tasted like beef?” asks Khan. And the results won’t always be pretty. “I hear the Chinese are working on what I like to call ‘meat things,’ basically organisms that take offal (entrails and other animal parts that are generally considered inedible) into their maw, process them into flesh, and discard the waste.”

“There will be modest improvements in standard grain crops through genetic engineering techniques. But I suspect a bigger change might be seen in forms of aquaculture – growing algae to process for food, and fish farming. Fish farming especially will probably have taken off by 2020, we’re almost there with tuna now.”

According to Frey, the ongoing research and development of “smart foods” will radically alter our eating habits and customs. “The future of foods is smart foods,” Frey says. “The food industry will resemble the body’s metabolism. Science will create real-time reactive sensors in our bodies that can read everything from the fluctuation of brainwaves, to micro changes in heartbeats, to gastro-digestive processes, to variations of skin perspiration rates. This constant monitoring of hundreds if not thousands of bodily nuances will bring about healthier food choices and, more importantly, choices tailored specifically to an individual’s needs. The sensors will need to interface with an equally nuanced supply chain to meet the needs of this next generation, hyper-individualized consumer.”

Further on Down the Road

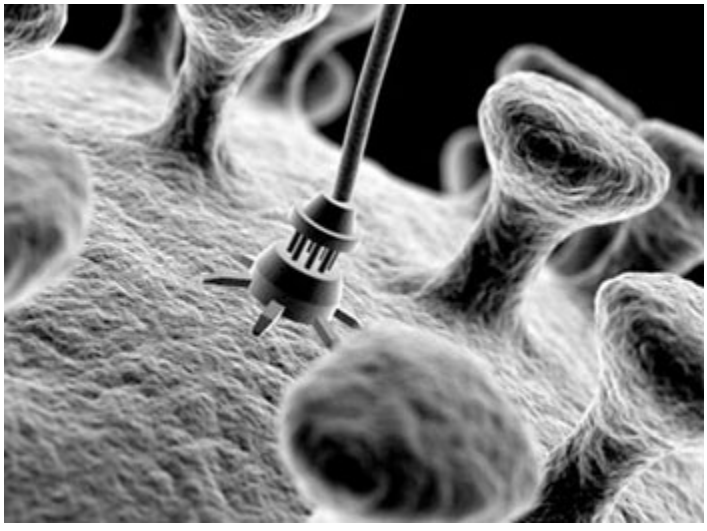
Frey sees 2030, not 2020, as a time when we’ll likely see a quantum shift in our food production and delivery system. “In the home of 2030, a personal monitoring system will generate a grocery list based on the anticipated needs and stated desires of that individual. Food orders will then be placed either automatically, or with as much control as the person desires. The order will go to the local food supplier, who will be in constant communication with regional suppliers, and they will be in constant communication with the food producers. The entire supply chain architecture will be wired to the needs of the end user.”

That means a crop will no longer be truckloads and truckloads of the same thing. “Farmers will become expert at producing ‘jacked-in’ food stocks with countless variations, managed through computerized processes designed to manipulate the end results,” says Frey. “Controls will be exercised along a broad spectrum, from environmental conditions such as light, water, and oxygen levels in the air to genetic manipulation, according to approved safety guidelines.”

“By 2030, a farm or ranch will adopt technologies that leave today’s operations far behind. Ultra-high-tech farms of the future will generate exotic half-plant, half-animal vegetation as well as crystalline plants, air plants, and generic non-species plants designed for post-harvest flavor
and nutrient infusions.”

Learning to Live with Living Longer

A new set of tools for manipulating both our food and ourselves will bring with it a whole bundle of ethical dilemmas. For instance, what complications can we expect when a population eats better, receives personalized medical



care on an unprecedented level, reaps the health benefits of nano-scale research, and ultimately lives appreciably longer? When is a person's condition – either through accident or some other unforeseen circumstance – simply too far gone to reclaim? What of those who harbor criminal attitudes? Can they be re-wired? Can we possibly fill our jails any more than they already are?

Frey points to all of the above and warns, "These may seem like distant concerns, but change is coming – this time, at lightning speed. In the past, advances for cures for even minor diseases moved glacially. From Leeuwenhoek's invention of the microscope in the late 1600s to Louis Pasteur's discovery of germs, the great achievement took centuries. Today, breakthroughs are arriving at greater speed, and accelerating to the point where barriers to near immortality are falling daily. We don't have the luxury of mulling such matters for decades."