Genetic engineering

Artificial chromosomes

As of 2007, human artificial chromosomes have already been created and patented, and companies have sprung up to exploit the technology.

In Japan, scientists are taking an artificial chromosome containing the gene to correct a serious disease and are simply putting it in a stem cell and transplanting into the body. [1]

Artificial chromosomes can not be used as vectors for gene therapy. They can carry small amounts of DNA, even multiple genes, but don't insert themselves into the existing genome. Instead, they sit inside the cell's nucleus expressing their genes alongside the original genome. This can cause a disruption in the rRNA synthesis and eventually damage the whole body's function due to lack of tRNA in the body.

Timeline

How neat it would be to have genetic engineering treatments to get extra eyes, fur or tentacles...

Genetic engineering.

- First (now-2015) we will see more and more smart drugs, i.e. drugs increasingly designed based on understanding on how genes and proteins work and not just random hit-and-miss experiments with organic molecules. It will become increasingly possible to regulate the human metabolism using the THIRD way (i.e. not neural or hormonal, but artificial drug-induced way). Things like Viagra, working drugs for losing (not gaining) weight, nootropic drugs, etc.

- Then (2015-2025) we are going to see first health-related genetic modifications. As e.g. Naam describes in his book, there are several ways to modify ourselves - inject the protein (drug - see above), add the DNA into the cell (noninsertional vectors) or into the nucleus (insertional). By that time we will strongly feel the fallout from the Human Genome project, understanding a significant part of the complex genetic chemistry. First we are going to change the DNA to fix the health defects, removing bad genes or fixing them.

- At the same time we will have genetic treatments in competitive sport (Olympics) to enhance the strength, endurance, etc. Some say that first such treatments are already being used. Each next Olympics will have more and more and by 2016 a very large portion of athletes will be using some form of genetic enhancement.

- By that time (mid-2010s) we will have some cyborgisation in healthy humans going on. Chips for interacting with the electronic environment, some enhanced senses (e.g. cochlear implants for healthy people). Enhancement surgery will be growing in popularity (things like LASIK, muscle surgery, lots of cosmetic surgery and a bit more advanced stuff). The "traditional" body modification techniques will be gradually improving. Everything that is cool today will be already passe and retro. Hard to predict these things, since they are irrational and random to a large extent like all fashion is. But one may speculate about subdermal displays, limited neuro-electronic connectivity (i.e. "implanted remotes"). Disabled people will have their artificial hands, legs, eyes and stuff in increasing numbers. But we still won't see genetically modified people with tentacles.
except in a few freaks, like the leet body modders today (however, even those would probably opt for surgery + drugs, not full-scale GE).

- Starting from about 2015 we will spend more and more time in both virtual and augmented reality. We will be more and more comfortable with modifying our appearance in arbitrary ways, spending time in animal bodies (even though only virtually), etc.

*By, say, 2020 we (at least the early adopters, not luddites) will be controlling our metabolism artificially a lot (using a combination of implanted automatic smart drug-release devices and genetic therapies). There will be a few cases when humans will be enhanced significantly changing their genetic code, when this can be done in a very safe manner and without side effects (this might come from one of the sports modifications). The parents will have great freedom in defining the DNA code of their kids to get rid of all bad stuff and ensure that good stuff is there, but no fins or fur yet. We will also have many artificial parts and will spend a lot of time in virtual worlds.*

- Around 2020-2025 we will see the spread of biotechnologies to the general population. We will also have desktop fabrication labs by then (and robots), some pretty useful (but not fully mature) nanotech (to compliment the biotech that we are talking about). We will have some good AI (but not human-level), so a lot of R&D will be possible to do using existing software. Software methodologies will be more advanced than today, so ordinary people will be able to get digital designs for a bio-lab, assemble it using their (may be not personally owned) desktop fab lab, get the information databases with genetic and other biological information and synthesise the DNA.

- There are likely to be some regulatory issues by than. Both scaremongers and responsible scientists/politicians will demand some control mechanisms and some will definitely be established, but we can also expect bio-hackers (and pirates) to emerge. There will obviously be a gradient - if some people are doing legit body-modifications (like people in tattoo/piercing parlors today), they can add a bit of illicit modifications, provide access to illegal drugs (controlled substances) without prescriptions (like offshore Internet pharmacies today), etc. This may end up looking a little bit like the cyberpunk predictions (e.g. traditional Gibsonesque cyberpunk).

- In 2025-2030 people will start to notice the exponential technological growth. Kids born in 2010 will be getting through their teenage phase (modified using mind-enhancing drugs, but not enough to turn them into obedient zombies). They will probably be the first to use the technology in radical ways. The transplantation industry would be mature by that time, with millions of transplantations performed every year - cloned parts, xenotransplants, artificial organs, etc. Stem cells would also be used to grow new organs (in vitro and in vivo). So it would be quite easy to do heavy cyborg and biological body-mods with little risk (and almost zero risk of serious complications that can't be fixed). As much as I am uncomfortable with that (today), more and more people will be experimenting with heavily modified bodies. Genetic engineering will be used in conjunction with surgery. We will also have the ability to direct body reconstruction - first selective apoptosis, then generation of stem cells and regrowth of the organs/tissues. This will obviously first be used for corrections, but eventually for rebuilding the body for other reasons.

- By that time technologies for genetic engineering will be widespread and accessible. Software products would exist (not in the form of products, but downloadable routines, AI modules) that can be used easily. By 2030 most people will have the ability to design new organisms from scratch and change their own bodies at will. My imagination is betraying me a bit, but when walking (or otherwise moving) on the street (or the future analogue of it) you will see people of different colours (including pink, orange and striped yellow-green), people with fur, people with animated skin, people with various additional parts (combs, spikes, etc.) added for aesthetic
reasons, people with various face adjustments ("unnatural" eyes, nose, lips, teeth, etc.), people with parts of them resembling animal parts (feline eyes, etc.).

- By that time the society will likely change enough to make these things not only more acceptable, but in a sense expected. Mind-enhancement techniques, significant social changes will mean that there won't be conservative job-places that don't let you come to work with wings and horns. Many people will not be working in the traditional sense, but living life in more creative ways, while the society/nature supplies them with necessities.

- Aging would have been cured before the end of the 21st century. Due to the negative image of teenagers and college-aged people being immature having died out due to nanobiotics and inclusion of teenagers into adults, people will want to be young for ever. They would not age beyond 20 either physically or mentally. They will have the sound minds and healthy beautiful bodies of adults at the peak of their youth. Therefore there would not be any need for facelifts as the result is not as effective as the halting of the aging process or nanobiotical rejuvenation in which people over 20 will have their bodies, faces, minds and genes rejuvenated to 20 years old in a matter of minutes in special clinics. However, people would be free to choose, but pressures to look young and beautiful would encourage a lot of people to undergo this painless treatment without negative side effects.

- The precise nature of the future society in regards to the look of its members will depend on an unpredictable factor - the relative success of different development approaches. It is clear that virtual reality, cyborgisation and genetic engineering will all provide almost unlimited possibilities for human expression. But which of the three methods will be more popular (at certain point) is hard to predict, because it depends on which one will be more advanced, more efficient, safer, cheaper, more available, easier to use, etc. It is likely that all methods will complement each other to some extent, but personally I am not ready to predict with certainty whether the society of 2030 will consist mostly of people inhabiting VR worlds, robots walking the streets or mutated chimeras flying and swimming around...

Predictions by Brian Wang:

- 2011-2014 - Customized cells
- 2011-2016 - 20%+ efficient genetically engineered algae ponds to generate hydrogen
- 2015-2025 - Almost all fish (for food) comes from massive isolated land-based fish farms, some with volumes approaching a cubic mile.
- 2011-2020 - Future Crime: Genetic modification of baby DNA to pass false paternity lawsuit

This page is speculative in nature.

If you can shine some light on this topic, please do it by contributing to this article and making it more factual. Alternatively, think about creating a scenario based on it.

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