

Oct/Nov Report

<https://www.theatlantic.com/science/archive/2018/11/vets-dog-dna-test/575152/>

(Nov 12, 2018_

- Mars Petcare first launched their DNA test for dogs in 2007
 - Could only get through a vet
 - Required a blood draw
- In 2009, the company changed gear and began selling their Wisdom Panel test directly to customers by extracting DNA from saliva instead of from blood
- Some other companies that do DNA testing for dogs:
 - Embark
 - DNA My Dog
 - Paw Print Genetics
- The tests tell you what breed mixes your dog is and some offer risk estimates to more than 150 health condition
- Many veterinarians are skeptical about these tests because clinical genetics is a new field to them and they are not very educated in it
- Also, while humans can be referred to genetic counselors, no such thing exists for dogs
- There is no larger body that regulates dog DNA tests
- As a result, dog-DNA companies are collaborating in the Harmonization of Genetic Testing for Dogs project in an attempt to self-regulate
 - At the core of this project is a database of dog genes that have been linked to different diseases in different breeds
- Embark (another company) has a veterinary team that reach out to customers and helps customers understand their results
- Through these genetic tests, these companies are creating a huge genetic data base that can be used for future dog research

<https://singularityhub.com/2018/11/14/designer-babies-and-their-babies-where-ai-and-genomics-could-take-us/#sm.000179ue6q1c2bd1rzmpnatmoysxz> (Nov 14, 2018)

- One crucial tech intersection is that of artificial intelligence and genomics
- The field of genomics
 - In 1953, James Watson and Francis Crick identified the double helix structure of DNA - realized that the order of the base pairs held a treasure trove of genetic information
 - 2003 - Human Genome Project was completed → learned the order of the genome's 3 billion base pairs and the location of specific genes on our chromosomes
 - 2018 – we are moving into the age of gene editing in plants, animals, and humans

- In 2016, DeepMind's AlphaGo (<https://deepmind.com/research/alphago/>) program outsmarted the world's top Go player
- 2017 – AlphaGo Zero was created (this machine was simply given the rules of Go) → in 4 days, it defeated the AlphaGo program
- Getting a standardized set of rules for our biology will require genomic data
- UK's National Health Service recently announced a plan to sequence the genomes of 5 million Britons over the next 5 years
- In the US – the All of Us Research Program (<https://allofus.nih.gov>) will sequence a million Americans
- China – goal of sequencing half of all newborns by 2020
- Most valuable information will come from comparing people's sequenced genomes to their electronic health records and their life records
- To compare genotypes and phenotypes at scale will require AI and big data analytic tools, and algorithms
 - This could lead us to predictive medicine where we know when and where different diseases are going to occur and prevent them before they start
- 1 application of genomic knowledge → embryo selection
 - Be able to predict with increasing levels of accuracy, specific traits and disease states
 - For instance, people could pick an egg based on its optimal genetic sequence in the process of
- The combination of in-vitro gametogenesis (IVG) and gene editing is highly likely
 - Gene editing technologies could allow us to repair, add, or remove genes during the IVG process and eliminate diseases or confer advantages
- This some with ethical conversations about what steps must be taken to keep this tech from becoming a tool for the wealthy and perpetuating inequality

<https://www.bloomberg.com/news/articles/2018-11-27/china-opens-a-pandora-s-box-of-human-genetic-engineering> (Nov 27, 2018)

- A Chinese researcher claims that he successfully modified the genes of human embryos
 - Jiankui He - an American-educated scientist based on Shenzhen
 - Announced Monday Nov 26, 2018 that he used Crispr (a powerful gene-editing tool) to make recently born twin girls resistant to HIV
 - His claims have not yet been verified
 - Some are saying this is irresponsible use of a technology whose long-term effects are still poorly understood
- China is likely to become the country where researchers most rapidly test the currently-accepted boundaries of genetic manipulation due to its aggressively entrepreneurial startups and less stringent regulation
 - Can capitalize rapid innovation
 - But could also put patients in serious risks

- This can cause a technology arms race with the US and Europe, who is for strict regulation
- A Chinese official started on Nov 27th and China had outlawed the use of gene-editing for fertility purposes in 2003
- Jiankui He is planning to make the project's data public on Wednesday Nov 28 at an international genetics conference in Hong Kong
- However, the hospital where Jiankui He got approval for his work is now stating that they believed signatures on an application to the hospital's medical ethic committee was forged
 - A public-security organization is now undergoing investigation
- China has been much faster to commercialize application of AI that would raise ethical and regulatory concerns in other countries
- Scientists could use gene-editing to engineer humans to be smarter, more resistant to disease, and even physically stronger → has the potential to be used create a rising superpower
- The university that Jiankui He serves as an associate professor has disassociated themselves from his work
- Renzong Qiu, who is known as the “father of bioethics” in China says that Jiankui He work likely violates existing government regulations
- The US and Europe has restricted the use of Crispr for germ-line editing → making changes that will impact the descendants of the patient
- While China has government guideline's that prohibit experimentation on embryos more than 14 days after fertilization, Chinese rules don't impose penalties for violations

<https://www.scmp.com/news/china/science/article/2174815/china-pins-its-hopes-beating-us-race-bio-intelligence-supremacy> (Nov 27, 2018)

- China invested US \$9 billion in expanding its AI and biotech capabilities inland and beyond its borders
 - This boost their ability to commodify biological and genomic data
- Some believe China's global leadership will emerge at the convergence of AI and genomics
- AI programs that can decode the genetic profiles of entire populations and ecosystems make cyber-colonization increasingly likely
 - Can lead to massive shifts in geopolitical power
- China and Silicon Valley are in a cyber race → to see who will control our biological data
- Biological data has become a fuel for economic, medical, and security supremacy
- China has already surpassed the US in large scale, low-cost gene-sequencing
- The world's largest genetic research center is in Shenzhen → Beijing Genomics Institute
 - Holds about 40 million people's DNA samples

- They provide their services to health and biotech groups in more than 60 countries
- In 2013, BGI bought Complete Genomics in California with the intent to build its own advanced genomic sequences machines
 - This was tech that was mainly mastered by American producers
- The Chinese company, WuXi NextCODE was an early investor in 23&Me → they now have their foot in the US and in China + an extensive library of genomes from both continents
- WuXi NextCODE is one of the largest genomic data platforms using machine-learning to better diagnose rare diseases and cancer and designing tailored therapeutics
- About US \$13 billion of Facebook shares was recently invested in the Chan-Zuckerberg Initiative → pursues the ambition to develop a human cells' atlas to cure, prevent, and manage all diseases in our children's lifetime
- The Chinese government has outlined a “military-civilian integration development strategy” to harness AI and biotech to enhance Chinese national power
- Beijing has also kept Silicon Valley giants out of the Chinese market for years
- In the first half of 2018, Chinese private equity and venture capital funds invested US\$5.1 billion in the US AI and biotech sectors
 - Their aim is to gain even more technological and human capital
- The dangers of this biotech race is inequality between countries that are tech leaders and those that are tech takers will rise
 - Capacities will raise ambitions to monetize and possibly even weaponize bio-intelligence
 - Unless there is a transfer of skills and financial benefit sharing
- Liquid biopsies – blood tests to diagnose cancer – are predicted to become the next commercial gold rush in health care

<https://www.siliconrepublic.com/jobs/genomics-medicine-ireland-jobs-wuxi-nextcode-investment> (Nov 27, 2018)

- Up to 600 jobs spanning research, informatics, data science, software and medicine are to be created in Ireland as part of a \$400m (€350m) investment in [Genomics Medicine Ireland \(GMI\)](https://genomicsmed.ie/careers/) (<https://genomicsmed.ie/careers/>)
- In an investment involving the Ireland Strategic Investment Fund (ISIF) as well as international investors WuXi NextCode, Arch Venture Partners, Polaris Partners, Temasek, Yunfeng Capital and Sequoia Capital, Dublin will become a global hub for genomics research.
- Under the terms of the investment, \$225m (about €197m) will be committed to GMI in the near term, increasing to \$400m in line with the achievement of milestones as GMI expands and as ICALS develops in the medium term.



Eugene Consulting Inc.
111 St. Clair Ave W
Toronto, ON
M4V 1N5

- GMI, currently based in Cherrywood in Dublin, is creating a scientific platform to examine the human genome in order to better understand the role of genetics in disease and rare conditions, leading to new prevention strategies and treatments.
 - Company was founded in Ireland in 2015 by a group of leading life sciences entrepreneurs, investors and researchers.
 - CEO of GMI: Anne Jones
- The investment will be used to create the world's largest wholesale genome sequencing programmes
 - Programme will target participation from 400,000 volunteers – or one in every 10 people in Ireland – including patients with a range of common and rare diseases.
- The population of Ireland is relatively homogenous, making key genes easier to identify
- As well as finding cures, the work of GMI and **WuXi NextCode's** (<https://www.wuxinextcode.com>) genomics platform could in turn be leveraged to attract more investment and make Ireland a global life sciences hub
- Similar to the experience of San Diego → San Diego has built an entire ecosystem around genomics and related life sciences sectors