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December 2019/January 2020 Report

Hackers target LifeLabs medical Database in B.C and Ontario – December 27, 2019
https://www.vicnews.com/news/hackers-target-lifelabs-medical-database-in-b-c-ontario/

- On November 1, 2019- The database of Canada's largest providers of medical lab testing services, LifeLabs, was targeted by a cyberattack
- Extent of the data break was not revealed but it potentially affected 15 million customers
    - Database included information such as names, address, email, customer login and passwords, healthcare numbers and lab test results
- The company has signed on 5 hospitals and clinics that will collaborate to build an infrastructure to collect and share high-quality, patient-consented data that can be used to provide precision care to cancer patients
- The company is targeting the fact that to date, no effort has successfully unified academic and community practices to work together in collecting the quantity of data necessary to advance precision oncology
    - Taproot Health's data-as-a-service enterprise helps to unite all oncology stakeholders in creating a nationwide oncology database comprised of patient-consented, high-quality prospective data that meets rigorous scientific standards

Deep Genomics Receives a $40M Series B round – January 7, 2020
https://www.fiercebiotech.com/medtech/deep-genomics-nabs-40m-round-doubles-down-ai-and-wilson-disease-work

- Canadian drug development company Deep Genomics received a $40 million series B round
    - Led by Future Ventures alongside Amplitude Ventures, Khosla Ventures, Magnetic Ventures, and True Ventures
- Deep Genomics is a biotech and drug development company that is using AI to help better understand and create new drug targets and design new drugs and animal models
- They state that 70% of their research projects have led to therapeutic leads and programs have been taken from target discovery to drug candidate in less than a year
- Part of the $40M funding will go towards pushing 2 early-stage programs to IND this year
- Deep Genomics will also be gathering up phase ½ data for its Wilson disease candidate (a rare and potentially fatal genetic disorder characterized by excess copper stored in various body tissues)
- Deep Genomics uses more than 20 machine learning systems to screen disease-causing mutations in search of new drug targets

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    - They have built a system that within 2 hours, can scan over 200,000 pathogenic patient mutations and automatically identify potential drug targets

Scientists combine AI with biology to create the world's first "living robots" – January 21, 2020
https://www.ecowatch.com/xenobot-ai-biology-2644880026.html

- A research team of roboticists and scientists announced how they have they have created a new lifeform called xenobots from stem cells → a living, programmable organism
    - They are completely organic and made of living tissue
- Xenobots are less than 1mm long and made of 500-1000 living cells
    - They have various simple shapes (some with squat "legs")
    - They can propel themselves in linear or circular directions
    - They can join together to act collectively and move small objects
    - They can live up to 10 days using their own cellular energy
- To make this, the research team used a supercomputer to test thousands of random designs of simple living things
    - The computer was programmed with an AI "evolutionary algorithm" to predict which organisms would likely display useful tasks
    - Scientists them replicated virtual models which they had created with frog skin or heart cells joined using microsurgery tools
    - The heart cells contract and relax, giving the organisms motion
- Xenobots are like robots because they can configure into different forms and shapes and "programmed" to targets certain objects which they unwittingly seek
- They can also repair themselves after being damaged

Possible medical uses:

- Xenobots designed with carefully shaped "pouches" may be able to carry drugs into human bodies
- Future versions may be built from a patient's own cells to repair tissue or target cancers
- They could also help us gain a deeper understanding of living and robotic systems

Legal and ethical concerns:

- They could be used for malevolent purposes
- Some argue, artificially making living things is unnatural and like you are "playing God"
- Risk of more advanced xenobots that live longer and reproduce could out-compete other species

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Genesis Therapeutics raises $4.1M in Seed Funding – Nov 21, 2019

- Genesis Therapeutics – a biotech company harnessing breakthrough AI-technology to optimize drug discovery and development
- The 4.1M seed funding as led by Andreessen Horowitz and Felicis Ventures as a major investor
- The company aims to discover and develop innovative small molecule drug candidates for the treatment of patients with severe and debilitating disorders
- The company originated in Pande Lab at Stanford
- Principal founder and CEO is Evan Feinberg
- Co-founder: Ben Sklaroff
- Backed by: Vijay Pande. Ph.D.
- The company actively partners with biopharmaceutical companies to launch select novel therapies

Sanofi buys cancer-focused biotech – December 10, 2019

https://www.ft.com/content/cd45a262-1a6e-11ea-97df-cc63de1d73f4

- Sanofi, the French drugmaker, is make a strategic shift to intensify its focus on key growth areas such as oncology, rare diseases and immunology and stop research into diabetes and cardiovascular disease
    - Sanofi has been seeking to strengthen its portfolio following the loss of patent protection on key diabetes treatments and political pressure in the US over the cost of insulin
- Chief executive Paul Hudson announced that its consumer healthcare division will become a standalone business
- The company signalled this shift when they announced that it was buying Californian biotech Synthorx for $2.5B
- The US-headquartered Merck also stated that they would acquire another cancer-focused biotech, ArQule for $2.7B
    - Because of its advances in precision medicine for cancer, including a leukemia drug in the early stages of clinical development
    - Cash deal of $20 a share → 107% premium to ArQule's closing price
- Sanofi will acquire all of Synthorax's outstanding shares for $68 a share in cash – a 172% premium to Synthorx's closing price on Friday

- Astellas Pharma/ADR announced they will be buying Audentes Therapeutics Inc for $60 per share – total equity value of $3B

Is Cloud Computing the Answer to Genomics' Big Data Problem?

- In 2018 alone, over 40% of FDA-approved drugs had the capacity for being personalized to patients, largely based on genomics data

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- The ever-increasing use of genomics has led to plummeting costs of sequencing a genome
    - The 1st sequence genome (as part of the Human Genome Project) cost 2.4B euros and took around 13 years to complete
    - Today, you can get your genome sequenced in less than a day for under 900euroes
- According to the Global Alliance for Genomics and Health, more than 100 million genomes will have been sequenced in a healthcare setting by 2025
    - Most of these will have been sequenced as part of large-scale genomic projects stemming from 1) big pharma and 2) national population genomics initiatives
- 1 whole human genome sequence produces approximately 200 gigabytes of raw data
- The massive amount of data can partially be managed through data compression technologies (with companies such as Petagene) but that doesn't solve the whole problem
- Genomics data analysis however normally generates an additional 1—gigabytes of data per genome for downstream analysis, and requires massive computing power supported by large computer clusters → this is still economically unfeasible for the majority of companies and institutions (this requires high-performance computers)
- Cloud computing has emerged as a viable way to analyze large datasets quickly, without having to worry about maintaining and upgrading servers
    - A pay-as-you-go model allowing you to rent computational power and storage
    - This is especially helpful for small life science companies
- Univa is the industrial leader in workload scheduling in the cloud and HPC
    - They say that 90% of organizations requiring high performance computing capacity has moved, or are looking into making, to the cloud
    - Sano Genetics is a startup based in Cambridge that carries out large data analyses for researchers using services in the cloud
- ON the cloud, data can be downloaded directly to the cloud and removed once the analyses are finished
- Cloud resources are allocated in virtualized slices called "instances"
    - Each instance hardware and software is pre-configured according to the user's demand, ensuring reproducibility
- Medley Genomics (a US-based Startup) has moved all company operations to the cloud in 2019 in a partnership with London-based Lifebit
- The cloud allows seamless collaboration and reproducibility – which are essential for research and drug discovery

Limitations preventing widespread adoption of the cloud by the field of drug discovery

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- Long-term cloud storage is more expensive than the HPC counterpart- cloud solutions charge per month per gigabyte
- Computations cost of a single analysis is five times more expensive compared to an HPC solution in many scenarios
    - It is expected that as cloud technologies continue to progress and the market becomes more competitive, prices will come down
    - While cloud providers have developed protocols to ensure the data is safe, some risks still exist
        - Privacy remains the main obstacle for pharmaceutical companies to fully embrace the cloud

Current players in the cloud genomics space

- 86% of cloud customers rely on 3 main providers: AWS (Amazon), Azure (Microsoft)
- Other companies like London-based Lifebit's technology allows users to run any bioinformatics analyses through any cloud provider with a user-friendly interface

Mayo Clinic to Sequence Genomic Data from 100K Participants
https://healthitanalytics.com/news/mayo-clinic-to-sequence-genomic-data-from-100k-participants

- Mayo Clinic is sequencing genomic data from 100,000 consented participants in partnership with Helix, a population genomic company
    - Together, they will create a library of genomic data to improve patient care
- They plan to use Helix's clinical Exome+ sequencing technology to reads all 20,000 genes that code for proteins, as well as hundreds of thousands of regions outside the protein-coding regions that are known to be informative and impactful to a person's health
    - This DNA test uses next generation sequencing technology to screen the exome for genetic variants that can significantly increase the risk of disease
- Participants' DNA will undergo Exome+ sequencing with results returned over time to the participants, as well as their Mayo Clinic provider
    - This will allow Mayo to evaluate the benefits of Exome+ sequencing and the short- and long-term effects of health-related outcomes, healthcare utilization, and physician acceptance
- This collaboration will also support research at the Mayo Clinic Center for Individualized Medicine

Human Genome Stuck in 5700-year old "Chewing Gum" Sequenced
https://www.genengnews.com/news/human-genome-stuck-in-5700-year-old-chewing-gum-sequenced/

- A 5700 year old birch pitch was recently found in Lolland, Denmark

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- The DNA in this birch pitch has now been sequenced to yield a complete human genome
    - The genome was assembled by scientists based at the University of Copenhagen
    - It belonged to a female who likely had dark skin, dark brown hair, blue eyes, and genetically more closely related to western hunter-gatherers from mainland Europe than those from central Scandinavia
- This marks the first time that an entire ancient human genome has been extracted from anything other than human bones

Researchers finally sequence Giant Squid's Entire Genome
https://futurism.com/the-byte/researchers-sequence-giant-squid-genome
https://phys.org/news/2020-01-mysterious-legendary-giant-squid-genome.html
- January 16th, 2020

- For the first time, scientists at the University of Copenhagen and Marine Biological Laboratory researchers have sequenced the entire genetic code of a giant squid
- They found several oddities in the giant squid's DNA – genes that are rarely found in other invertebrates
    - Researchers spotted over 100 genes in the giant squid's genome that aren't typically found in invertebrates – 1 linked to brain development which may help to explain why giant squid have vastly more complex brains than other invertebrates
    - They also identified more than 100 genes in the protocadherin family – typically not found in abundance in invertebrates
        - These are thought to be important in wiring up a complicated brain correctly
- The giant squid's full genome was just about 90% (2.7 billion DNA base pairs) the size of the human genetic code
- In terms of their genes, they look a lot like other animals → this means they can use this to study more about humans
- Important developmental genes in almost all animals were present in single copies only in the giant squid genome
    - This means the giant squid did not get so big through whole-genome duplication
- They also analyzed a gene family that is so far, unique to cephalopods, called reflectins
    - Reflectins encode a protein that is involved in making iridescence