Digital Health for All – Hype or Hope?

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Previously with AstraZeneca, Pfizer, GlaxoWellcome, Hoffman La-Roche

What is digital health / healthtech?

Why is it rising in importance?

The coming together of several digital technologies ➡ synergy

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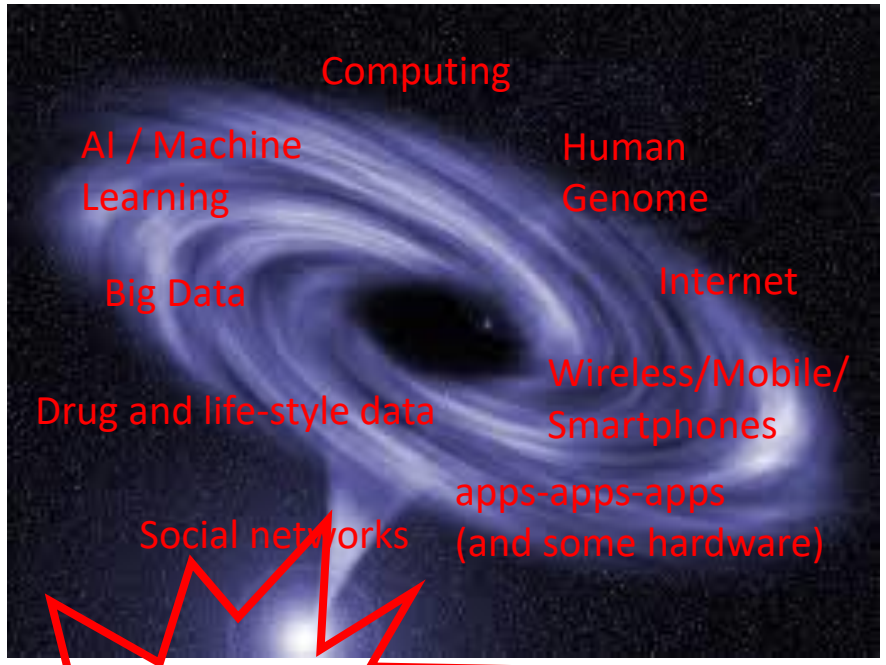


Transformation of medicine and healthcare

Genome - the DNA you inherited from your parents (and mutations acquired in your lifetime).

Transcriptome - DNA makes RNA which has many functions

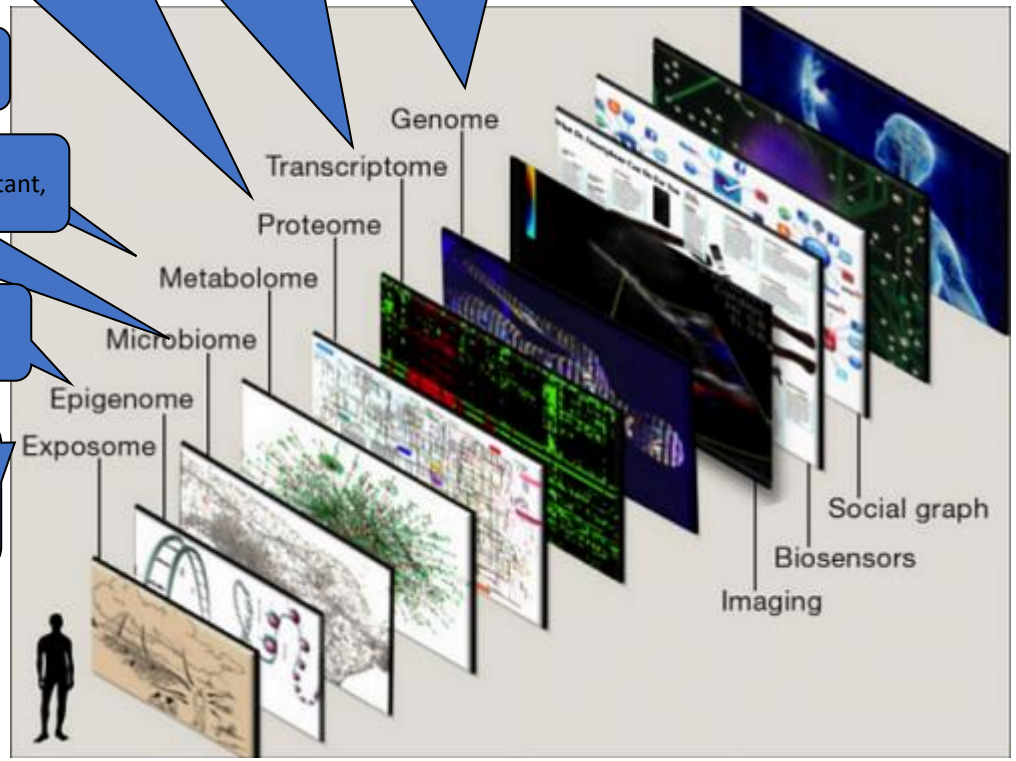
Proteome - the proteins coded by your DNA / RNA

Proteins get modified by other proteins (enzymes)

Bacteria in your gut contain 10x more DNA, may be just as important, and change all the time

Chemical changes to your DNA and histone proteins. ('Methylation') Your lifestyle modifies your DNA!!!

And not only DNA is modified by the environment, proteins etc are too.
Lifestyle, finances, mental state etc



It's not just your genome

The majority of disease causation is non-genetic.

Nature vs Nurture - genes vs environment - it is blurred.

Environmental exposures cause permanent genetic changes via mutagenesis and also have long-term impact on gene expression through epigenetic mechanisms.

Why healthtech matters: Change is needed urgently

We really do need change (1)…

This is where we are now.

JAMA on <u>your</u> medical record

Primary care → Specialist:
50% of data from primary care to specialist gets lost.

Specialist → Primary care:
25% specialist opinions do not get back to primary care.

Hospital → Primary care
48% hospital discharge records are wrong on your medical history
75% of your medical information after hospitalisation comes from you personally on next visit primary care visit.

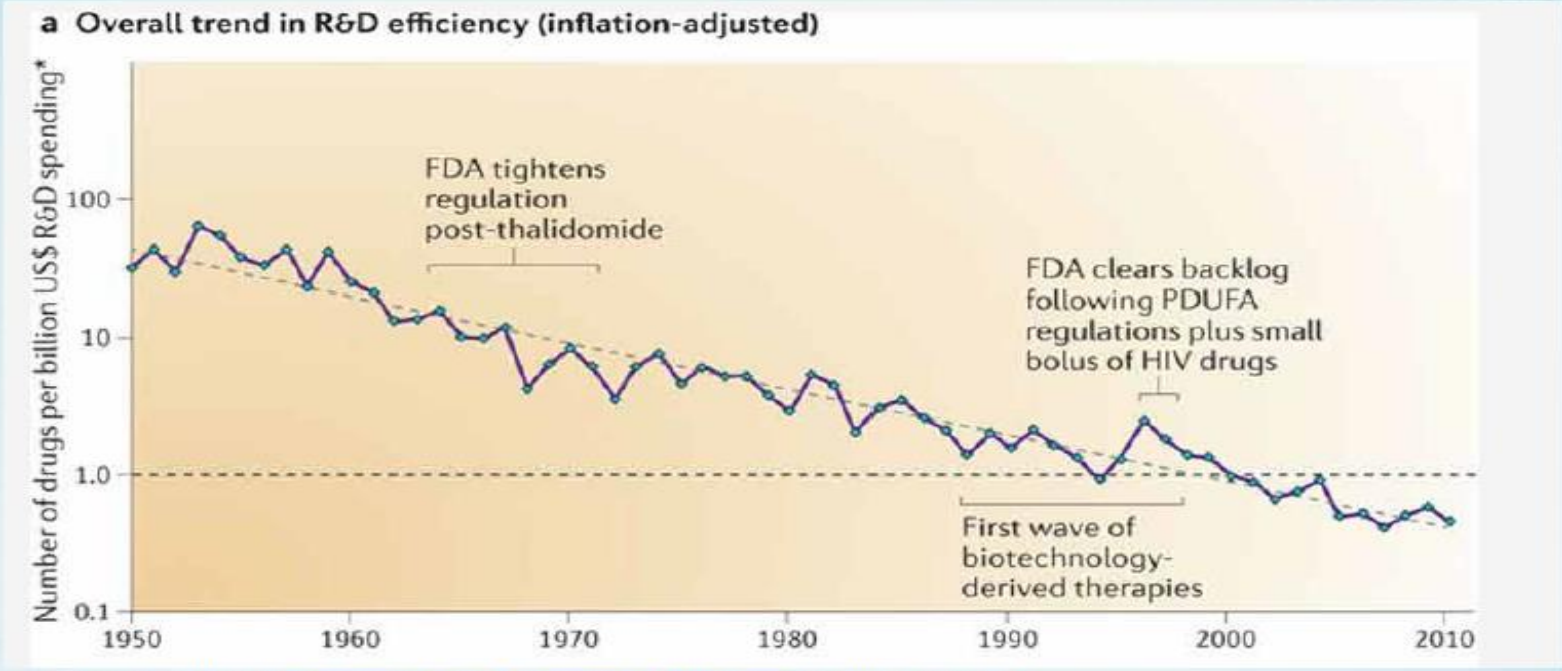
Source data from the Journal of American Medical Association (JAMA) in these two studies:
http://jama.jamanetwork.com/article.aspx?articleid=205790 and
http://archinte.jamanetwork.com/article.aspx?articleid=226367

We really do need change (2)...

EROOM'S LAW
MOORE'S LAW

The Problem

Discovery of new medicines is declining continually.
The old methods are not working sufficiently well.



Source: Nature Reviews, Diagnosing the decline in pharmaceutical R&D efficiency; Jack W. Scannell, et al.

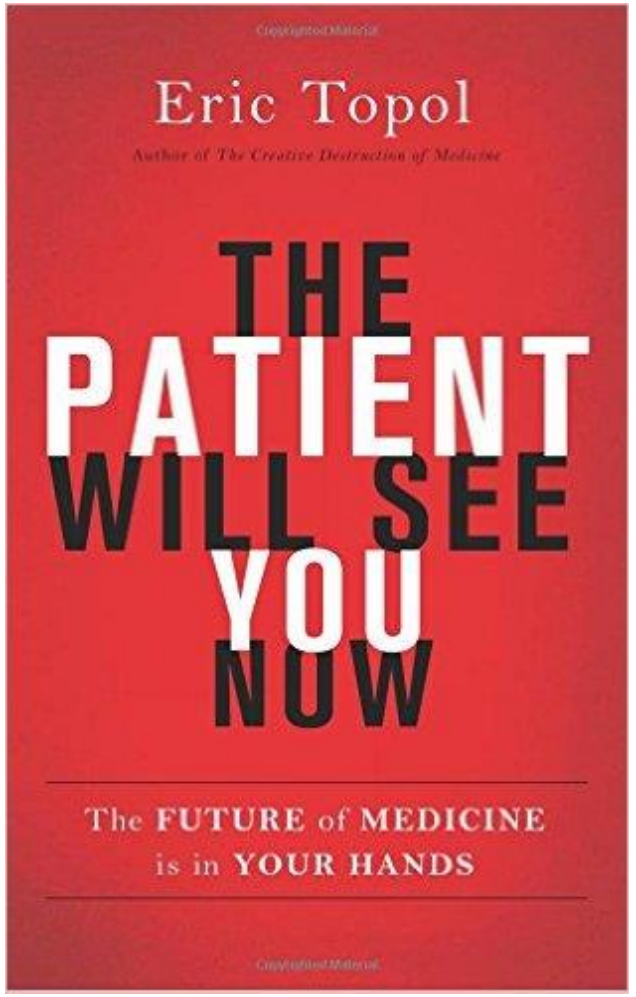
- 29 drugs out of 30 tested fail: $5M - 10M in sunk cost each
- 2/3 of tested compounds never make it to human clinical trials

CYCLICA

A view from a leading cardiac consultant and researcher

Dr. Eric Topol is a leading cardiologist and professor of genomics

" The future of medicine is in your hands."



Some quotes from his book

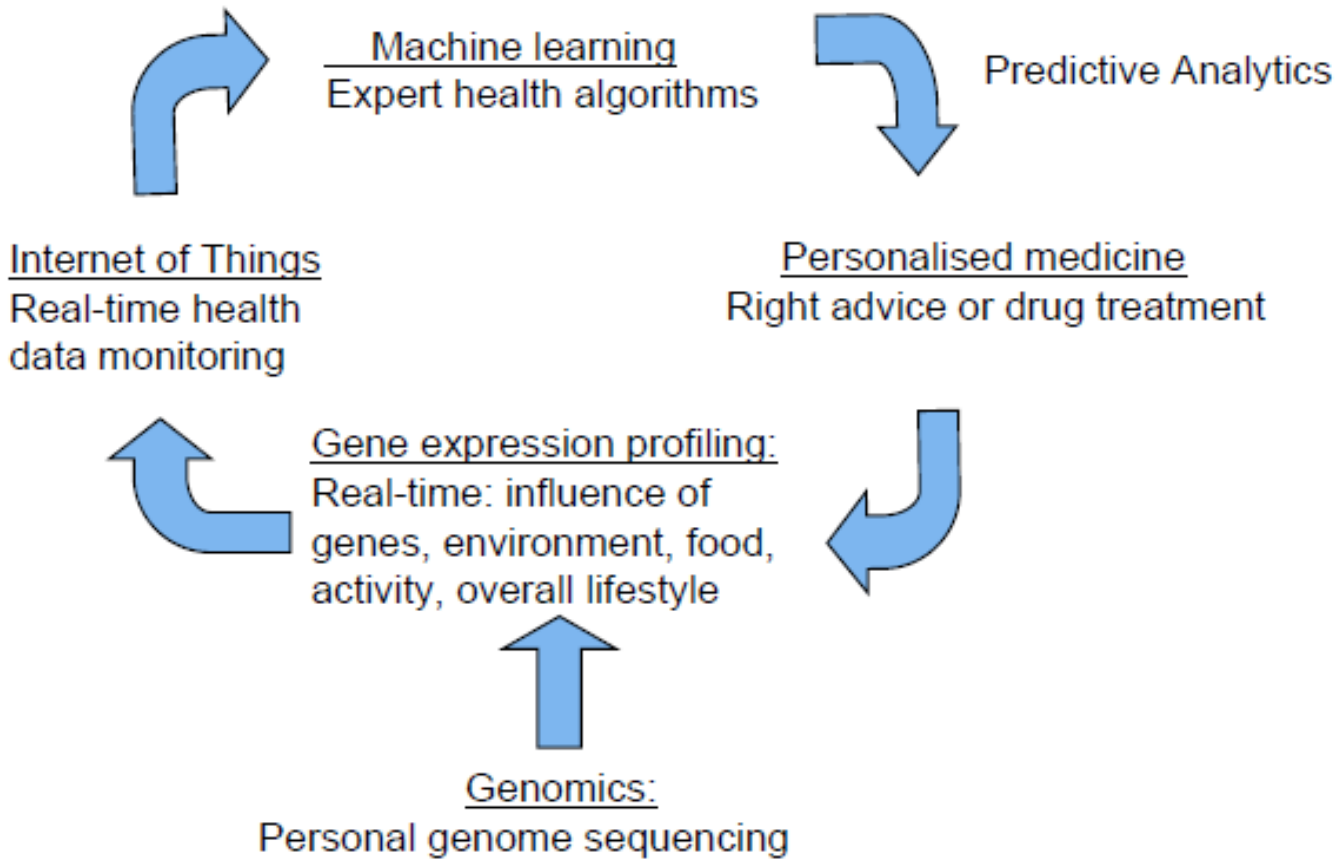
"Medicine is remarkably conservative to the point of being properly characterized as sclerotic, even ossified."

"Beyond the reluctance and resistance of physicians to change, the life science industry (companies that develop and commercialize drugs, devices, or diagnostic tests) and government regulatory agencies are in a near paralyzed state, unable to break out of a broken model."

"Without the active participation of consumers in this revolution, the process will be inexorably slowed. All the other forces that could come to bear—doctors, the life science industry, government, and health insurers—are incapable of catalyzing this transformation."

Eric Topol

The health learning circle



This vision depends on the I-o-T

Now becoming possible with 5G

- Fed by sensors (wearables, clothing etc)
- 'Intelligent' apps
- Real time data collection and analysis
- Massive data storage and analysis requirements
- Will drive new consumer goods and business opportunities
- Multi-trillion-dollar market
- Reorganisation of healthcare industry
- Impact on healthy ageing and future growth of a huge longevity industry

Progress requires the following
(business opportunities)

- Information security
- Seamless public and private cloud computing
- Agreement on standards
- Next-generation analytics
- New storage management technologies
- New data access tools and processes
- Automatic tagging of data
- Ability to deal with real-time data

Genomics data storage size could far exceed all other domains

Stephens ZD, Lee SY, Faghri F, Campbell, RH, Zhai C, Efron MJ, et al. (2015)
Big Data: Astronomical or Genomical?
PLoS Biol13(7):e1002195.doi:10.1371/journal.pbio.1002195

We therefore estimate between 100 million and as many as 2 billion human genomes could be sequenced by 2025, representing four to five orders of magnitude growth in ten years and far exceeding the growth for the three other Big Data domains. Indeed, this number could grow even larger, especially since new single-cell genome sequencing technologies are starting to reveal previously unimagined levels of variation, especially in cancers, necessitating sequencing the genomes of thousands of separate cells in a single tumor [10].

My view: Healthcare predicted to be the largest generator of data…yet the figures in that paper may be a massive under-estimate. Why?

- Genomes sequenced to date have been whole exome. Future focus will be whole genome.

- More than genome will be needed, much more!

  Phenotype data also required. Gene expression data, physiological changes, real time diagnostics and prognostics, feedback etc. T

- And eventually live data collection and analysis will be in demand for most humans via Internet-of-Things
  - Data from embedded systems, the signals from which are a major component of the Internet of Things, grew from 2% of the digital universe in 2013 to 10% in 2020. Healthcare will push it much higher in the 2020s.

    The Healthcare Learning Circle.

The winners in digital healthcare may not be the current dominant healthcare players

Business Model Innovation is

More Powerful than Technology Innovation.

Those Without a Legacy Have

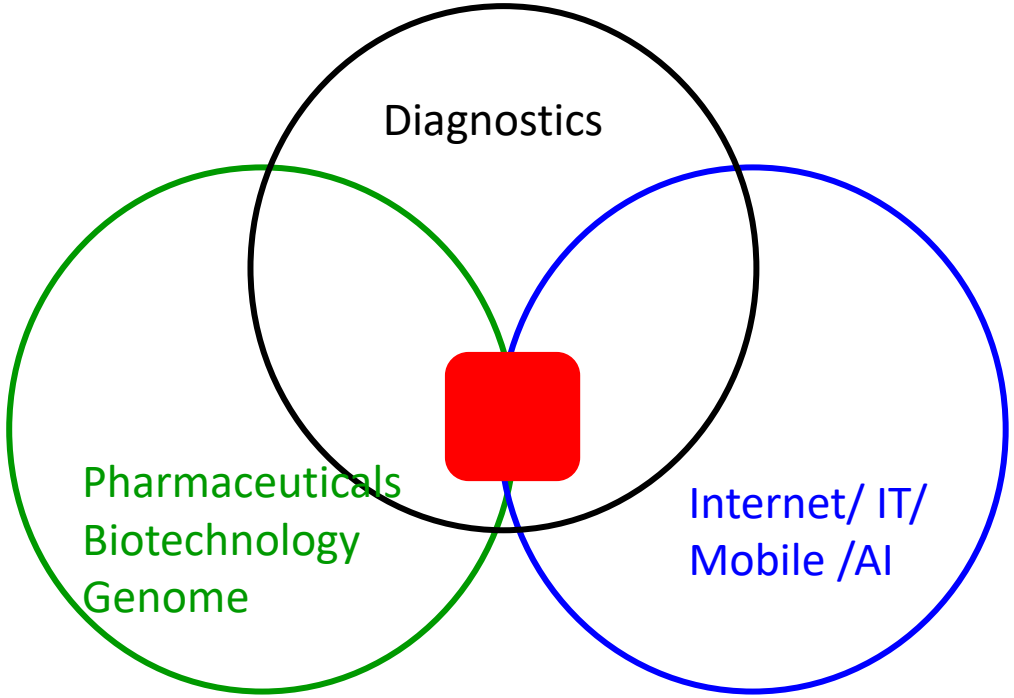
Fewer Barriers to Adopting Radical Innovations

Three business models will merge:

- Pharma/biotechnology
- Diagnostics
- Internet

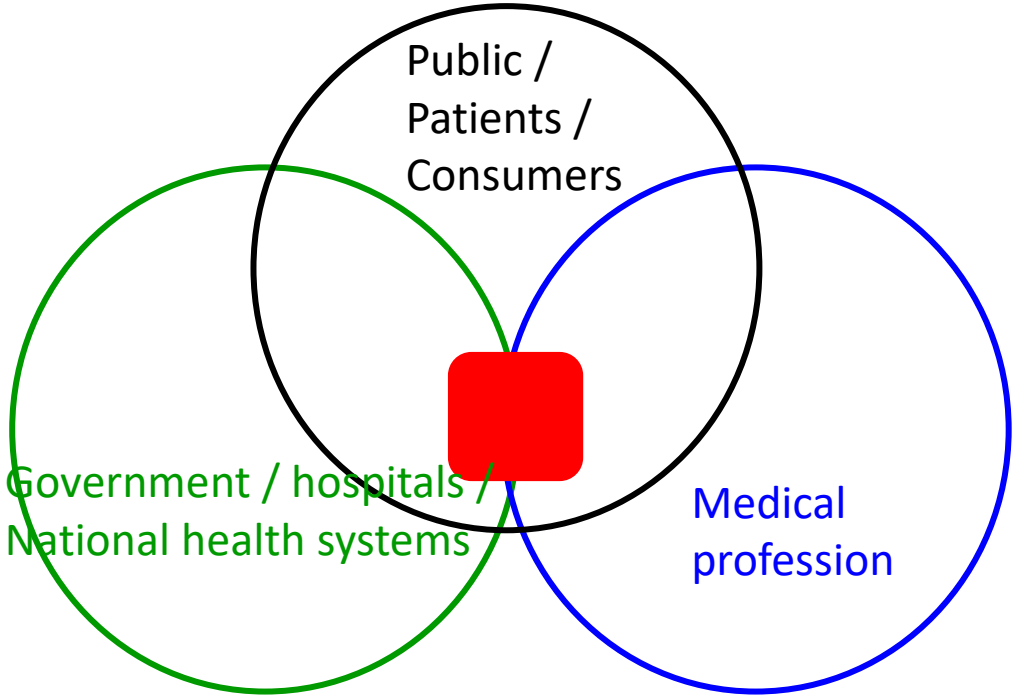
...creating a totally new business model

The new healthcare…
Businesses



New business models.
Current businesses will be challenged and over-taken.

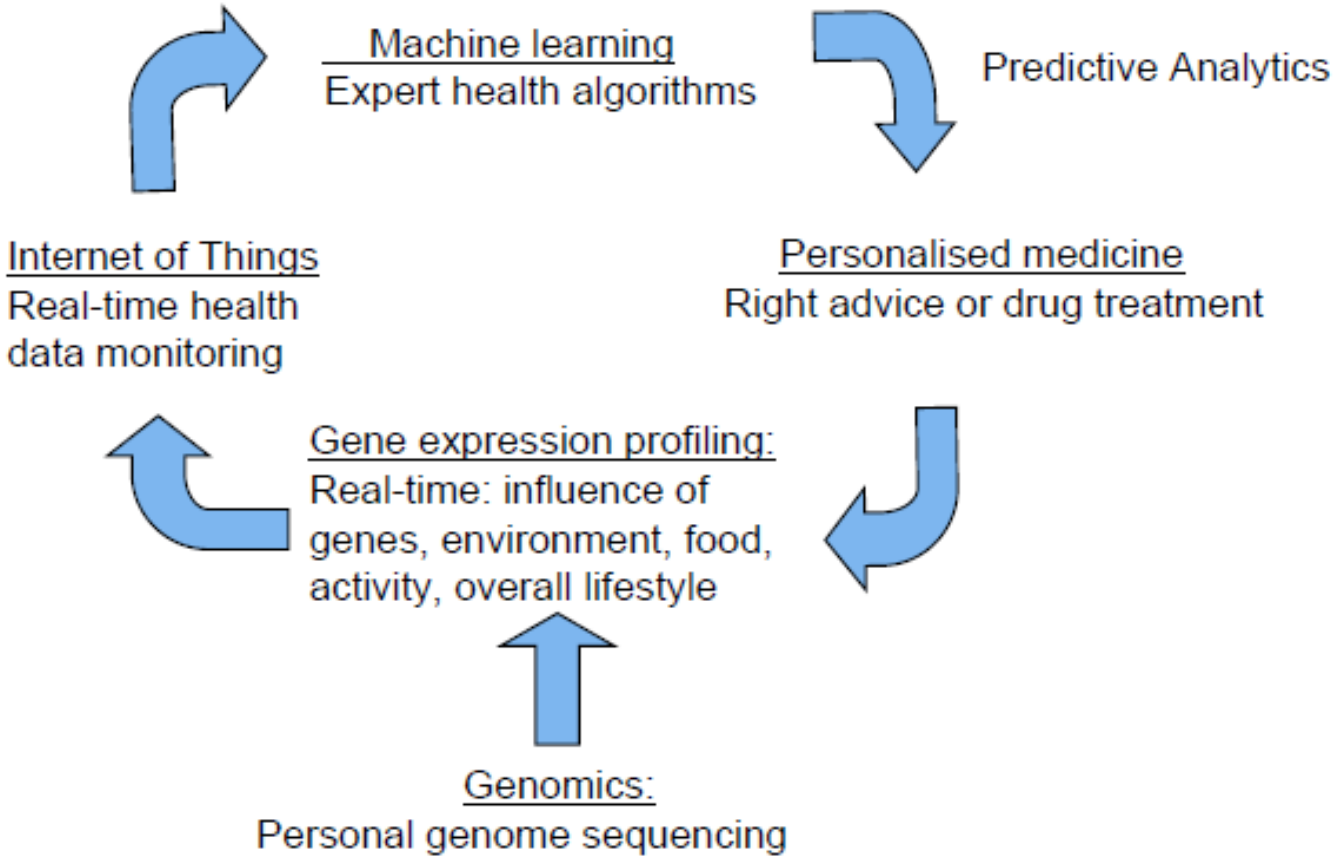
The new healthcare…
People



Massive change in all three sectors

Please keep this slide in mind, and find ways to provide the pieces to make it happen.
A life well lived!

The health learning circle



15 pointers to succeed as an entrepreneur

1. Have HUGE ambition – transform globally - anything less will not get funded
2. Aim for Trillion-dollar markets
3. Have a compelling vision and Founder story
4. Founder Mojo – read the paper by Suranga Chandratillake at Balderton Capital
5. Know your customers, competition, NPV, exits for investors. That's what they care about
6. Find a board chair (as co-founder if possible) who has done it before successfully - shares your vision - and does not want to steal your glory. The MOST IMPORTANT appointment of all
7. Work your board to death - use their skills to fill skill-gaps in your management team
8. Understand the company's finances and accounts
9. As founder, you need very experienced executives to lighten your management load, you focus on the long-term
10. Take the money when it appears, even if not needed yet, if the investor is right for your company
11. The unexpected will happen. Things will take longer than planned. Be sure you have a Plan B.
12. Surround yourself with positive thinkers (remove 'non-deliverers', 'blockers', 'controllers', 'selfish')
13. Use OKRs rigorously
14. Look after your health, family etc. Take family holidays. Take a long weekend every 6 weeks. Off-line. Meditation helps.
15. Hang in there through the hard times!