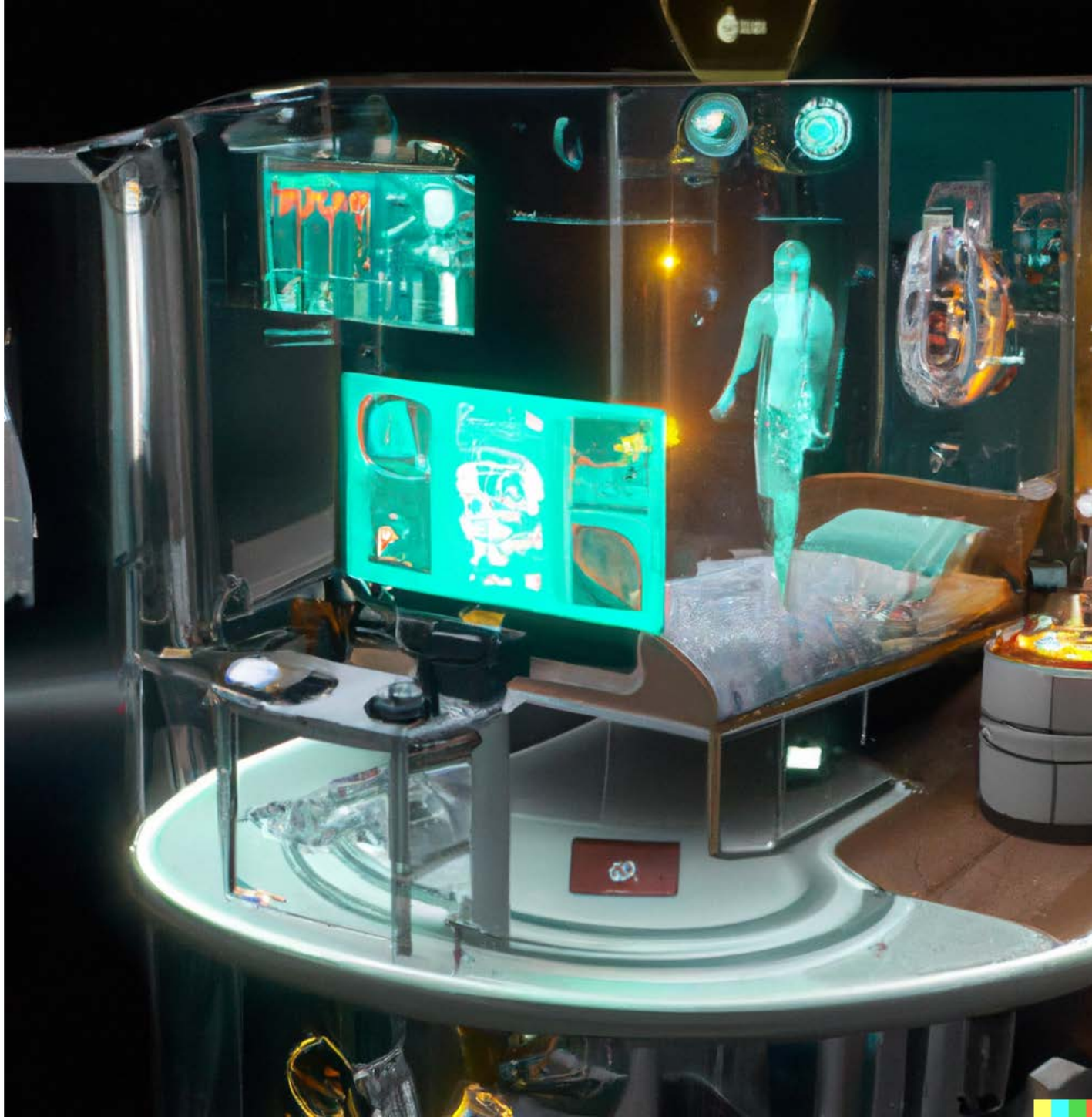
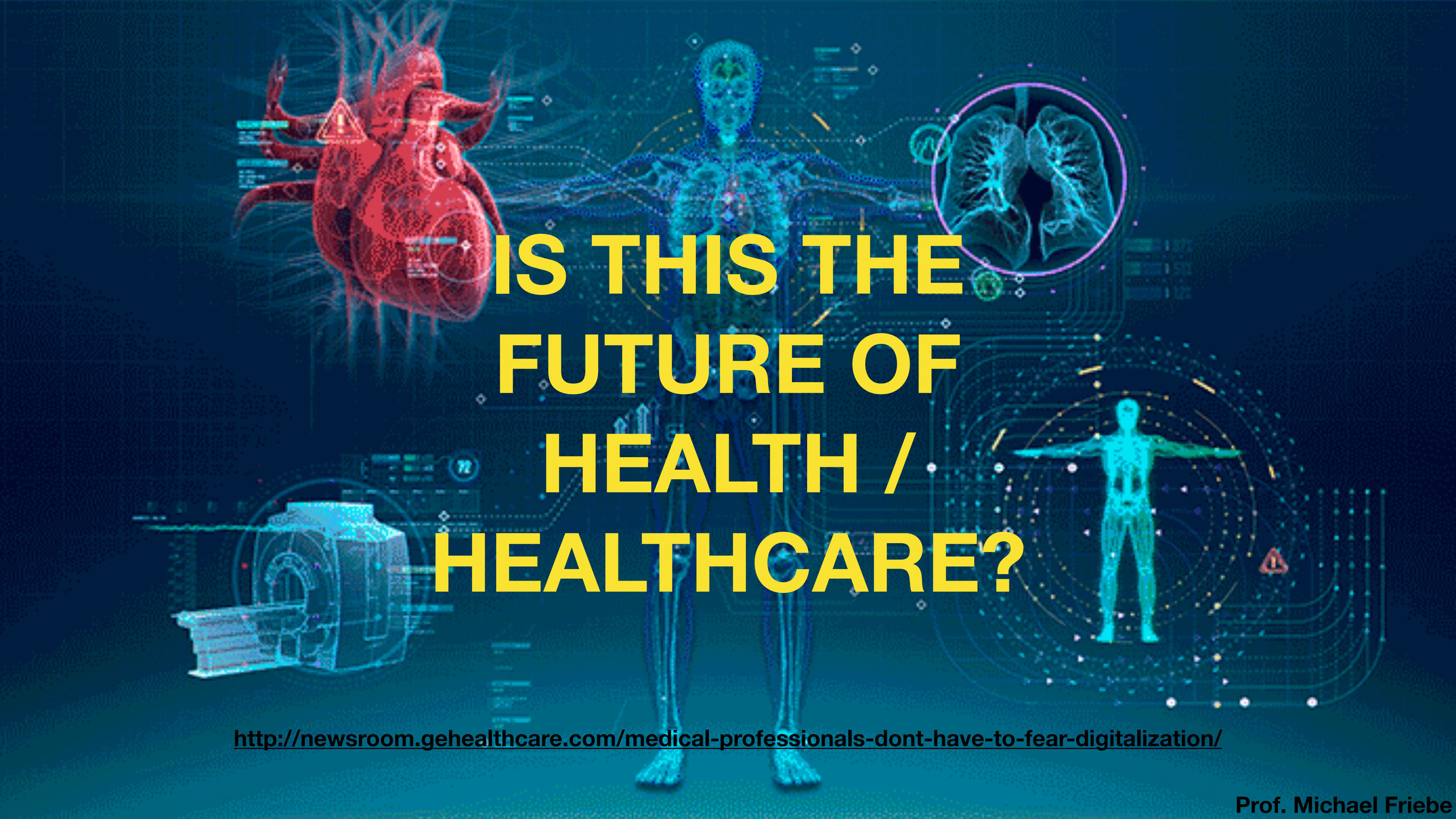
Exponential Technologies + Global HEALTH 3.0 Disruption

What should our development goals be?



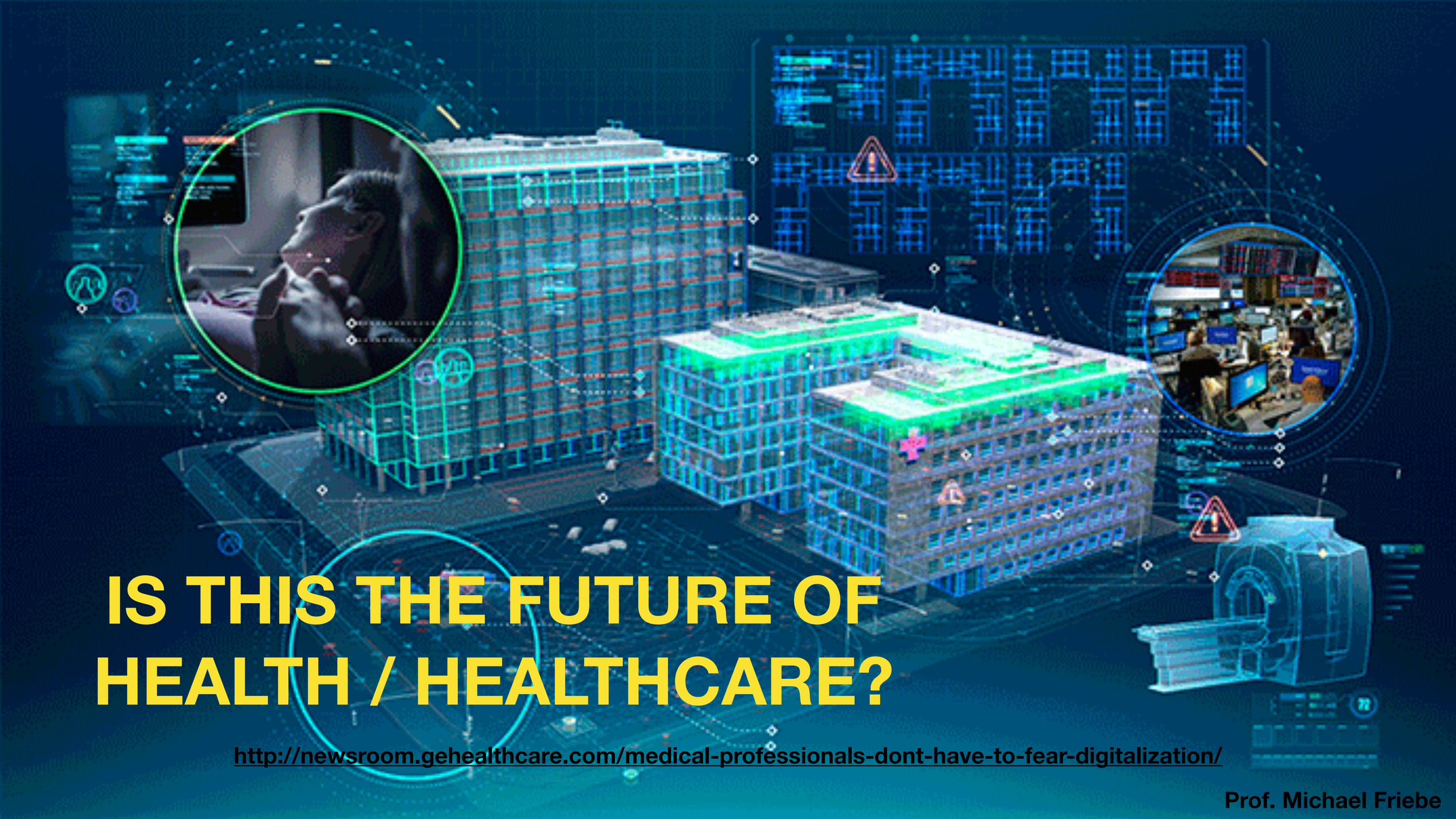
Prof. Michael Friebe



http://newsroom.gehealthcare.com/medical-professionals-dont-have-to-fear-digitalization/

Let's put the power of exponential technologies into patient's hands and revolutionize how we live.
We are edging closer towards a dramatically extended healthspan.
Where "100 years old can become the new 60"
—Peter Diamandis, MD

https://doi.org/10.1007/978-3-031-08191-0



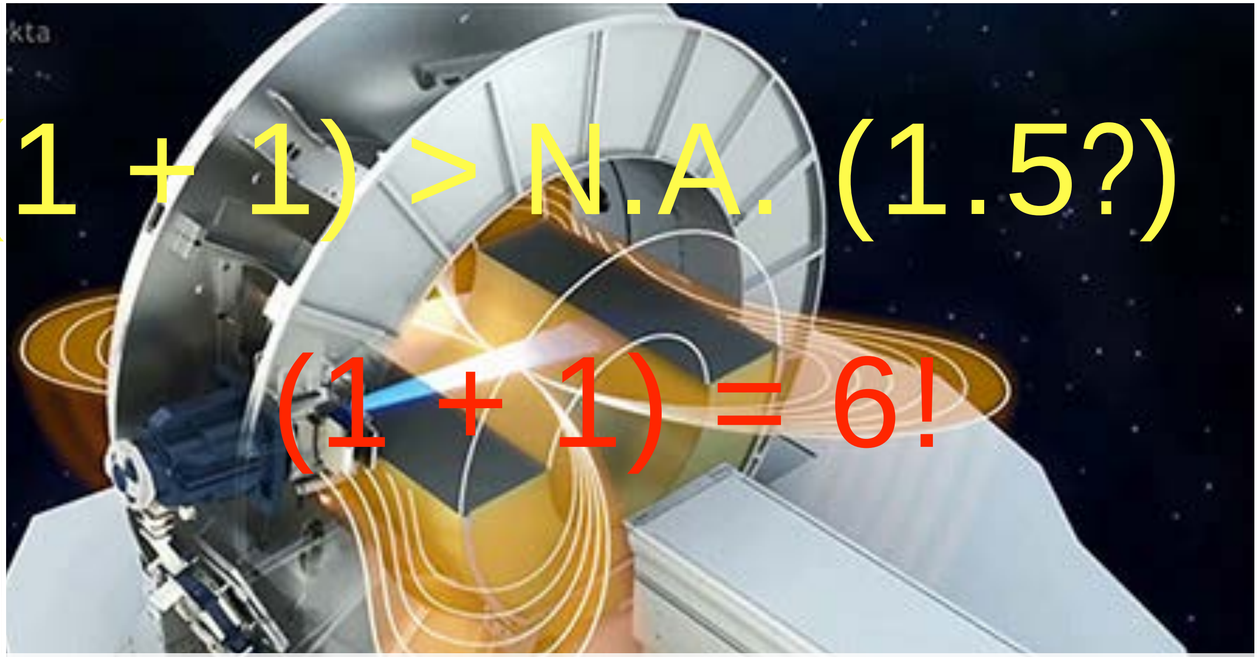
IS THIS THE FUTURE OF HEALTH / HEALTHCARE?

http://newsroom.gehealthcare.com/medical-professionals-dont-have-to-fear-digitalization/

Prof. Michael Friebe

Is this the FUTURE in Healthcare?

Will these devices be the ones that benefit everyone?



Performance: (1 + 1) > N.A. (1.5?)

Cost: (1 + 1) = 6!

Gene Saragnese, CEO Imaging at Philips Healthcare, says:

> *"This is an exciting development that could benefit many current and future cancer patients. Cancer is a major global disease that we hope to control with more targeted treatments. MRI is emerging in oncology applications because of its excellent real-time 3D visualization of soft tissue. Together with our partners, all leaders in radiation therapy delivery, we are convinced that the integrated MRI-guided radiation therapy system has the potential to become a game changer in cancer care on a global scale."*

Niklas Savander, President and CEO of Elekta, also has high expectations:

> *"We expect that high-field MRI-guided radiation therapy will become the standard of care within the next 10 years."*

Medical technology OEMs have to innovate and develop solution benefits, not just product features, in order to stay competitive and relevant.

'It is paramount to keep in mind that the incentive to purchase/procure a medical device is very different from the benefits that are perceived as critical by the end users'

What is driving Health Innovation at the Moment?

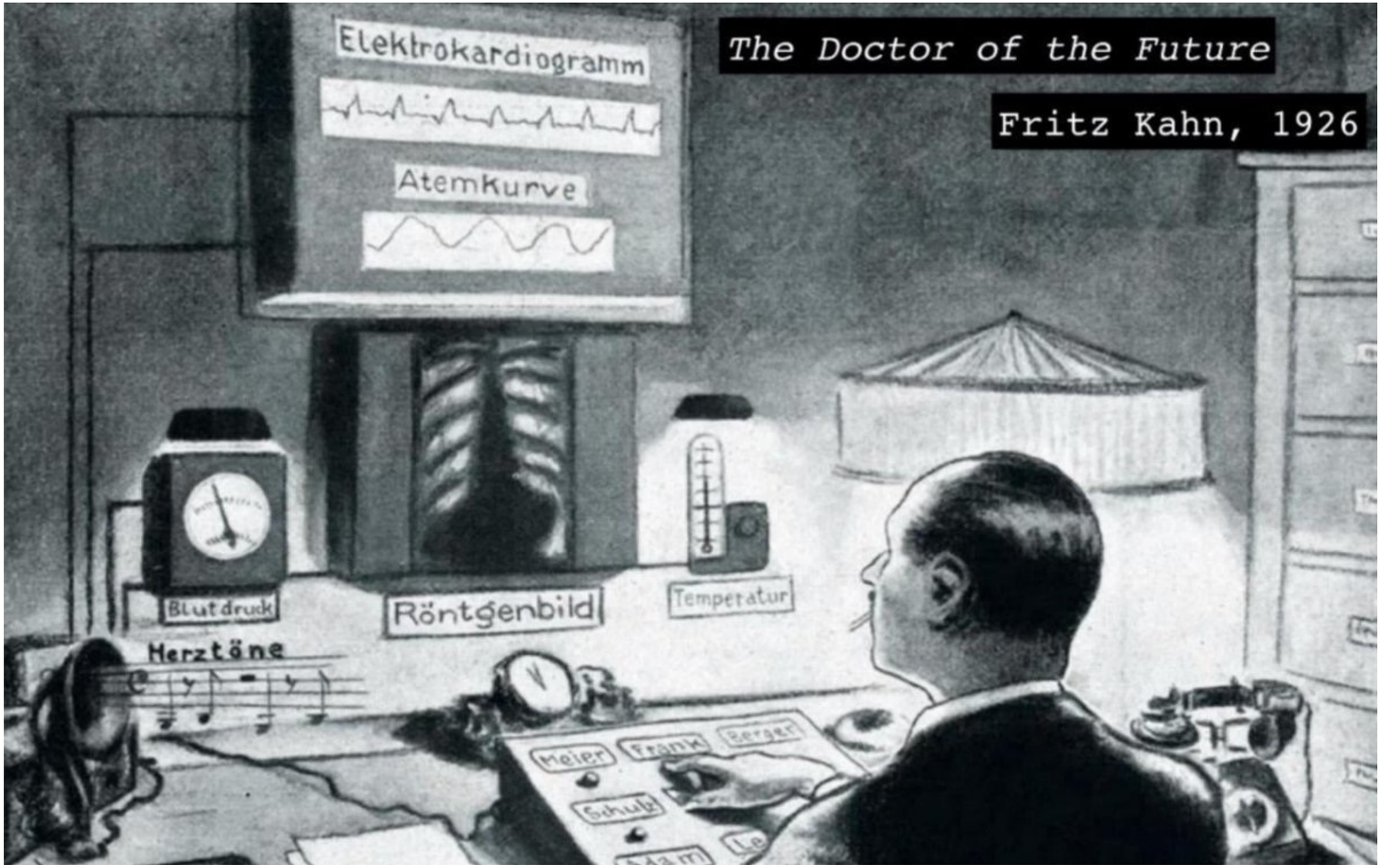
What does the Doctor want (Radiologist / Urologist / Cardiologist / …)?

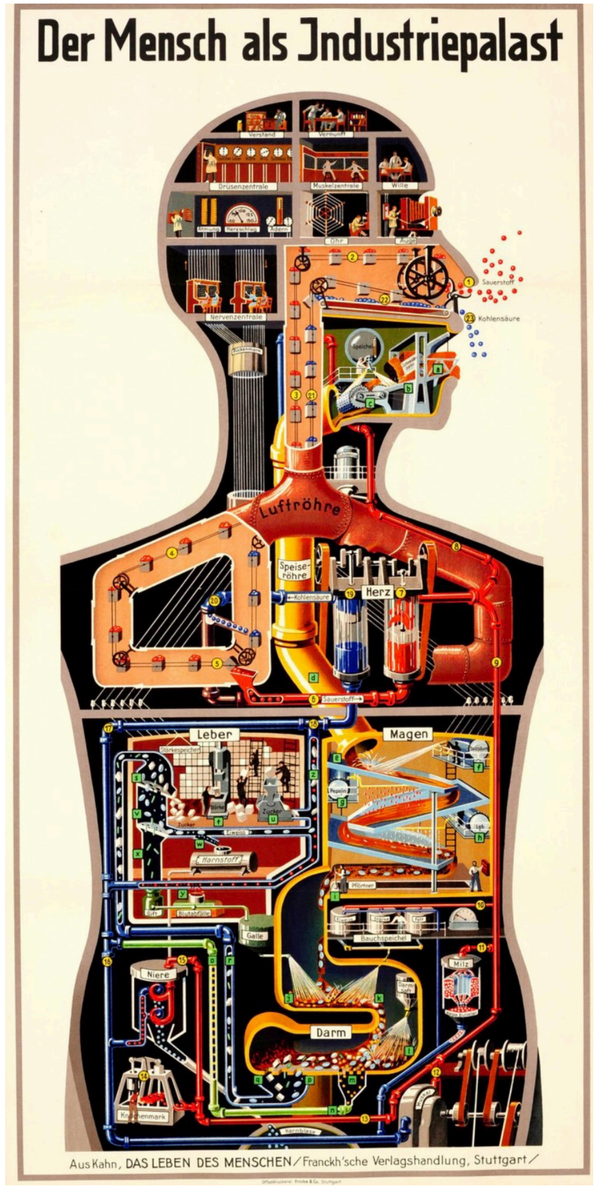
What does the Hospital want?

What does the Health Investor want?

What do YOU in your interaction with the HC System want?

All these talks are about the future of Healthcare and Healthcare delivery ...





Healthcare will change dramatically in the coming years ...

Heard that one before ... many times ... every conference I attend …

BUT WHY?

... AND WHY IS CHANGE REALLY NEEDED?

... AND WHAT DOES THAT MEAN FOR FUTURE INNOVATION (and EDUCATION)?

What has happened to US Healthcare in 40 yrs?

Metric	1975	Now
N of healthcare jobs	4 million	> 16 million (#1 US economy)
Healthcare spend per person	$550/yr	> $11,000/yr
Most expensive drug	$1200/yr	> $700,000/yr
Time allotted for office visits	60 min new, 30 min return	12 min new, 7 min return
% GDP healthcare	<8	18
Hospital daily room charge (avg)	~ $100	$4,600
Miscellaneous	None of these	Relative value units, EHRs, PBMs, "health systems"

Cost = our biggest problem??

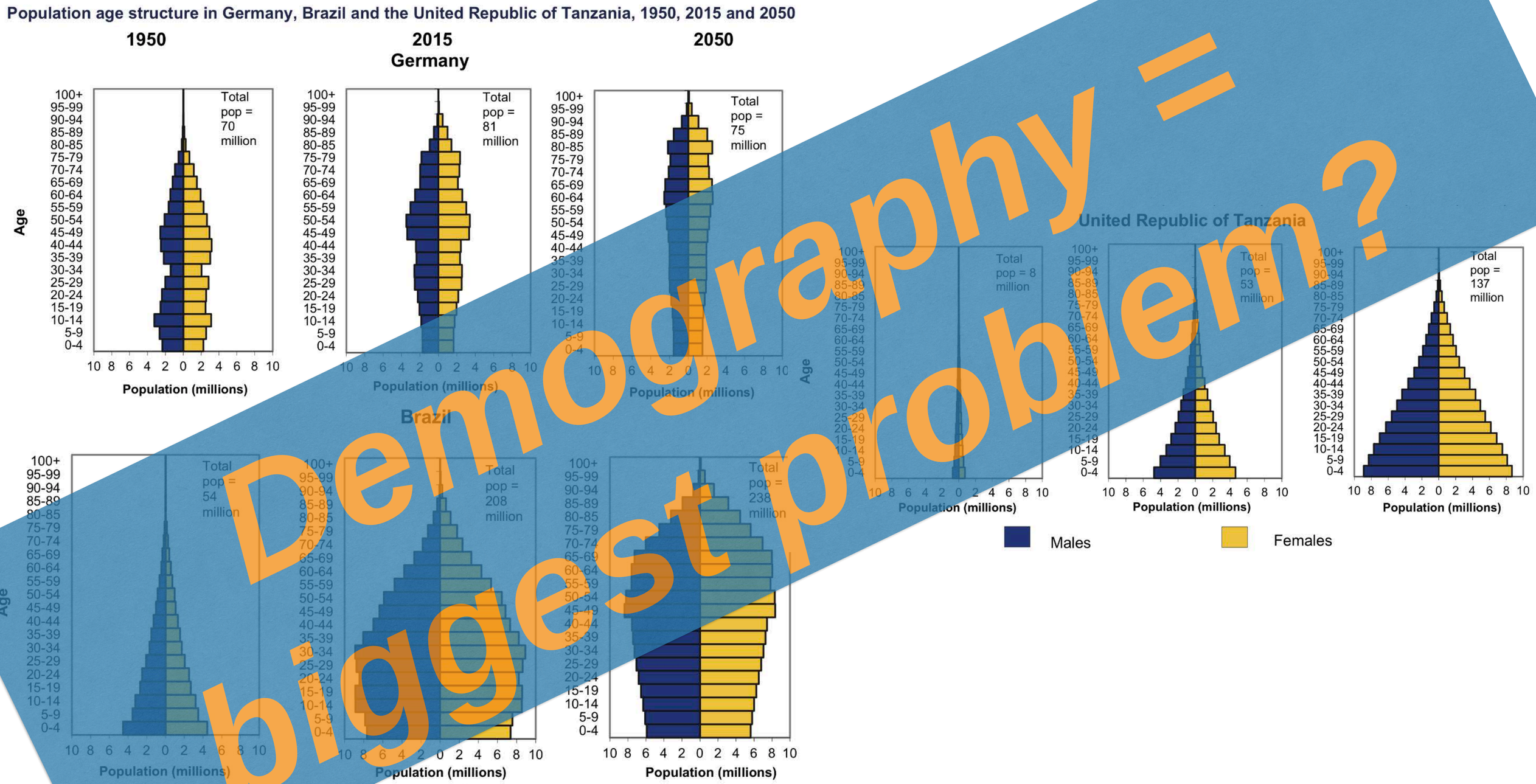
Eric Topol
@EricTopol

$ trillions are lost to non-communicable disease.

But **costs** are expected to **double** in the next decade.

Non-Communicable-Diseases?

Noncommunicable diseases (NCDs), also known as chronic diseases, are not passed from person to person. They are of long duration and generally slow progression. The 4 main types of noncommunicable diseases are cardiovascular diseases (like heart attacks and stroke), cancers, chronic respiratory diseases (such as chronic obstructive pulmonary disease and asthma) and diabetes.


Population age structure in Germany, Brazil and the United Republic of Tanzania, 1950, 2015 and 2050
1950
2015
2050
Germany
Total pop = 70 million
Total pop = 81 million
Total pop = 75 million
Brazil
Total pop = 54 million
Total pop = 208 million
Total pop = 238 million
United Republic of Tanzania
Total pop = 8 million
Total pop = 53 million
Total pop = 137 million
Age
100+
95-99
90-94
85-89
80-85
75-79
70-74
65-69
60-64
55-59
50-54
45-49
40-44
35-39
30-34
25-29
20-24
15-19
10-14
5-9
0-4
10 8 6 4 2 0 2 4 6 8 10
Population (millions)
Males
Females
Demography = biggest problem?

BIGGEST PROBLEMS FOR A HEALTHY AND LONG LIVE

- Dementia becomes increasingly common with age (32% for 80-89 yoa / 58% for 90-95 yoa)
- NCD's (Diabetes, Osteoporosis, Vascular Diseases, Cancer, Stroke, ...
- NUTRITION, HEALTH EDUCATION and ACTIVITY?
- ...

Getting old = biggest risk of dying!!

FUTURE HEALTHCARE PROBLEMS

- *Who pays for healthcare in the future? — Government? Private? Mix?*
- *How do we move from reactive treatments (Sickcare) to proactive prevention (Healthcare)?*
- *How do we democratize Healthcare?*
- *Should Healthcare be a business or is it a basic need / right?*
- *How do we avoid unequal Healthcare and delivery problems between rural and urban areas will cause social unrest!?*
- *Problems with lack of Medical Staff?*
- *Regulation, ethical issues, ...*
- *... and many more!*

And enough reasons to believe in HEALTH DISRUPTION

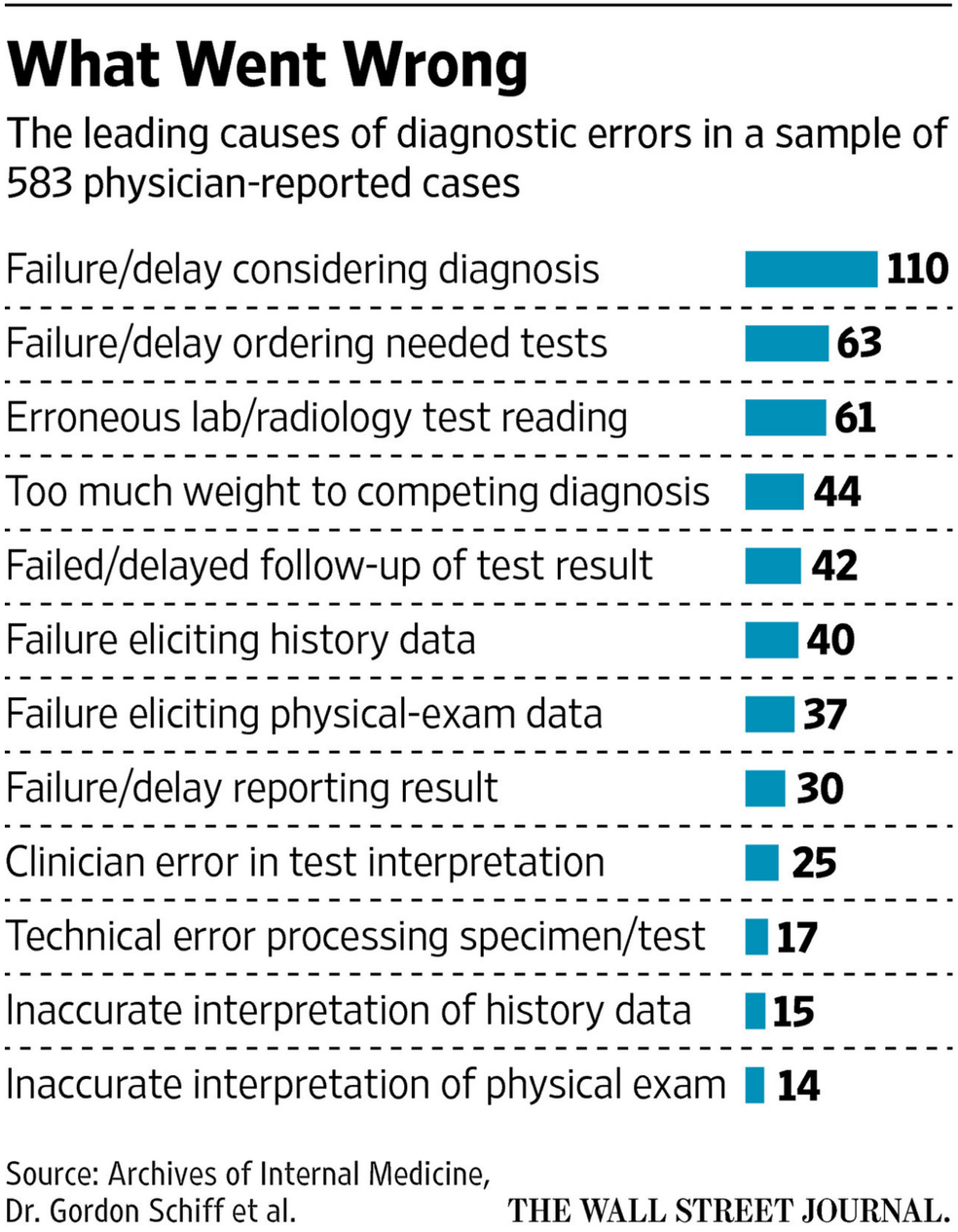
All of them provide INTERNATIONAL innovation opportunities


Healthcare does not like disruption and isn't agile. In fact, it's pretty close to the bottom of nimble industries.
Healthcare today is reactive, retrospective, bureaucratic and expensive.
It's sick care, not healthcare.

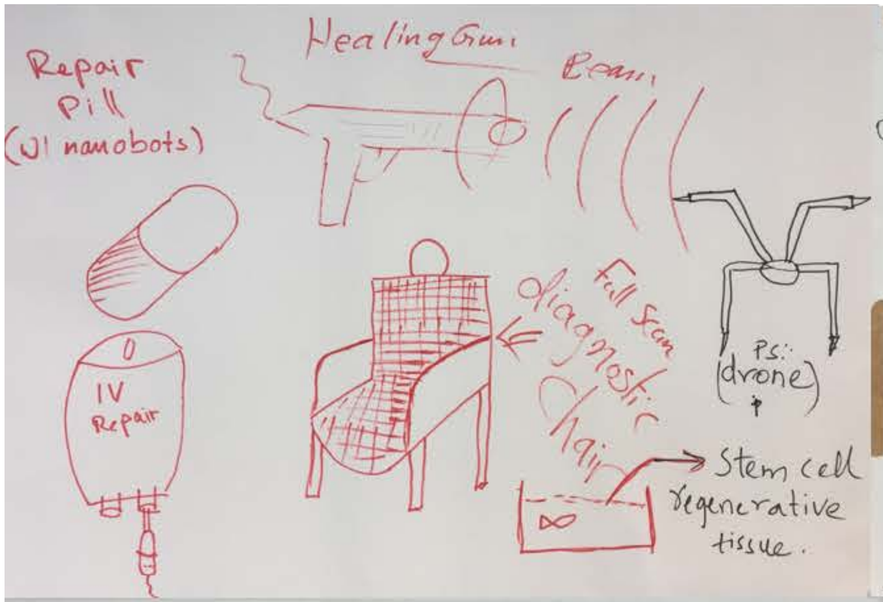
- 30% of care provided is useless
- 45% of the necessary interventions are missed
- Medical errors are the #3 cause of death
- 25% of all costs in HC are related to Administration
- JHU estimated that 250.000+ die every year because of lack of data and mistreatment
- Fake medicine kills 1.000.000 people
- Only 4% of the approved pharma is for neglected diseases
- 120.000 surgeons are missing by 2030

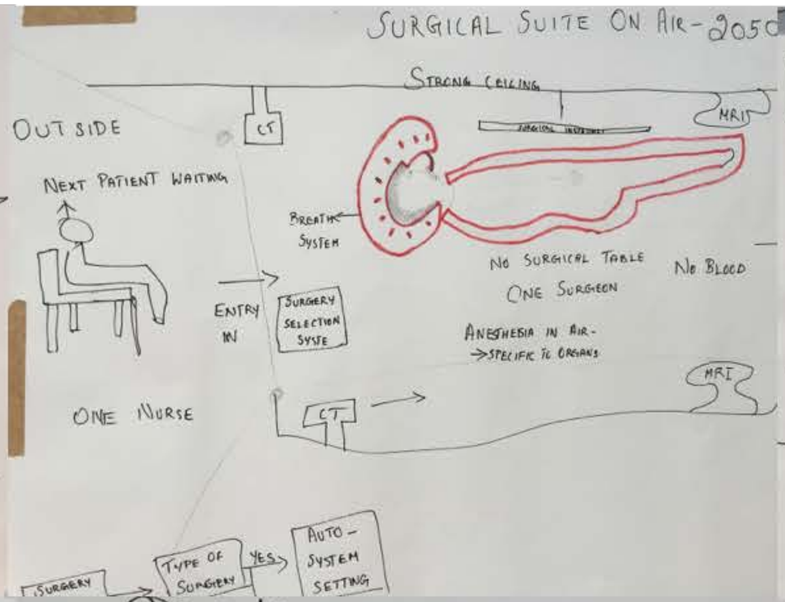
INNOVATION is identifying the problems that matter!

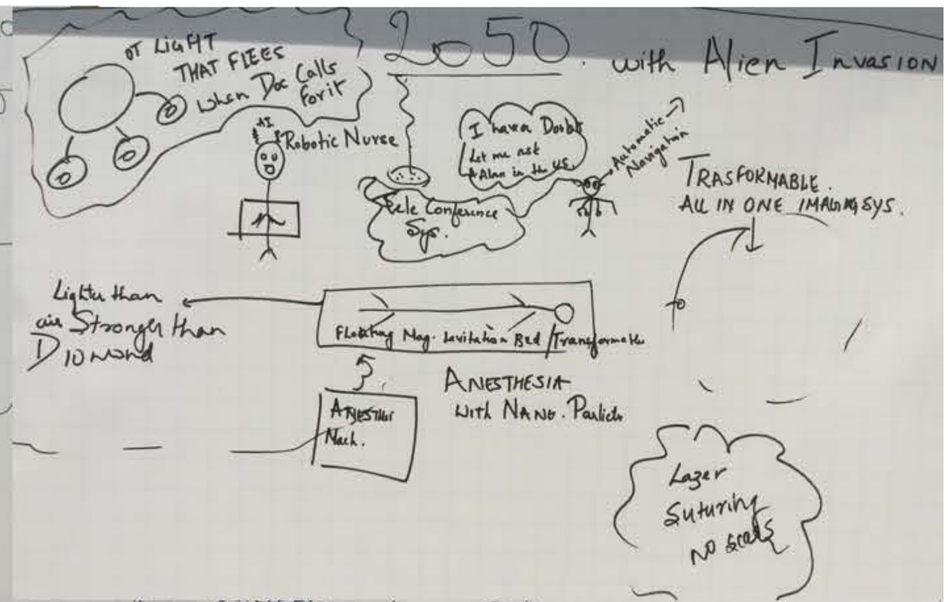
(NL Health Minister: wicked problem, as stakeholders want to leave things in place and do not like major change)

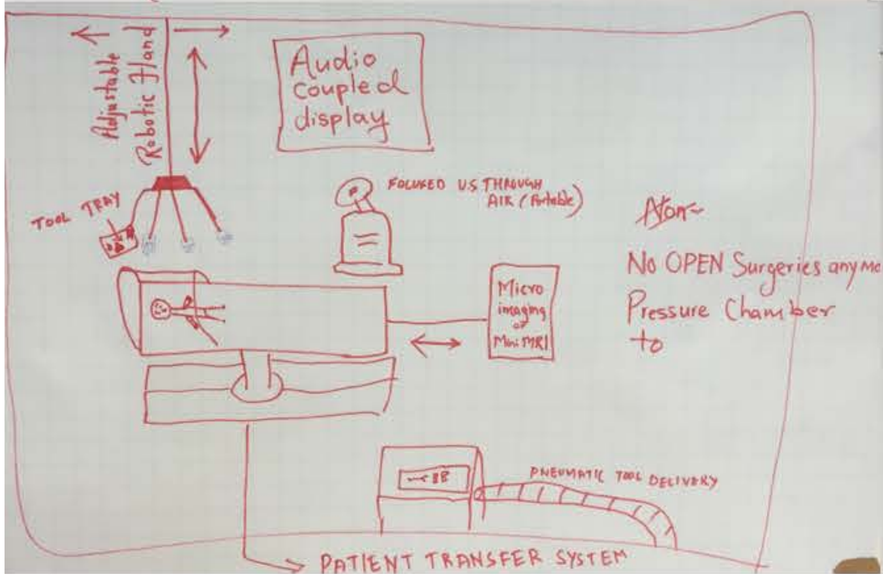


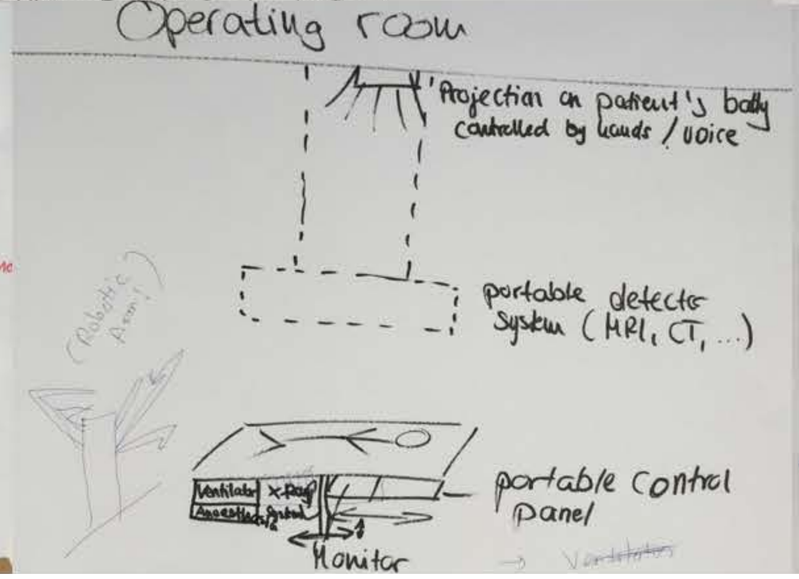
Design the Surgery Room 2033 -- consider social impact

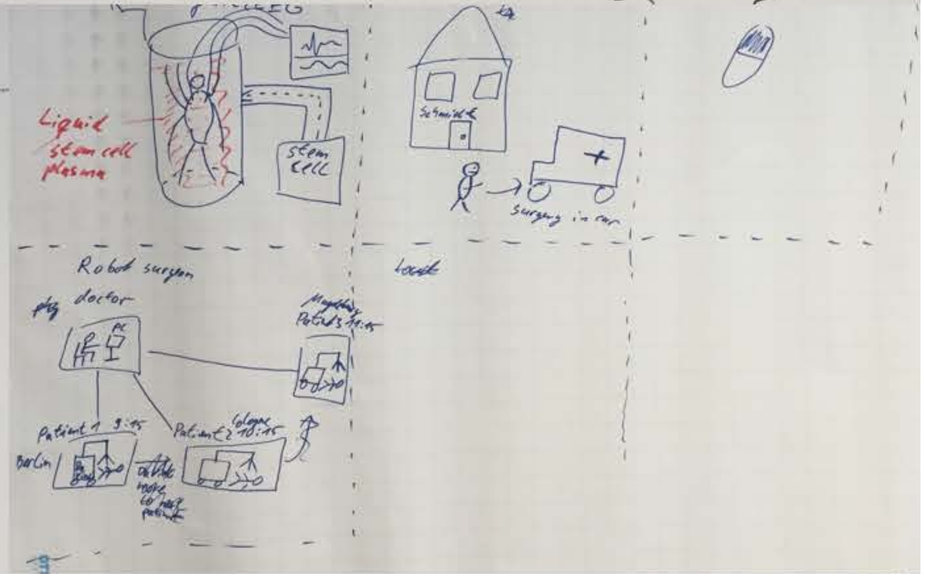












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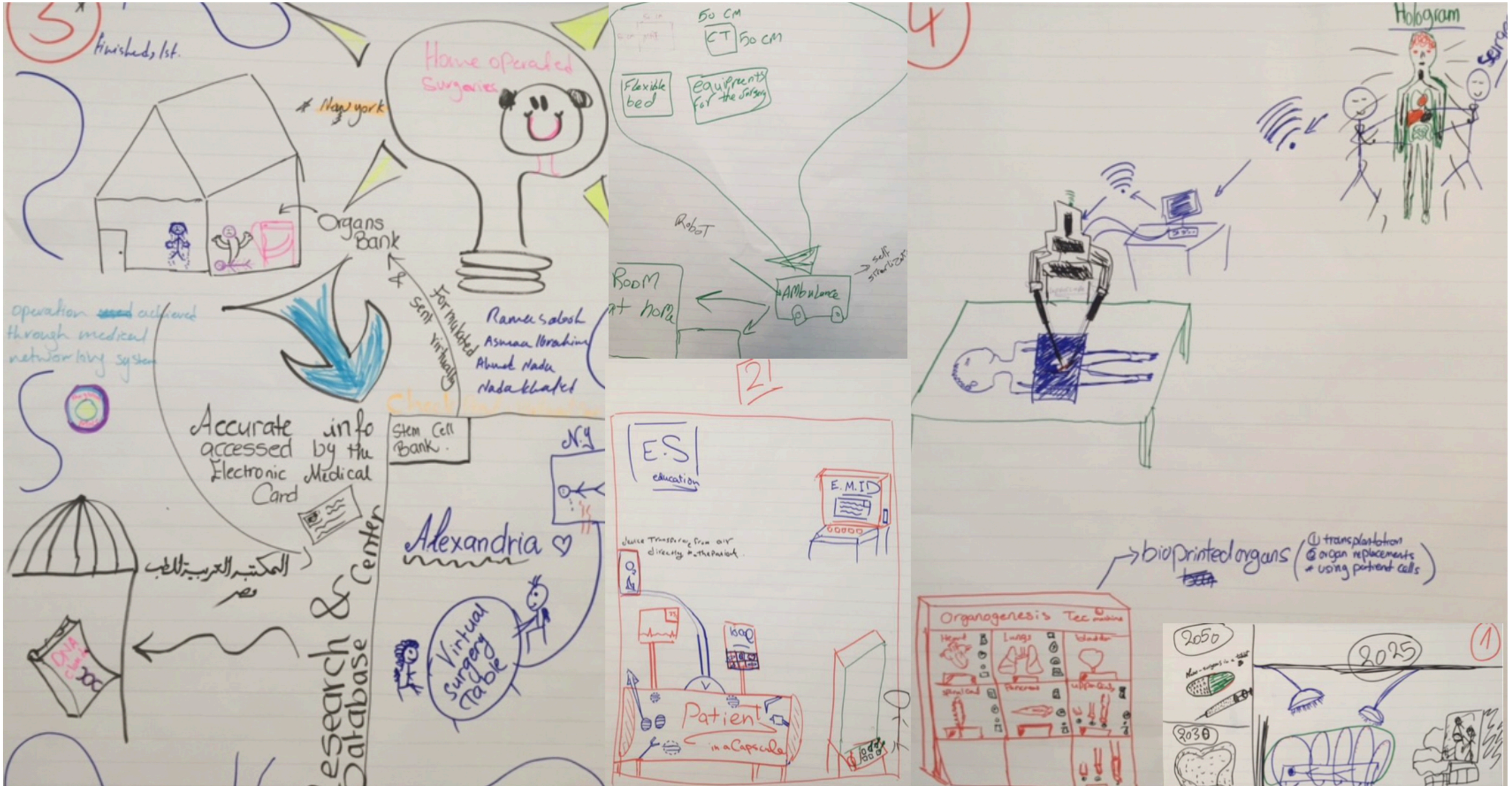


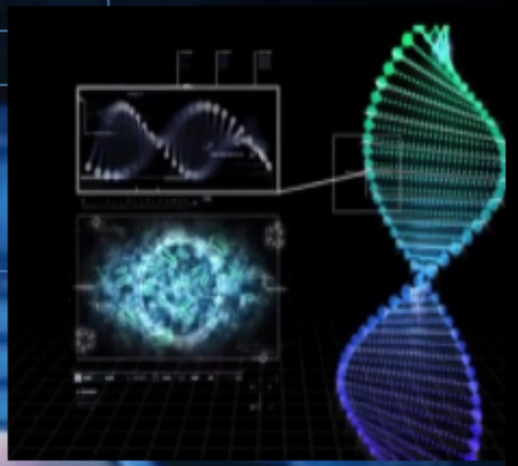
PATIENT CONTROLS

ROBOTIC SURGERY

SMART PILL

FUTURE HOSPITAL

ONE HealthCare Worldwide



PATIENT RECORD MONITORS

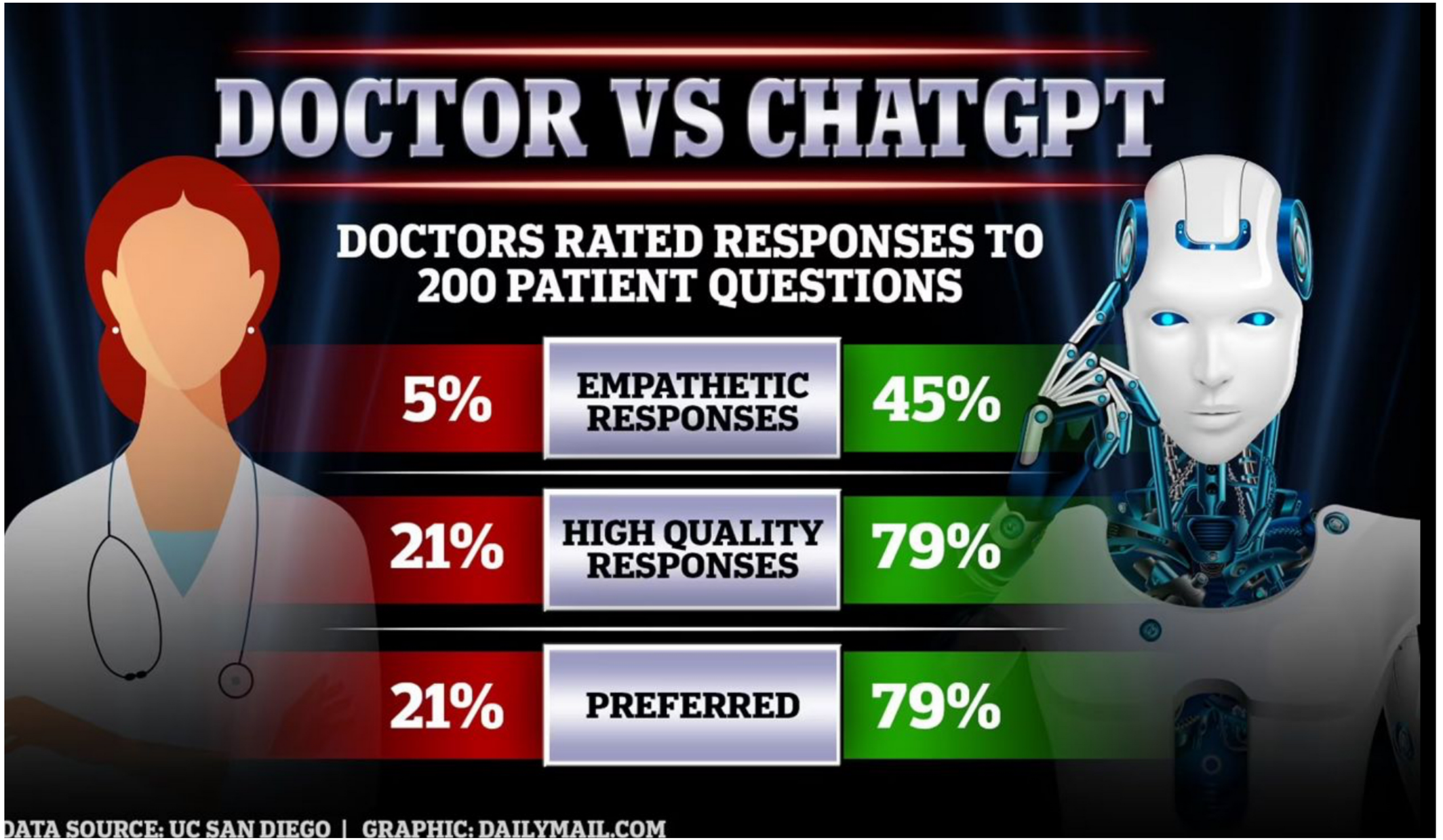
SMART PHONE ULTRASOUND

ADV. BIOTECHNOLOGY

ORGAN PRINTING

Excessive (and often misleading) diagnosis with non empathetic clinical staff?!

FUTURE HEALTHCARE SOLUTIONS



When evidence says NO, but the Doctor says YES!

- Stents for stable patients prevent ZERO heart attacks and extends the lives of the patients by ZERO.
- The surgery is not necessarily useless, but rather that it is performed on a huge number of people that unlikely will get a benefit.
- Mammography Screening? PSA and Prostate Biopsies? Thyroid Screening? Clinical Responsiveness to Drugs? ... INCIDENTALOMAS ...

PERSONALIZED MEDICINE NEEDED - BAYES THEOREM!!

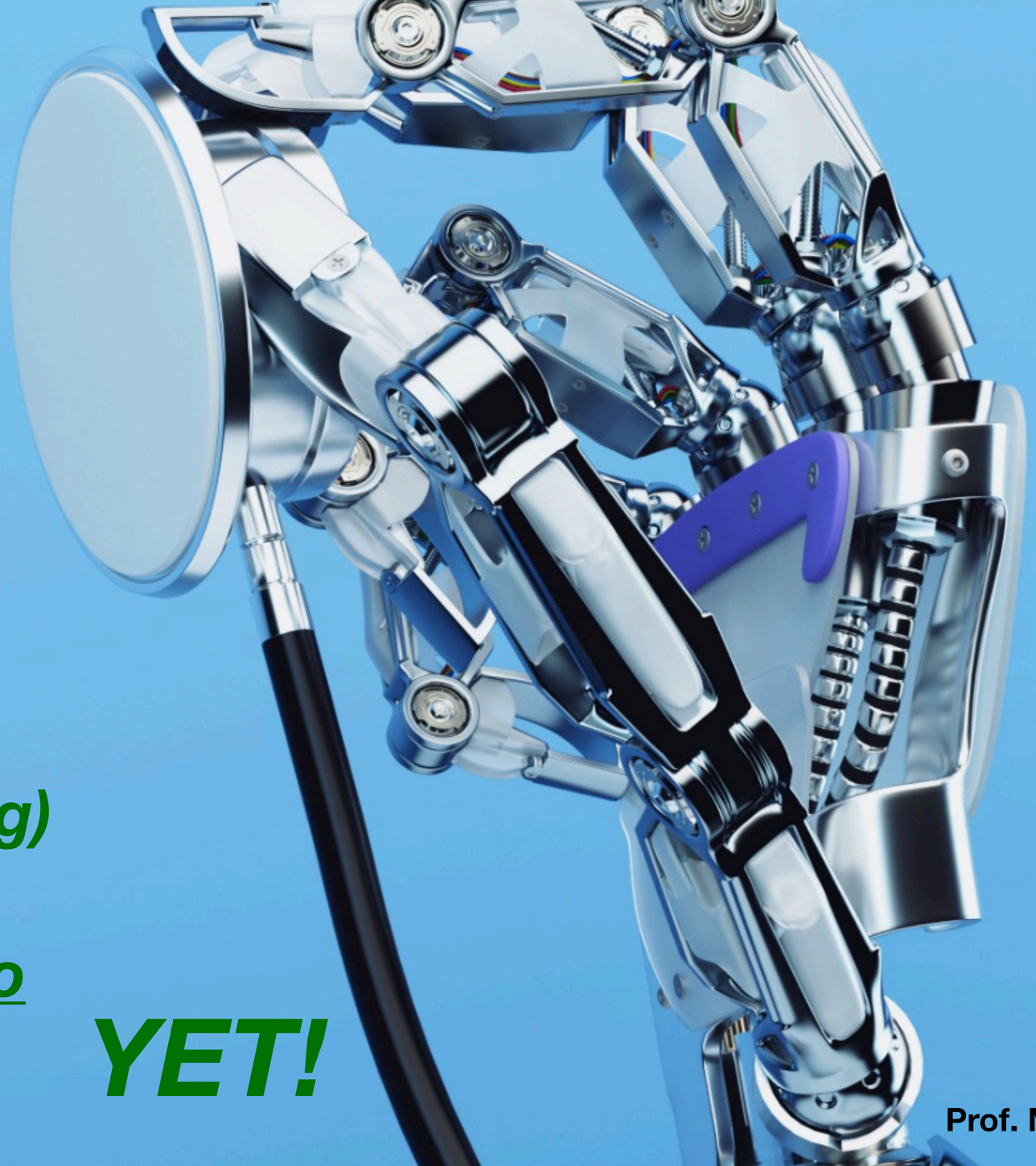
Value-based care model is a process based approach used by healthcare providers to deliver accurate diagnosis and treatment algorithms to improve patient outcomes and thereby reduce disparities in treatment of diseases and conditions.

EMPOWERED PATIENT in the CENTER of Healthcare Delivery with Technologies embraced by the Stakeholders!

HEALTH INNOVATORS DILEMMA

We are supporting Sickcare … <u>there is a business model!</u>

We are not massively investing (and developing) in what we want as individuals … <u>there is no business model …</u>



YET!

Prof. Michael Friebe

Exponential Technologies — Impact, Changes, and Challenges for the future Entrepreneur“

The HEALTH 3.0 Transformation Framework

N. Counts et al (2018), *"Redesigning Provider Payments to Reduce Long-Term Costs by Promoting Healthy Development"*, Discussion Paper, National Academy of Medicine, Washington, DC. doi: 10.31478/201804b

5P Future of Health

PREDICTION PREVENTION PERSONALISATION PARTICIPATION PROLONGEDHEALTH

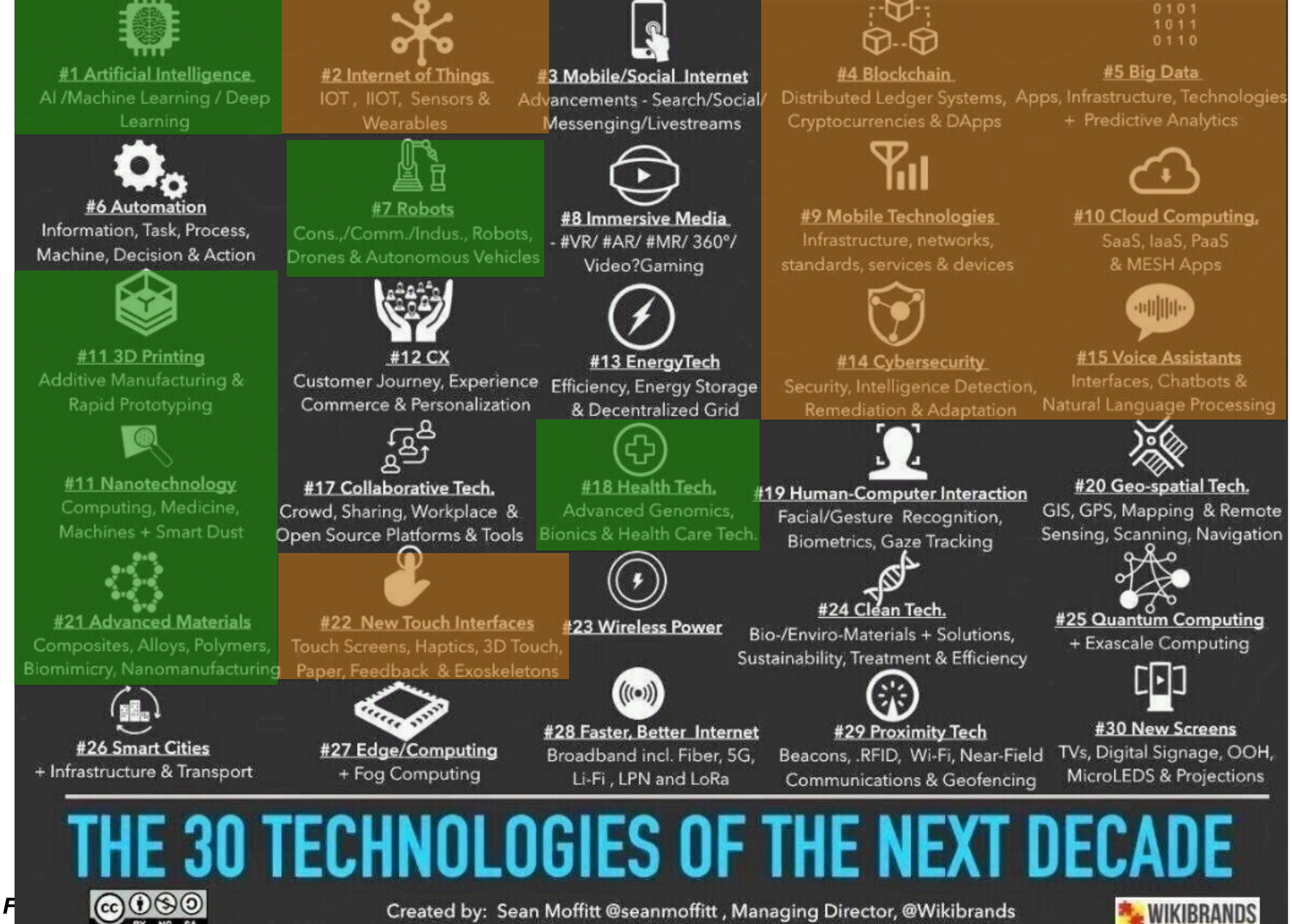
Develop with a **PURPOSE** for **PEOPLE** and **PLANET**

CR - Michael Friebe

HELP TO CHANGE!

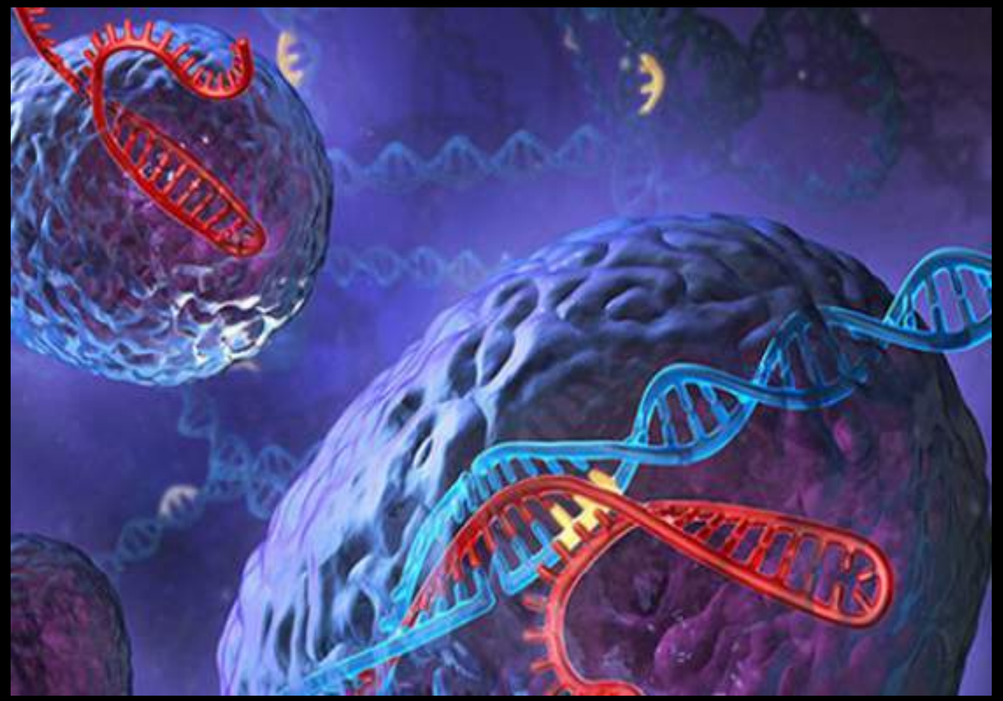
Prof. Dr. Michael Friebe

It is not just AI … many technologies will have a significant influence on the upcoming HealthCare changes!


#1 Artificial Intelligence
AI /Machine Learning / Deep Learning
#2 Internet of Things
IOT , IIOT, Sensors & Wearables
#3 Mobile/Social Internet
Advancements - Search/Social/ Messenging/Livestreams
#4 Blockchain
Distributed Ledger Systems, Cryptocurrencies & DApps
#5 Big Data
Apps, Infrastructure, Technologies + Predictive Analytics
#6 Automation
Information, Task, Process, Machine, Decision & Action
#7 Robots
Cons./Comm./Indus., Robots, Drones & Autonomous Vehicles
#8 Immersive Media
- #VR/ #AR/ #MR/ 360°/ Video?Gaming
#9 Mobile Technologies
Infrastructure, networks, standards, services & devices
#10 Cloud Computing,
SaaS, IaaS, PaaS & MESH Apps
#11 3D Printing
Additive Manufacturing & Rapid Prototyping
#12 CX
Customer Journey, Experience Commerce & Personalization
#13 EnergyTech
Efficiency, Energy Storage & Decentralized Grid
#14 Cybersecurity
Security, Intelligence Detection, Remediation & Adaptation
#15 Voice Assistants
Interfaces, Chatbots & Natural Language Processing
#11 Nanotechnology
Computing, Medicine, Machines + Smart Dust
#17 Collaborative Tech.
Crowd, Sharing, Workplace & Open Source Platforms & Tools
#18 Health Tech.
Advanced Genomics, Bionics & Health Care Tech.
#19 Human-Computer Interaction
Facial/Gesture Recognition, Biometrics, Gaze Tracking
#20 Geo-spatial Tech.
GIS, GPS, Mapping & Remote Sensing, Scanning, Navigation
#21 Advanced Materials
Composites, Alloys, Polymers, Biomimicry, Nanomanufacturing
#22 New Touch Interfaces
Touch Screens, Haptics, 3D Touch, Paper, Feedback & Exoskeletons
#23 Wireless Power
#24 Clean Tech.
Bio-/Enviro-Materials + Solutions, Sustainability, Treatment & Efficiency
#25 Quantum Computing
+ Exascale Computing
#26 Smart Cities
+ Infrastructure & Transport
#27 Edge/Computing
+ Fog Computing
#28 Faster, Better Internet
Broadband incl. Fiber, 5G, Li-Fi , LPN and LoRa
#29 Proximity Tech
Beacons, .RFID, Wi-Fi, Near-Field Communications & Geofencing
#30 New Screens
TVs, Digital Signage, OOH, MicroLEDS & Projections
THE 30 TECHNOLOGIES OF THE NEXT DECADE
Created by: Sean Moffitt @seanmoffitt , Managing Director, @Wikibrands
WIKIBRANDS

HEALTH RELATED EXPONENTIAL DEVELOPMENT

CRISPR 2.0 CAN CHANGE A SINGLE NUCLEOTIDE, EASILY, ACCURATELY

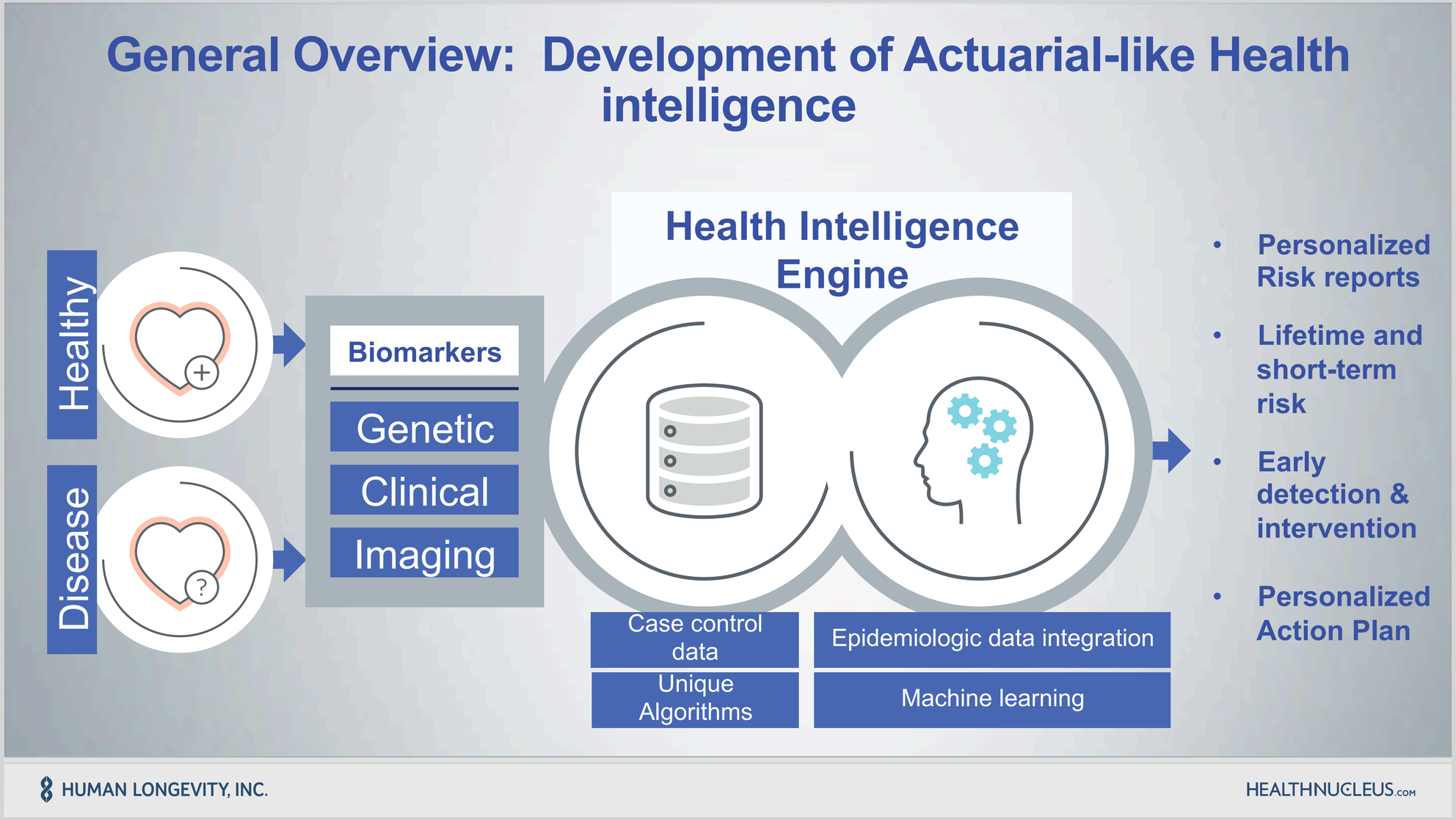


MIT & Harvard have discovered new “single base editing”.

32,000 out of 50,000 diseases are caused by single-point mutations.

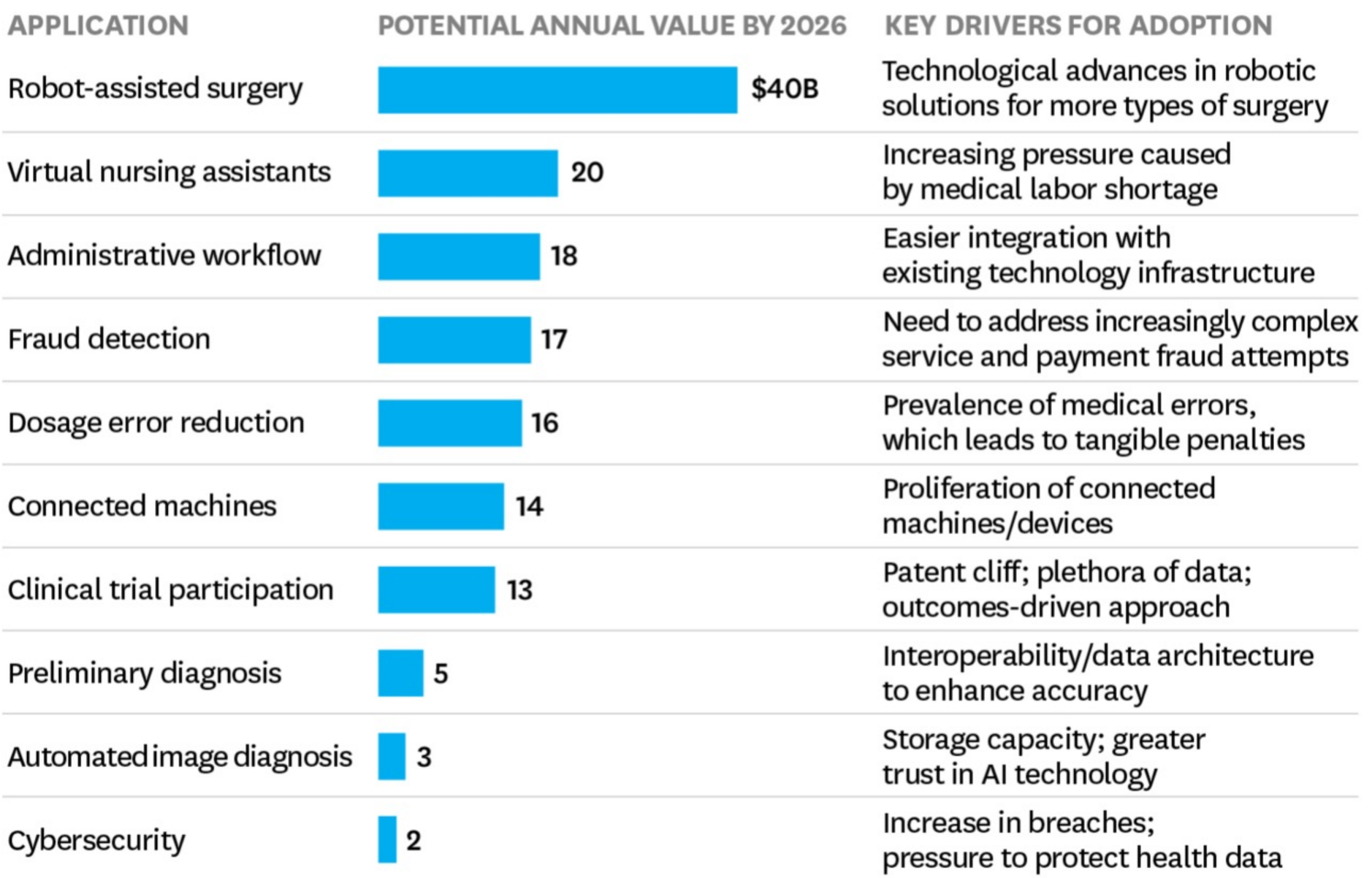
AI + DIAGNOSTICS + DIGITAL BIOLOGY + GENETICS = PARADIGM SHIFT

HEALTH RELATED EXPONENTIAL DEVELOPMENT



DIAGNOSTICS + DIGITAL BIOLOGY + GENETICS = PARADIGM SHIFT

10 AI Applications That Could Change Health Care



- ***AI needs Data — Data Generation needs Sensors ...***
- ***Healthcare Translation requires Workflow changes ...***
- ***Incremental Innovation is NOT changing the current HC delivery and associated issues***
- ***Incremental is the domain of the established players***

- ***Burning Problems need Painkillers — Disruption required***
- ***Disruption comes (predominantly) from entrepreneurial and interdisciplinary activities***
- ***We need to be proactive and need to change the current educational setup***

Innovation = Invention x Commercialization

HC I = Outcome x Personalization

Outcome for Stakeholders +

Data (connect / combine / share)

Future HC Value = (HC I)exp Data

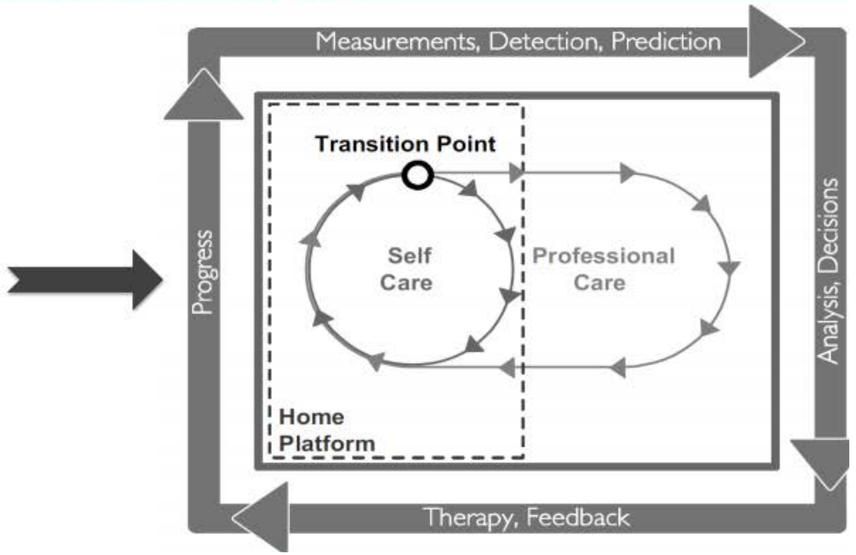
$$FV = HCI^{DATA}$$

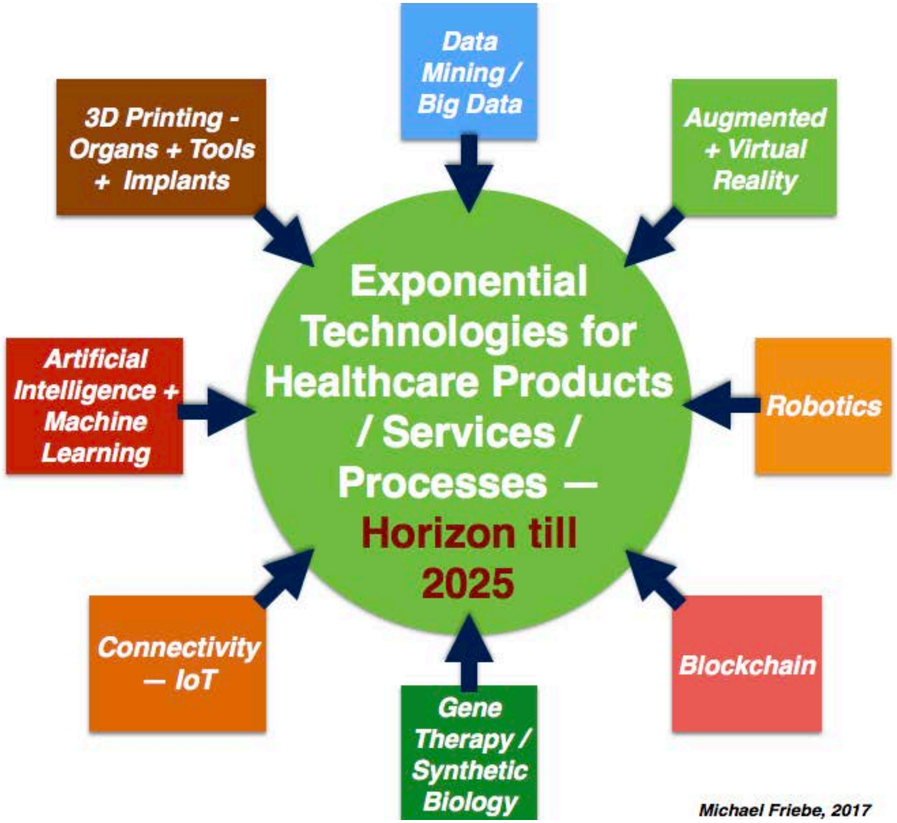
Look for opportunities where the convergence of exponential technologies will have a big impact on health care and then develop that new technology.

Future Trends and Challenges

Future trends:

- Concentration on prevention
- Assess of risk profile
- Integration of technologies for accurate diagnosis
- Local drug delivery
- Cheap transplant
- Developing country and third world country oriented healthcare system
- General care to personal care
- Home care centre for elderly people
- Improve patient outcomes at lower overall cost





Development Goal:

Effective (Unmet Clinical Problem), Cheap, Easy to Use, Small Footprint, Intelligent, Digitized and Connected (IoT), Robust / Transportable, Scalable

DISRUPTIVE MEDTEC IN USE

nature

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Article | Open access | Published: 11 October 2023

Design and testing of a humanized porcine donor for xenotransplantation

Ranjith P. Anand, Jacob V. Layer, David Heja, Takayuki Hirose, Grace Lassiter, Daniel J. Firl, Violette B. Paragas, Adam Akkad, Sagar Chhangawala, Robert B. Colvin, Russell J. Ernst, Nicholas Esch, Kristen Getchell, Alexandra K. Griffin, Xiaoyun Guo, Katherine C. Hall, Paula Hamilton, Lokesh A. Kalekar, Yinan Kan, Ahmad Karadagi, Feng Li, Susan C. Low, Rudy Matheson, Claudia Nehring, ... Wenning Qin

+ Show authors

Nature **622**, 393–401 (2023) | Cite this article

"Aging is plastic, we can wind it back, and people are starting to get that, which is a great thing."

-Phil Newman

METATREND #14: INCREASED HUMAN HEALTHSPAN

Peter H. Diamandis

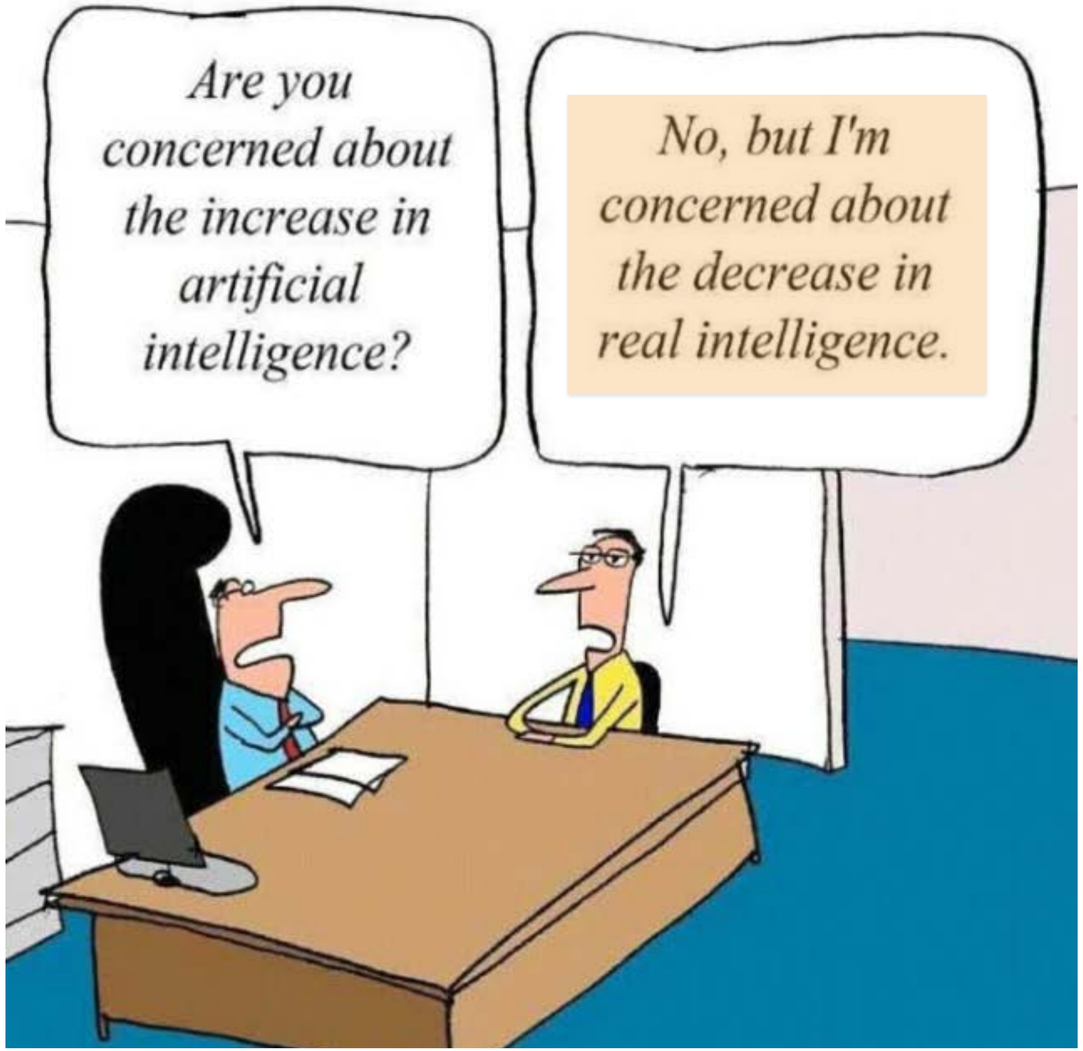
Following

Working to inspire a...

“The real challenge in innovation is not invention — coming up with good ideas — but in making them work technically and *COMMERCIALLY*.”

T.A. Edison

Artificial Intelligence / Machine+Deep Learning / Big Data



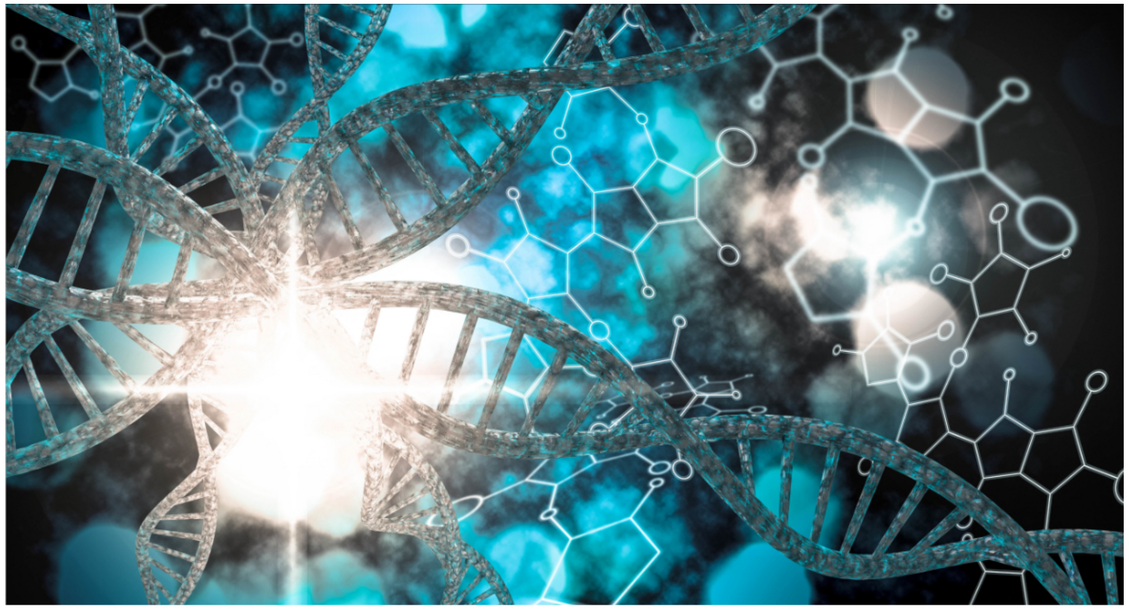
Dr AI is ready to see you
(at your convenience,
and at no charge)

The key Questions! Can you answer that?

Just because there is no business model YET, does not mean there won't be one in the near future.

Question is on whether it makes sense or not …

5P makes sense!



METATREND #14: INCREASED HUMAN HEALTHSPAN

Peter H. Diamandis
Working to inspire a...
Following

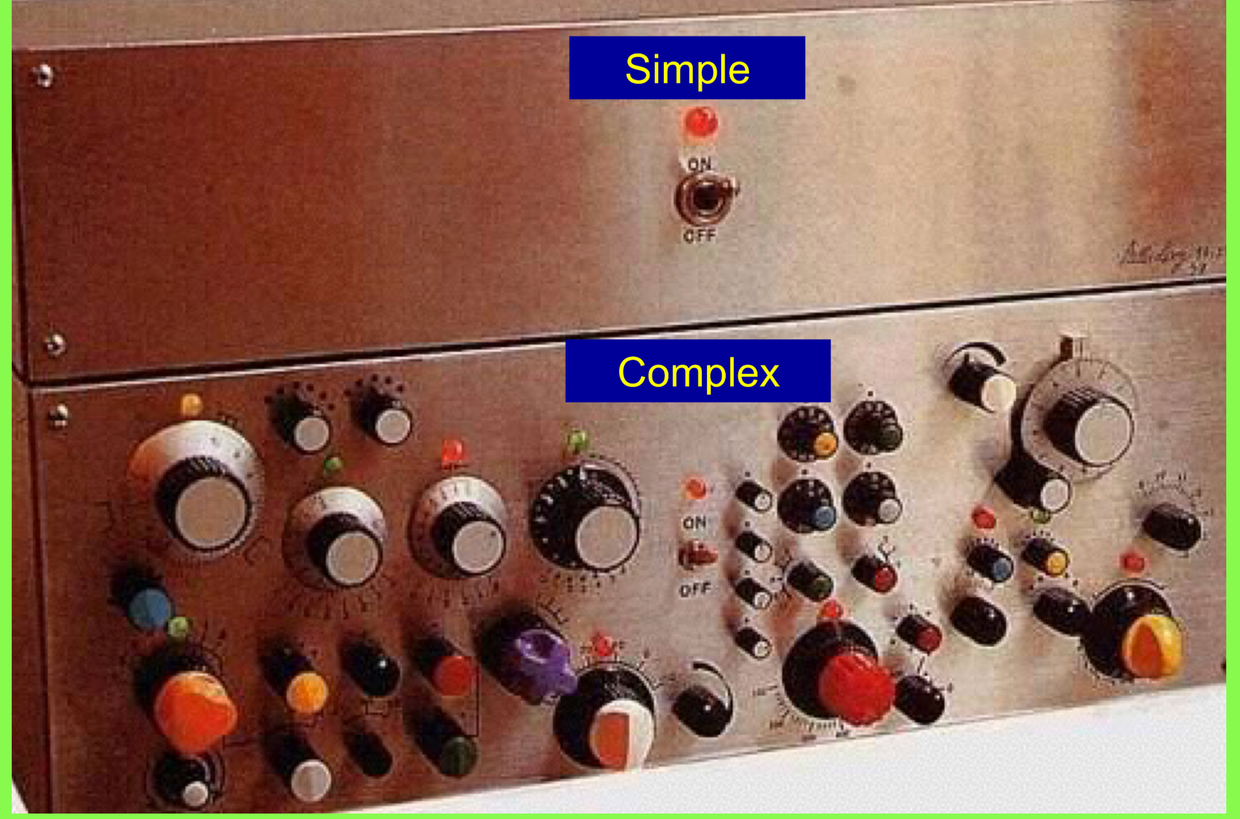
METATREND #15: DISRUPTING HEALTHCARE. DEMATERIALIZING, DEMONETIZING & DEMOCRATIZING HEALTH

Peter H. Diamandis
Working to inspire a...
Following

METATREND #15:
DISRUPTING HEALTHCARE.
DEMATERIALIZING, DEMONETIZING & DEMOCRATIZING HEALTH

Peter H. Diamandis
Following
Working to inspire a...

REVERSE INNOVATION … lets help solve the health problems of LIN with technology and bring the results back to HIN!



Future Development Goal (should be):

Effective, Cheap, Easy to Use, Small Footprint, Intelligent, Digitized and Connected (IoT), Robust / Transportable, Scalable — "5P COMPATIBLE"

Exponential Technologies + Global HEALTH 3.0 Disruption

Michael Friebe
Prof. Dr., HealthTEC Inventor/
Disruptor/Entrepreneur

THANK YOU FOR YOUR ATTENTION!

QUESTIONS?

INFO@FRIEBELAB.ORG