

# **Chapter IV**

**2018-2022**

## **The Rise of the Longevity Industry**

- **Digital Health**
- **Artificial Intelligence**
- **Blockchain**
- **P3 medicine**
- **AgeTech**
- **Exponential acceleration of further progress**
- **Objective forecasting for 2018 - 2022 (applying TRL's)**

***“ We have the means right now to live long enough to live forever. ”***

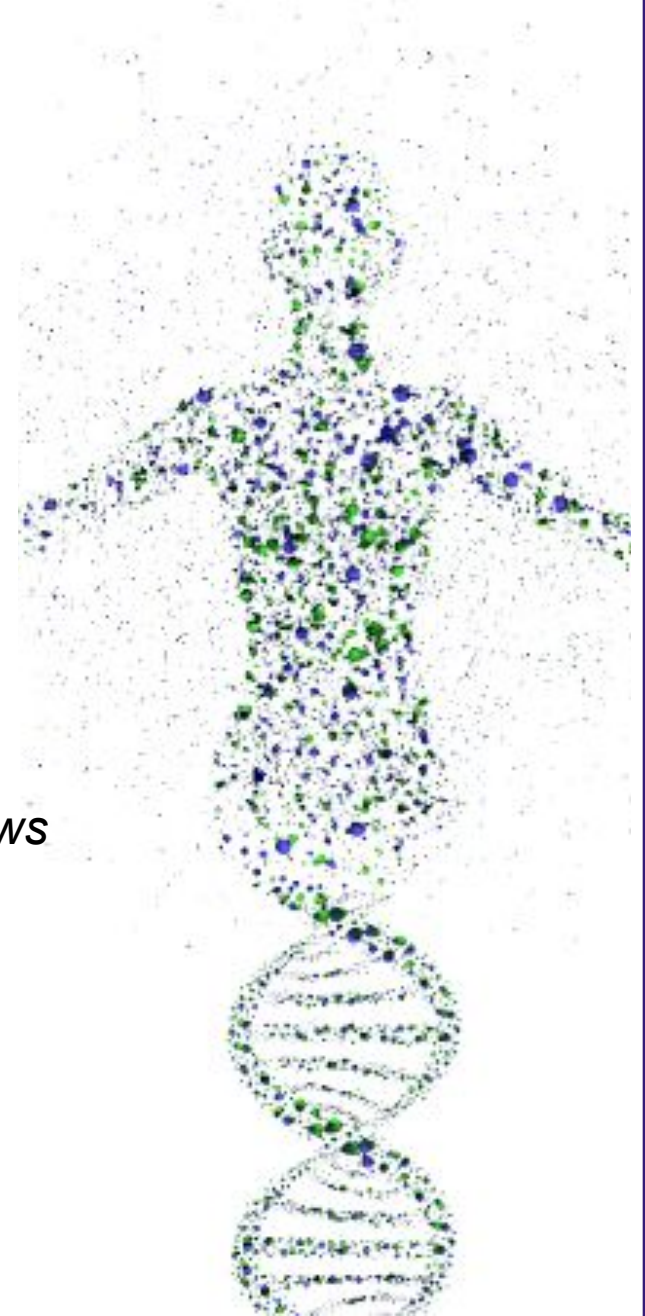
*~Ray Kurzweil*

The following chapter describes the manner in which these technologies combine to form an industry.

But any industry worthy of the Industrial Revolution title must have some form of automation or technological optimisation, and a system of finance behind it.

This chapters examines how AI and blockchain technology form the engine of the future industry, and touches upon some novel financial systems.

***“I see a bright future for the biotechnology industry when it follows the path of the computer industry, the path that von Neumann failed to foresee, becoming small and domesticated rather than big and centralized. ” ~Freeman Dyson***



# Convergence of Technological MegaTrends

## 5 Mega Trends to Disrupt the BioTech & Venture Capital Industry in 5 Years

### Major Disruption on the Horizon

The BioPharma and BioMedicine industry is now on the edge of a major shift which will happen in 2018-2019.

There is clear evidence of this today, but due to the significant inertia pervading the BioPharma industry relating to the traditional business model of pharmaceutical companies and heavy government regulations, the capacity for the industry to translate novel trends into actual practice is significantly lacking.

We have major evidence for these emerging trends all around us, but for several specific reasons they are only recognized by a few top executives in the industry. Those executives that don't begin to recognize these trends and act accordingly will be responsible for colossal industry failures in the next 5 years.

The window of opportunity to board this departing train is 1, maximum 2 years from now and in the next 5 years the first pharma company to openly embrace AI at the C suite and board level focusing on their own development instead of relying on the "old-school" technology companies, will see its stock skyrocket.

### Major

### Disruptive

### Trends:

- I. **AI in BioPharma and Healthcare**
- II. **Blockchain and Next Generation IT in Healthcare**
- III. **Longevity & Gero Science**
- IV. **Broken VC and BioPharma Business Model and Novel Financial Systems**
- V. **AgeTech**

## **I. Artificial Intelligence**

- AI in Healthcare is rising very fast. There have been several deals worth tens to hundreds of millions of dollars in just the past few months alone
- As this trend continues it will mostly be applied by existing IT giants, with the exception of areas such as electronic health records and digital pathology where these do not have access to the data
- These advances will occur much faster than even the most optimistic scenarios, outperforming even the speed of AI development demonstrated by the big IT giants of today - Google, Facebook, NVIDIA, Baidu, etc.
- The continuous development of software, the rise of the sharing economy, the distribution and processing power and AI, along with the convergence of all these niches causes transformation at a global scale making the right forecasting for healthcare and BioPharma in particular, needed, and where key players should switch from thinking of niche areas to a much more holistic and inclusive approach
- One of the most important patterns in this emerging area is AI in drug discovery, and it holds the greatest disruptive potential. It has begun to penetrate into Big Pharma's drug discovery departments at a rapid pace

## **II. Blockchain in Healthcare**

- This will take the form of blockchain integration into healthcare governance systems, into telemedicine mobile apps for securing and transmitting personal medical information, and into systems for analyzing and optimizing healthcare business processes, among others
- The overarching trend will be blockchain as healthcare's backend
- Its speed of penetration is enormous and on the rise, and its speed of penetration into new fields that could benefit significantly from enhanced protection of data and enhanced logistical optimization, like the healthcare industry, is huge



### **III. Longevity & Healthcare**

- Longevity is another major trend, but is much more complicated than the above 2 trends
- With AI, this window of opportunity is very short. For longevity it is much longer - around 5 years
- The window of opportunity is longer for longevity, but its potential to disrupt the field is also much larger
- Because the window of opportunity is larger, there is much more time and opportunity for Pharma to begin activities within this emerging trend

### **IV. A Broken VC and BioPharma Business Model**

- During recent years we have seen significant stagnation in the VC industry, not only in biotech but many other industries
- The industries most affected are those with big requirements for DeepTech, advanced R&D
- This stagnation is due to the outdated model of typical VC funds, which made sense 5-10 years ago, but not so much nowadays
- There is an emerging phenomenon already disrupting the typical VC industry, known as Initial Coin Offerings and Crypto Liquid Venture Funds, applying advances in blockchain and cryptocurrencies to create radically progressive and dynamic investment models
- VC funds, in the US in particular, are also beginning to recognize the disruptive potential of this new investment model
- These new investment models and instruments are in a sense like the merger of VC funds and Hedge Funds, with all their advantages and fewer of their disadvantages

- VC funds sometimes have very high profits but very low liquidity. Hedge funds typically have lower profits but very high liquidity
- These new investment models have both - high profits and very high liquidity
- I predict that 2018 will be the threshold when many promising biotech startups will begin receiving substantial investments in the form of angel financing and crypto fundraising

## V. AgeTech

- A fifth major trend will be what can be called AgeTech - the integration of FinTech and HealthTech
- Financial services designed for the aging demographic that integrates cutting-edge FinTech services with emerging geoscience and P3 (personalized, precision and preventive) medicine therapies to deliver optimized financial and healthcare services for elderly citizens
- The aging demographic is rising rapidly and will witness enormous growth over the next 20 years.
- AgeTech services will serve to extend the healthy, productive and functional years of elderly citizens' lives and will promote them to remain in or re-enter the workforce, enhancing their lives and the economy simultaneously

*"It's vital that individuals and businesses recognize the tremendous potential of this longevity revolution. Our aging population could generate the most significant opportunity of our lifetime."*<sup>216</sup>

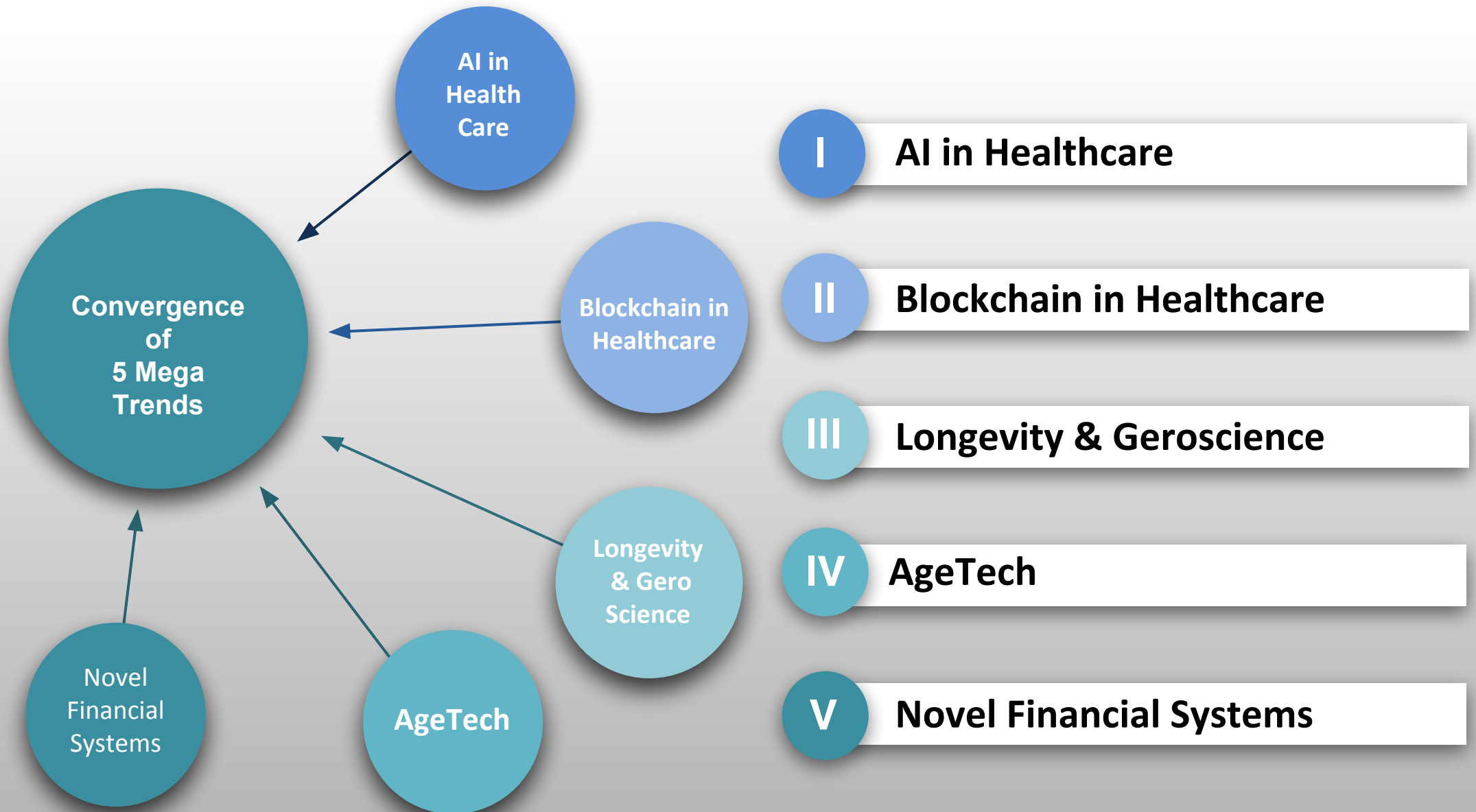
*– Andy Sieg, Head of Merrill Lynch Wealth Management*

*-Milken Institute, Silver to Gold*

## VI. Conclusion

- Keep an eye on these 5 rapidly emerging trends - AI in Healthcare and Drug Discovery, Blockchain in Healthcare, Geroscience and Longevity, AgeTech and Crypto Liquid Venture Funds
- In 5 years these 5 areas will disrupt the BioMedicine and BioPharma industry nearly beyond recognition to what it is today as well as many other industries
- It is well known that professionals are unable to see these trends on a grand scale, the real transformation will happen because of convergence between all these 5 trends in combination. This convergence will further influence the acceleration at an unforeseen rate that requires deep forecasting
- The era of venture capital and unadaptable BioMedicine and BioPharma companies in this industry is coming to a close with ample opportunity for them to adapt or die making way for up and coming R&D groups and startups that take advantage of these new technologies and financing mechanisms.
- Development of the BioMedicine and BioPharma industries will be faster than anyone can imagine including the pessimists and optimists because of the convergence of these trends, the more the number of dimensions, the greater the acceleration as the industry leapfrogs into a new era.
- These megatrends will become much clearer in the next two years and we will make adjustments to these megatrends in 2018 when the picture becomes clearer and we can forecast the synergy between the rate of acceleration of these trends and of their convergence

# 5 Mega Trends to Disrupt the BioTech & BioMedicine Industries in the next 5 Years



# Consequence: The Major Shift in the BioMedicine Industry

The emergence to the AI and Blockchain technologies in Biopharma and Biomedicine industry will start the rapid development of these technologies, the mass emergence of new startups and the fundamental changes in the world politics and economy

The window of opportunity to launch such technology startup will remain open for maximum 2 years from now. After that, the market will be full and these new nowadays technologies will be adapted by the large corporations and governments in the next 5 years

In this period, approximately to 2022, the pharma companies will openly embrace the AI and Blockchain technologies and will focus on their development instead of relying the 'old-school' technologies, which are in use

2017

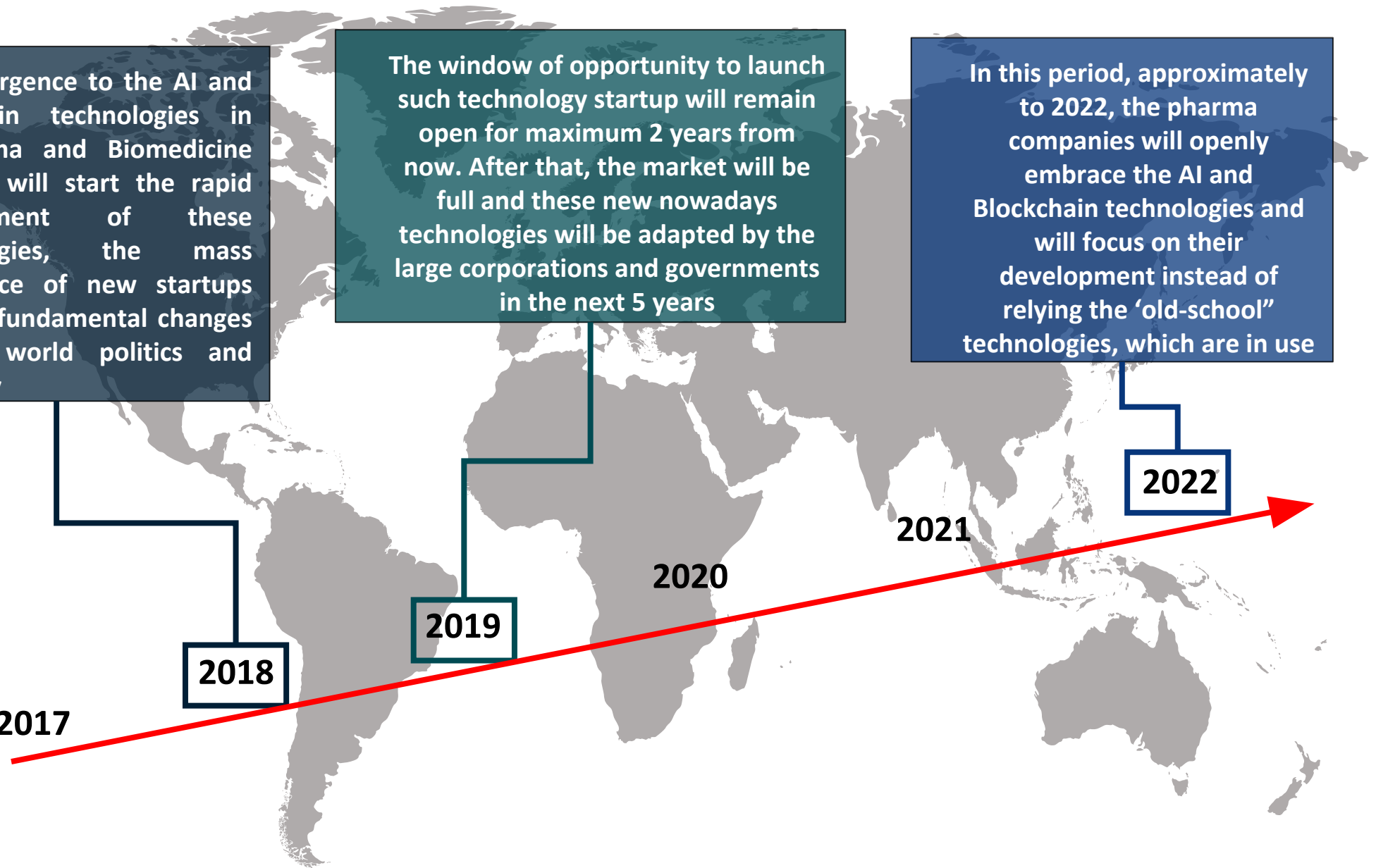
2018

2019

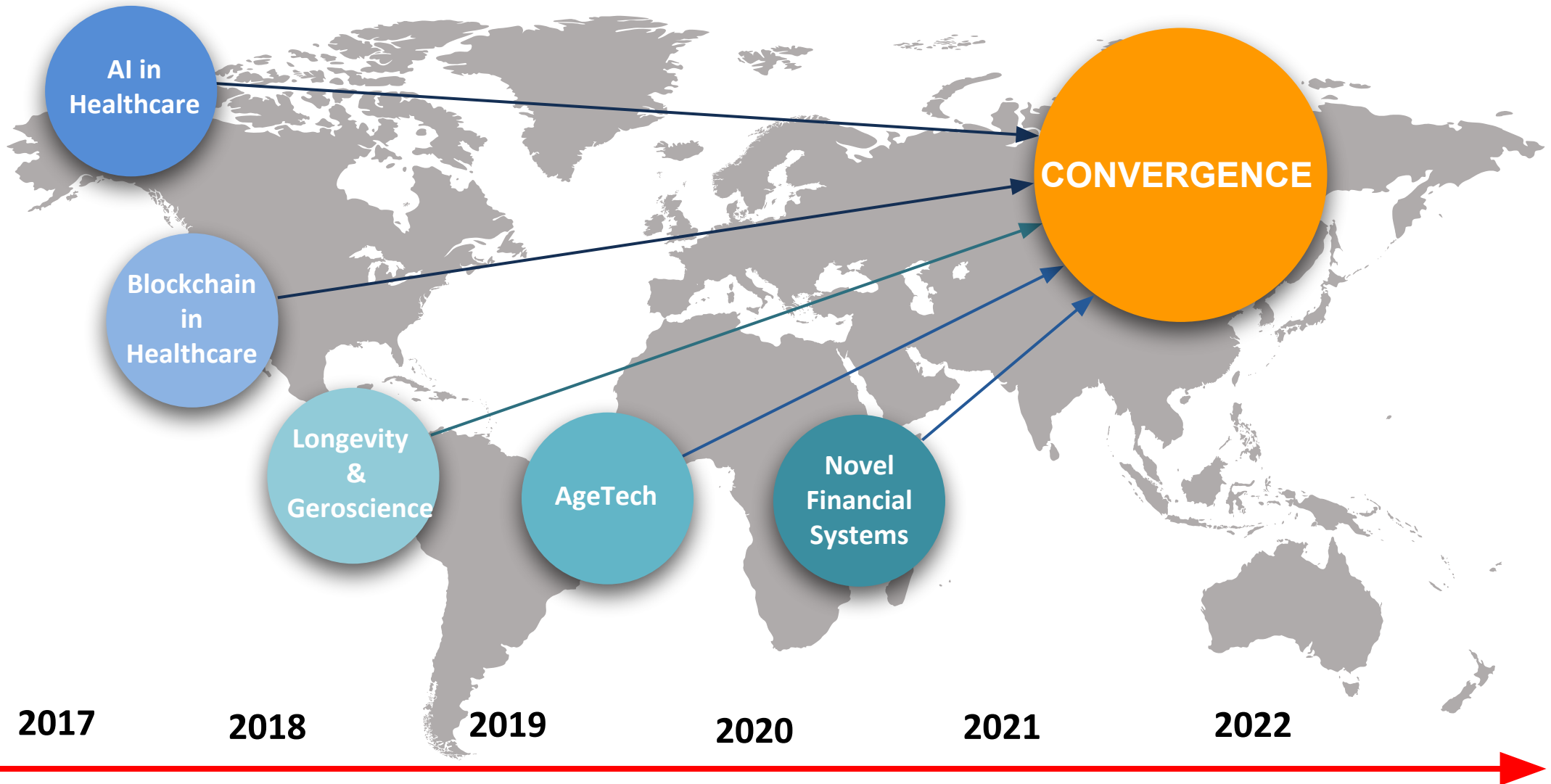
2020

2021

2022



# Convergence of 5 Mega Trends



# Digital Health

Digital health covers a broad range of applications and areas. This includes mobile health, health information technology, wearable devices, telehealth and telemedicine, and personalized medicine.

The digital and genomic revolutions in particular hold great potential for digital health: while it took 10 months to sequence a genome in 2007, today it takes as little as just one hour.

Digital health concerns itself with the following goals:

- Reducing inefficiencies and costs
- Increasing quality of care
- Improving access
- Making medicine more personalized

Over \$16 billion have been invested in 800+ digital health companies since 2014; \$3.5 billion in the first half of 2017 alone, but no unicorns so far. Healthcare is an old industry with traditional institutions that struggle to innovate; hence the high interest in investing in up and coming, innovative startups.

This means that digital health startups need early funding for a relatively extended period of time - compared to the average apps and platforms - before they can start reaping the benefits of their work in contrast to apps and platforms.

Data also represents another challenge for these companies. The metrics of success for healthcare companies are harder to come by and usually take a long time to come by.

### 1. Digital Health Interventions:

Interventions delivered through digital technologies, such as smartphones, website, text messaging hold great potential to healthcare delivery making it more efficient, effective, accessible, and personalized. This is an area of interest particularly to insurance companies, since it can improve success rates for treatments and reduce patient readmissions.

### 2. Doctor-Patient Interaction:

Documentation requirements have taken over the patient encounter in many specialities. Digital solutions that streamline the documentation workload and allow doctors to give their full attention to the patient are currently being developed. Some of solutions being tested include head mounted displays that stream the doctor-patient interaction to a remote transcription center.

### 3. Big Data:

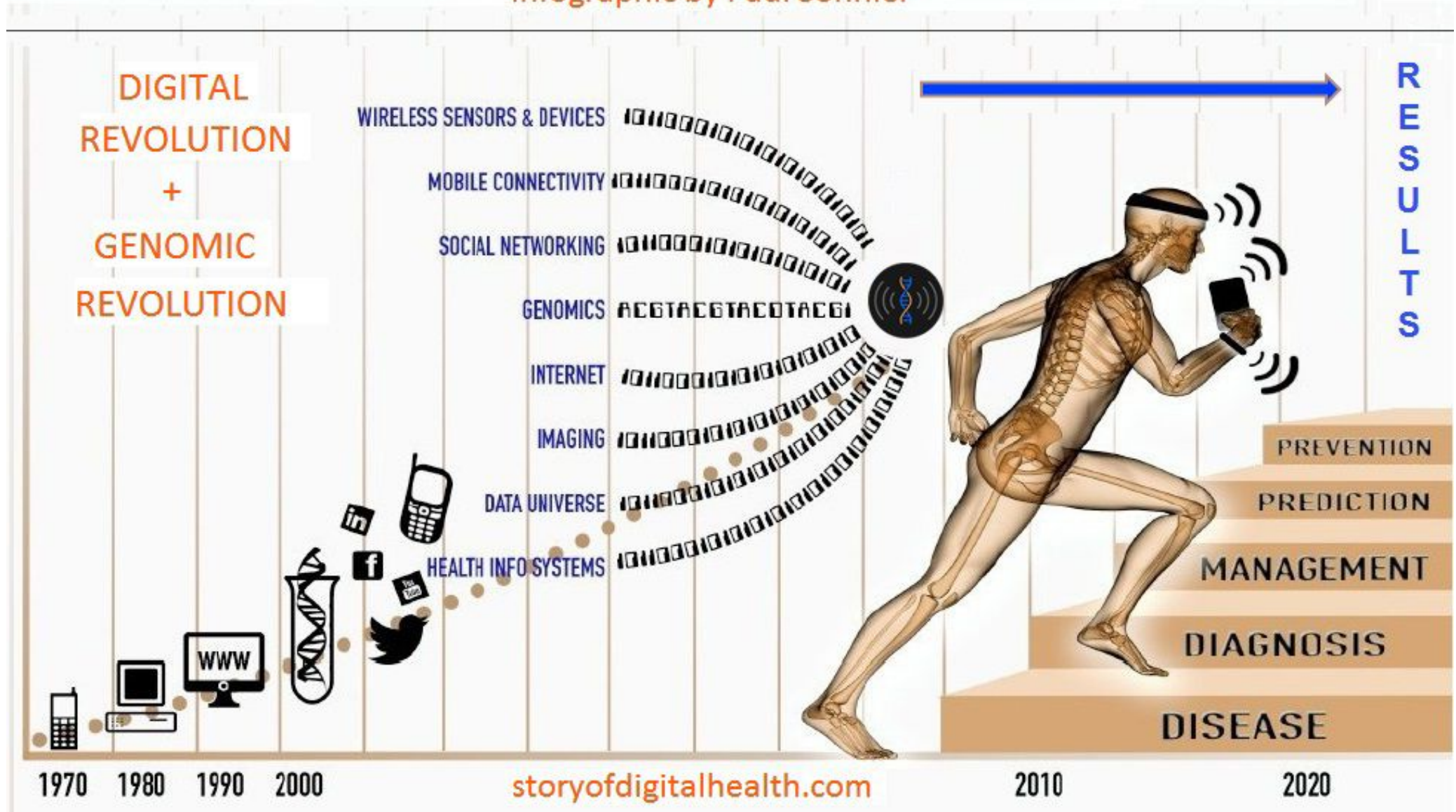
Companies have so much data that they can model the risk factors associated with a given patient or procedure, i.e. assume the likelihood of someone being readmitted or the recovery time. In another instance, looking at thousands of cases, and taking the patient's own history in context, companies can draw conclusions on whether a certain procedure might be riskier for a given patient.





# THE DIGITAL HEALTH REVOLUTION

Infographic by Paul Sonnier



# The Healthcare Internet of Things (IoT) Market Map



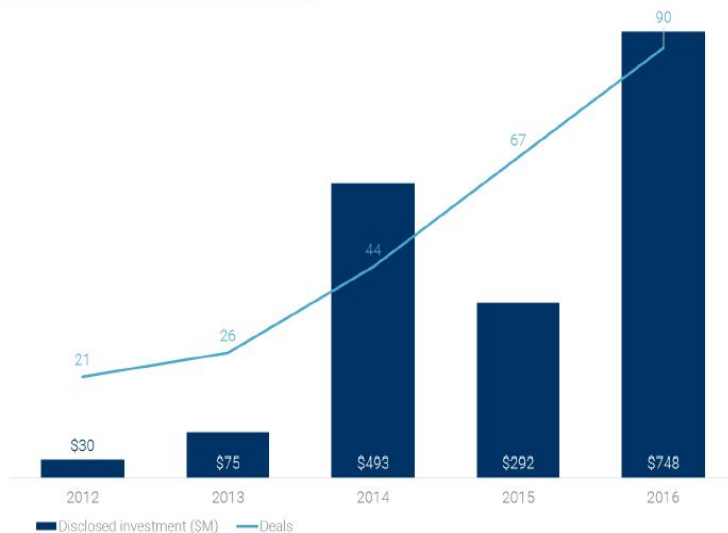
www.cbinsights.com

# Artificial Intelligence

Much of the current commercial applications of AI concern what is known as weak artificial intelligence, aka narrow AI; think Google, Apple, or Amazon's personal assistants that use natural language processing to understand a query then do a relatively simple search, taking into consideration a few factors from your history and behavior. A truly artificially intelligent system is one that learns on its own, is capable of processing very large amounts of data and digging up associations, and imitates human behavior. We are just beginning to scratch the surface of AI in healthcare.

When talking about Artificial Intelligence in healthcare, more often than not, Big Data is the first topic that comes into discussion. Digital data is growing at an exponential rate - by 2020, the data created annually will reach 44 trillion gigabytes. Tech titans such as Google or IBM, are trying to tap the potential of patient data mining using their AI tech. It is worth noting that IDC predicts that the worldwide spend on AI and cognitive computing will reach \$46 billion by 2020.

ANNUAL FUNDING HISTORY



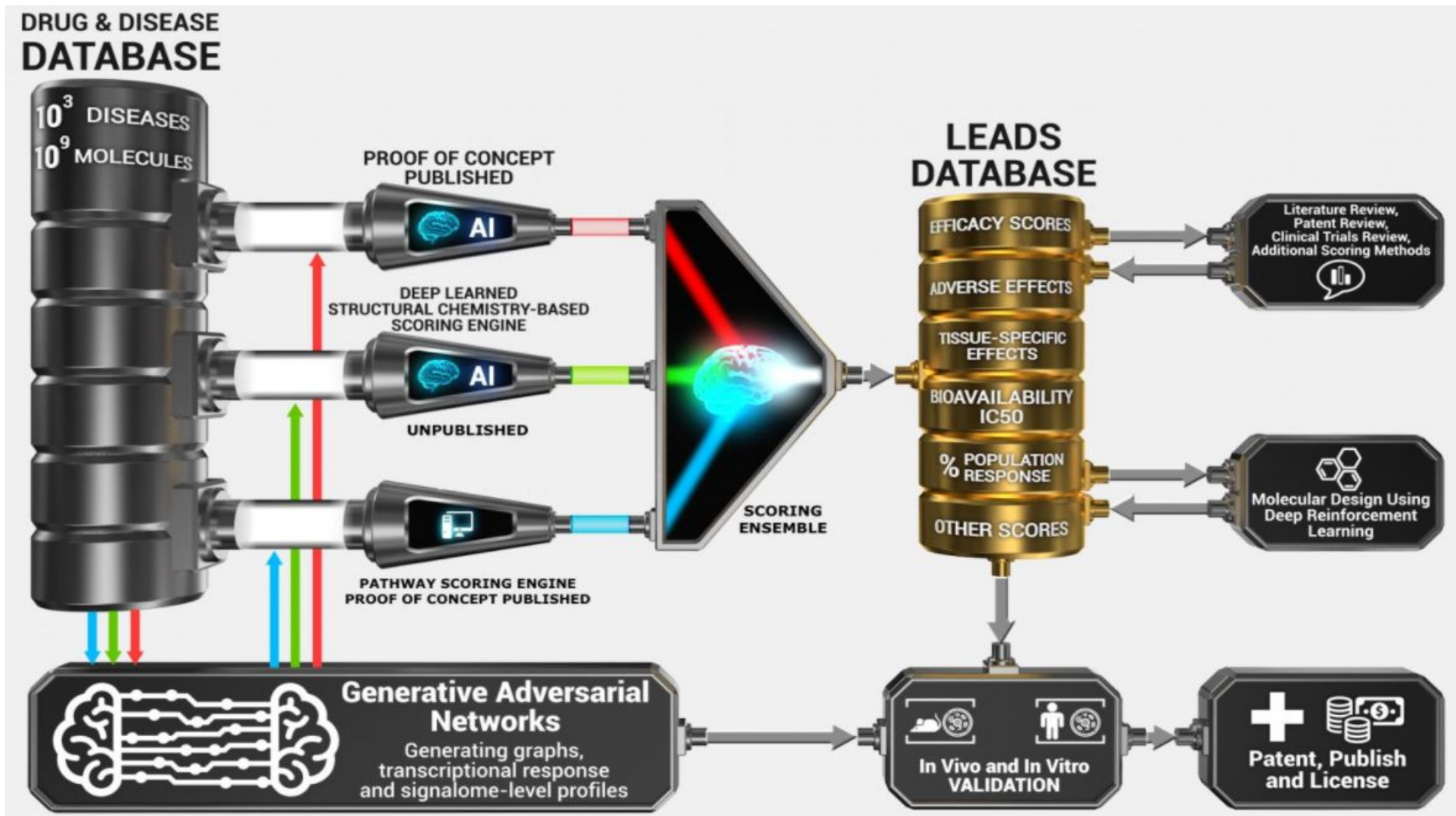
Alphabet, the parent company of Google, recently launched the Google Deepmind Health project. Deepmind Health is able to process hundreds of thousands of medical information entries within minutes. This will enable providers to provide better and faster health services. Google also aims to employ the same algorithms that power its search engine to genetic data in the hopes of understanding what makes people healthy.

IBM on its part, is using Watson technology to power WatsonPaths. The aim is to help physicians make informed and accurate decisions, faster, and to glean insights from electronic medical records.

AI in healthcare dominates all other industrial applications of AI in terms of equity deals, raising \$1.8B across 270 deals since 2012.



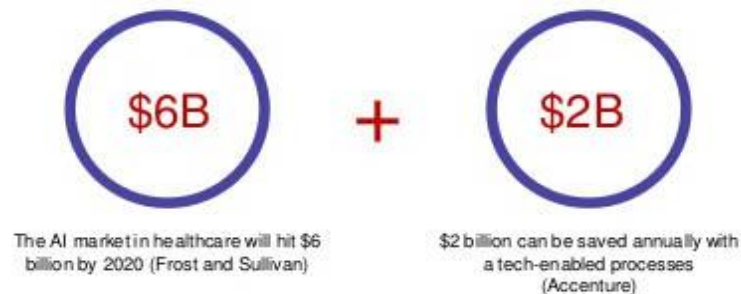
# INSILICO MEDICINE / DRUG DISCOVERY ENGINE



Real artificial intelligence is already being used to detect diseases. According to the American Cancer Society, a large number of mammograms yield false results - as much as half of healthy women are wrongly diagnosed with cancer. AI, on the other hand, is able to review and translate mammograms 30 times faster, and with a 99% accuracy rate.

This is possible because we are able to train algorithms to tell the difference between groups of pixels that represent cancer versus groups that don't. The algorithms constantly learn. Software is able to process millions of those images, or others, in a day.

Gartner predicts that by 2025, half of the population will rely on “virtual personal health assistants” powered by AI. These personal assistants would be cognizant of a user's unique medical conditions, history, and genetic makeup and able to incorporate them in its decision making. Automating primary care needs is also a great boon to the elderly demographic in particular, who typically lacks mobility. These assistants will help seniors remain independent for longer, and reduce the need for hospitalization or staying in nursing homes. Overall the progress of AI implementation in healthcare will carry great reduction in costs and time.



AI for instance will be able to accelerate drug development and make it more cost effective; by contrast, the costs of developing pharmaceuticals through clinical trials can reach billions of dollars and can take more than a decade.

Banks have embraced machine learning quickly, looking more like IT firms with each passing day, but the executives of pharma have been less agile. Top managers are avoiding risk rather than showing results. They don't want to be the executive who reduced earnings by engaging in advances IT capex. However, in neglecting disruptive technological risk, they are failing to hedge properly. The same is true of countries, including the United Kingdom.

# Global Healthcare AI Market Growth Through 2024



Source: Markets and Markets; Global Market Insights, Inc.

The U.S. healthcare AI market exceeded \$320 million in 2016, and is estimated to grow by more than a 38% CAGR through 2024 (Global Market Insights, “Healthcare AI Market Size, Competitive Market Share & Forecast, 2024”).

The Global Healthcare AI market, among the AI industry’s fastest growing sub-sectors, is expected to grow at a 39.4% CAGR to over \$10 billion in worldwide revenue by 2024.

Source: TM Capital “The Next Generation of Medicine: Artificial Intelligence and Machine Learning” Report

**accenture**

## Top 10 AI Applications

APPLICATION	VALUE*
Robot-Assisted Surgery**	\$40B
Virtual Nursing Assistants	\$20B
Administrative Workflow Assistance	\$18B
Fraud Detection	\$17B
Dosage Error Reduction	\$16B
Connected Machines	\$14B
Clinical Trial Participant Identifier	\$13B
Preliminary Diagnosis	\$5B
Automated Image Diagnosis	\$3B
Cybersecurity	\$2B
TOTAL = ~\$150B	

Source: Accenture analysis  
 \*Value” is the estimated potential annual benefits for each application by 2026.

\*\* Orthopedic surgery specific



# 106 STARTUPS TRANSFORMING HEALTHCARE WITH AI





# Blockchain

We have already discussed the power and importance of Blockchain technology in creating trust in the ecosystem. Trust to share health data, which is paramount to harnessing the power of biological science and research.

We also went over the value that blockchain can offer when it comes to logistical matters, such as maintaining and unifying health records, establishing a log of accountability and transparency, as well as fighting counterfeit drugs.

All of those advances are a great boon to the longevity industry. But to delve deeper into the effects of blockchain on longevity, there has been accumulating evidence that suggests that aging is linked to genetic and epigenetic alterations.

Epigenetic, by definition, describes the study of changes in gene expression that do not involve changes to the underlying DNA sequence, instead arising from nongenetic influences on gene expression.

Given the reversible nature of epigenetic mechanisms, they provide promising avenues for therapeutics against age-related decline and disease.

Looking at epigenetic data, deep learning algorithms can predict the risk of a disease in time to prevent it. However, ensuring security and privacy in transmitting and storing personal epigenetic profiles will require building a new and open data ecosystem. Blockchain has the potential to do just that.



# BLOCKCHAIN FOR DRUG TRACEABILITY



## 1 Health organizations direct information to the blockchain

Health organizations provide services to patients

Clinical data is tracked in existing health IT systems

Standard data fields and a patient's public ID are redirected to the blockchain via APIs

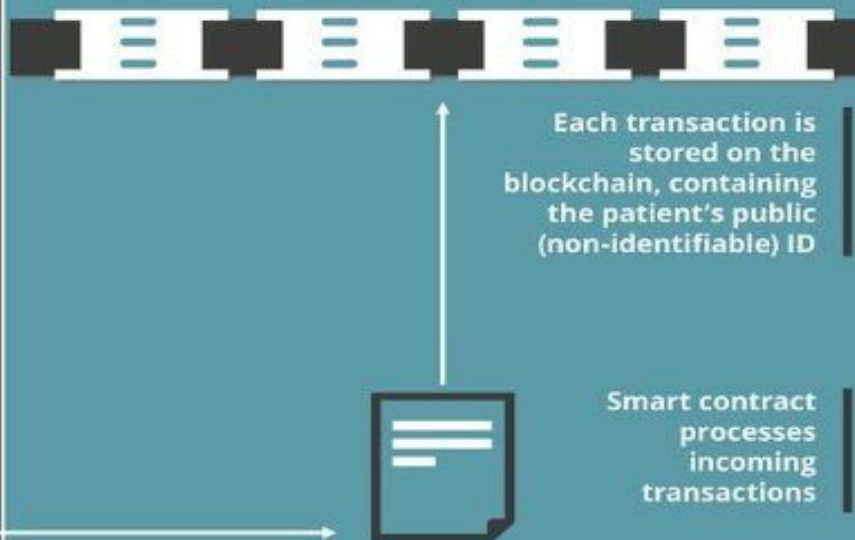


## 2 Transactions are completed and uniquely identified

Blockchain

Each transaction is stored on the blockchain, containing the patient's public (non-identifiable) ID

Smart contract processes incoming transactions



## 3 Health organizations and institutions can directly query the blockchain

Blockchain

Health organizations and institutions submit their queries via APIs

Non-identifiable patient information (e.g. age, gender, illness) is viewable

Data can be analyzed to uncover new insights



## 4 Patients can share their identity with health organizations

The patient's private key links their identity to blockchain data

The private key can be shared with new health organizations

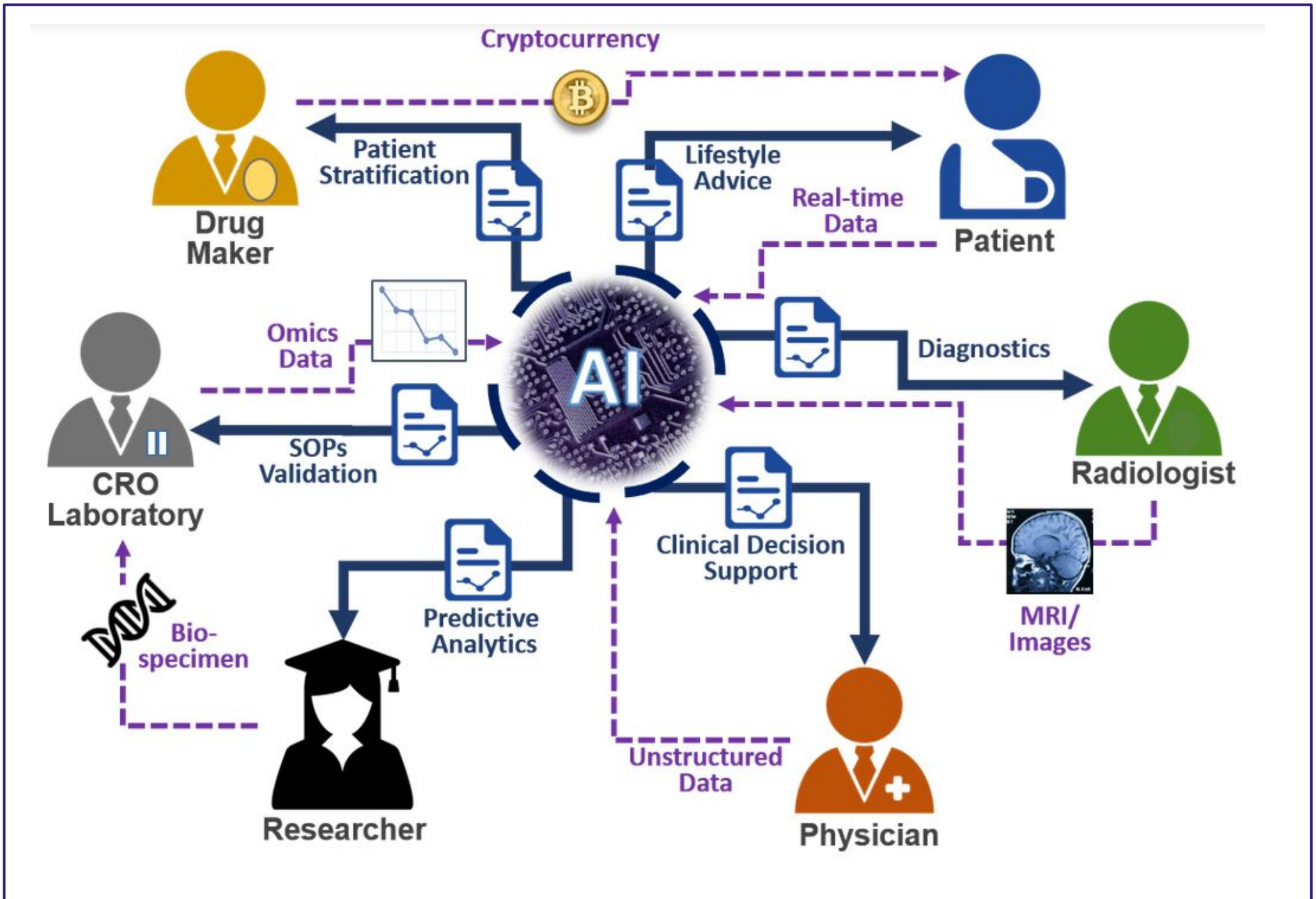
With the key organizations can then uncover the patient's data

Data remains non-identifiable to those without the key



Blockchain will enable secure and verifiable sensitive data storage and sharing, while allowing patients to choose to share their individual data with relevant parties such as doctors and researchers, as well as for clinics to access non-identifiable patient data through queries via APIs.

Each patient is assigned their **private key** to enable sharing of their data which remains unidentifiable to anyone from the outside without the key.





## P3 medicine

**Precision, preventive, and personalized medicine, also known as P3 medicine**, represents the next evolutionary step from reactive disease care. In contrast to the latter, P3 covers three functions: the early detection of factors responsible for diseases (predictive), reducing the likelihood of diseases (preventive), and therapy that focuses uniquely on each patient (personalized).

P3 medicine is made possible thanks to the convergence of three trends. One is the advances in systems medicine - a field of study that looks at the systems of the human body as part of an integrated whole that are affected by biochemical, physiological, and environment factors - particularly its increased ability to understand the complexity of diseases. Two is our increased ability to collect, store, and analyze data. And three, an ever easier access to information afforded to consumers about their own health data, leading to a rise in their active interest in managing their health.

The human genome is made up of about 25,000 genes, but some genes may not be fully expressed, some genes share multiple responsibilities, and each gene encodes multiple proteins, all of which produces very complex interactions. This is where supercomputers come in. They are able to model biological networks and simulate the functioning of these networks to identify any perturbation, or disease, and the therapies most likely to 'fix' the network.

P3 medicine is much more effective than the medicine we know today. While the current status is marked by increasing healthcare costs, the promise of P3 is that it could lead to better health for consumers and an industry that is more efficient financially.

Personalized medicine is an interdisciplinary field that is entering the market with a promise to revolutionize the industry. Personalized medicine can be defined as an approach in healthcare that creates therapies based on individual characteristics of the patients.

Personalized medicine is used in conjunction with the precision and preventive medicine to form the P3 Medicine. The core ideas of the P3 approach are:

- Take **personal** traits of the patient into the consideration
- **Predict** diseases before they do any substantial damage
- **Prevent** diseases when possible, rather than to treat them

P3 Medicine stands as a key enabler in the longevity technology framework that ties multiple innovations in a single industry,



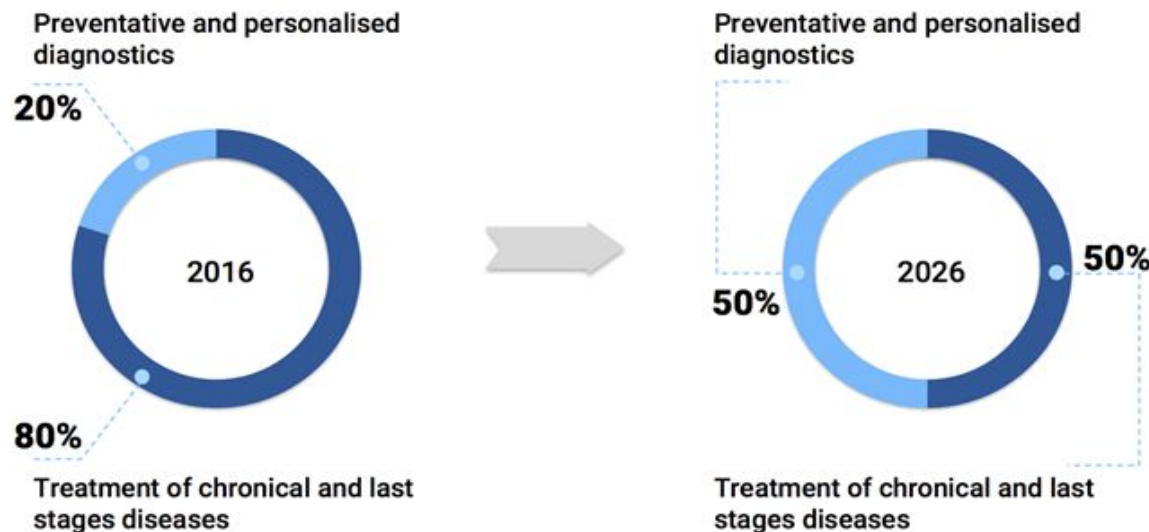
P3 Medicine mirrors another notable trend in modern healthcare, gene therapy. While the latter is using advancements in genetics and related fields in order to treat diseases by altering patient's genome, P3 looks to learn from one's genetics instead of altering it. This approach can be seen as a safer and less invasive one.

The strongest point of P3 medicine from the longevity perspective is the fact that it is **already being partially implemented** while having enormous potential for further development.

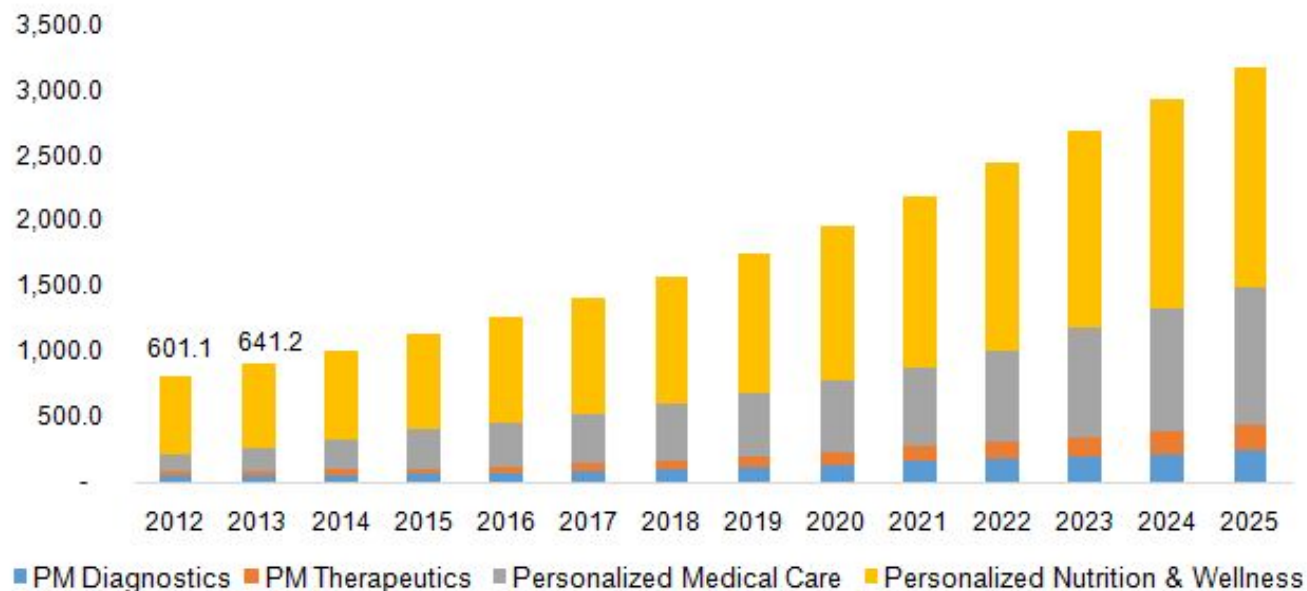
P3 market is expected to develop significantly over the course of the next ten years. This is because P3 Medicine is a complex structural change for the healthcare industry that heavily relies on other **emerging technologies** that are also expected to be fully developed in ten years.

It is expected that personalized and preventive approach in treatment of chronic diseases will become the prevalent one by 2026.

The changes in healthcare systems together with emerging technologies will double the P3 medicine market by 2022, compared to 2012.



**Global personalized medicine market, by product, 2012 - 2025 (USD Billion)**



Source: <https://www.grandviewresearch.com/industry-analysis/personalized-medicine-market>

# AgeTech

*“We need a seismic shift from collective responsibility for retirement to individual responsibility.” ~ Laurence D. Fink*

AgeTech is the amalgamation of Fintech and Healthtech. Age-friendly banks use technology to attract and protect vulnerable older customers.

A person's financial decision-making ability peaks roughly in their mid-50s, and begins to deteriorate afterwards. Elderly people in general struggle with day-to-day banking activities, are more susceptible to poor investment choices and financial fraud; the average age of victims of mass-marketing scams is 75.

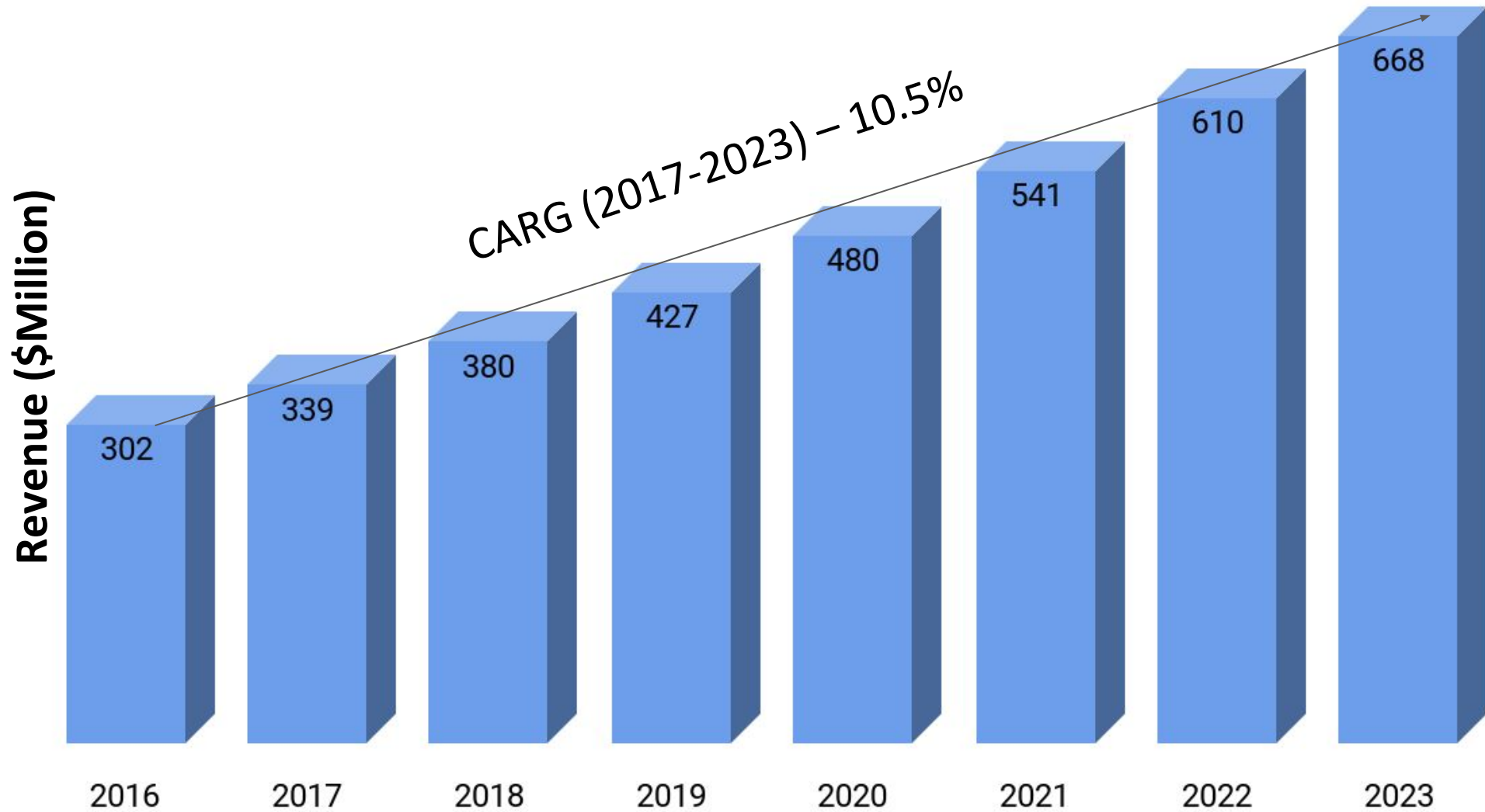
Barclays for instance uses voice recognition to help customers who have trouble with passwords. Other fintech solutions for the elderly focus on mobile technology: the devices currently found on the market aren't friendly to the elderly populations. A revolution in AgeTech then is very much dependant on the spread of mobile devices that are easy to use for old people. Only then will banks be able to unlock mobile banking for that demographic.

More significantly, algorithms are helping banks spot any alarming changes in behavior - such as spending patterns - which could signal trouble.

## **Managing people's money can shed light on their health**

A much more intriguing pattern is emerging: banks are well placed to spot elderly individuals who are at risk. A decline in financial management skills can be an early sign of health problems, dementia for example. Banks will be able to refer a person to a doctor. In addition to spotting financial abuse, some banks are currently training their staff to spot dementia.

## Eldery & Disabled Assistive Devices Market



Source: <https://www.alliedmarketresearch.com/disabled-and-elderly-assistive-technologies-market>





Commenting on the changing retirement landscape in a 2013 speech to NYU Stern MBA students entitled *Longevity in the Age of Twitter*, Laurence D. Fink, CEO of BlackRock and an NYU Trustee raised the spectre of the Silver Tsunami:

*“When I was growing up, the U.S. was launching the Great Society, which sought to summon the resources of government to wipe out poverty. Today, the generation that came of age with the Great Society is headed for retirement and giving you a Grey Society – where we will need to summon up even greater resources just to meet their needs.”*

Turning to the role of technology in managing senior finances:

*“ We need a seismic shift from collective responsibility for retirement to **individual** responsibility. ”*

By adapting to the changing biological reality of each individual's as they age, the growth of AgeTech hands back to old people their former individual decision making capacity, putting the wisdom of individual life experience back behind the grey pound.

# Objective forecasting for 2018 - 2022 (applying TRLs)

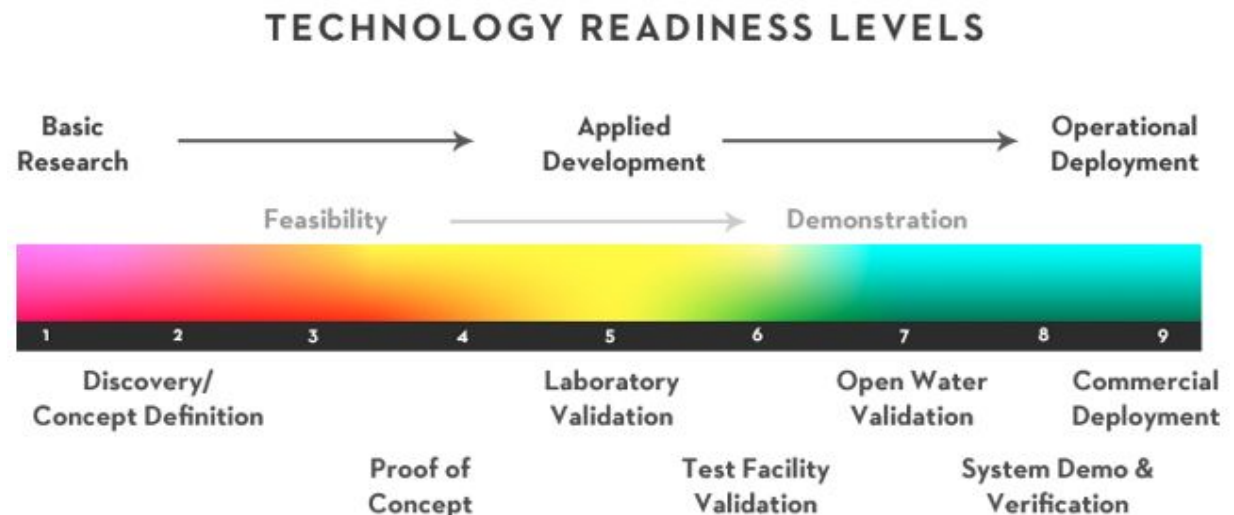
Technology readiness levels (TRLs) enable the gauging of the maturity of Critical Technology Elements (CTEs) determined during a Technology Readiness Assessment (TRA) that examines program concepts, technology requirements, and demonstrated technology capabilities.

TRL use a ranking 1 - 9, with 9 being the most mature technology, with specific TRL levels being assigned to specific technologies by a group of scientific experts familiar with each specific technology. The use of TRLs enables consistent, uniform discussions of technical maturity across different types of technology.

In the coming years, TRLs can underpin efforts to shed light on the most important technologies, but also those that are at present furthest away from their practical application; therefore enabling the right timing and focus to ensure the accomplishment of specific endpoints with regard to each emerging technology, and the interactions that are possible between technologies that are currently at different points on the TRL scale, but can be expected to merge in level over the coming few years.

Using TRLs can expedite progress in the coming 5 years by employing TRLs to provide an **objective** lens through which various technologies are viewed.

In the same way that using this scale has benefited the aerospace industry, it can bolster the efforts of the life sciences industry in the coming years.



# THE SCIENCE OF PROGRESSIVE MEDICINE 2017 LANDSCAPE

Top 120+ R&D Topics TRL 4-7

## Regenerative Medicine

Cellular Therapeutics  
Tissue Engineering  
Organ Engineering

## Blockchain

Distrib. Health Records  
Health Info. Exchange  
Blockchain Drug Verif.

## Translational Geroscience

Compar. Geronte-n omics  
Longev. Gene Therapy  
Ageing Gene Knockout

## Artificial Intelligence

Big Data in Medicine  
Deep Learning Drug Disc.  
Generative Adversarial Networks

## 3D Bioprinting



## Gene Therapy

## Stem Cell Therapy

## Sequencing

## Bio-informatics

## Biologics & Small Molecules

## Geroceuticals

Gero-protectors  
Senolytics  
SASP Inhibitors

## Biomarker Technologies

Realtime Biomark. Tracking  
Pop. Specific Biomark.  
in vivo Biomarker Sensors

### Technology Readiness Level (TRL)

9	Commercialized
8	Pre-Production
7	Field Test
6	Prototype
5	Bench/Lab Testing
4	Detailed Design

Technology Readiness Levels (TRL) are a common measure of how close a technology is for practical use, used in many engineering disciplines.

By applying it to progressive medicine, we can forecast how long it will take a given therapeutic or technology to witness practical applications in the clinic or home. The darkness of each hexagon represents its TRL, with darker colors indicating a low TRL and brighter colors indicating a high TRL.

All technologies and therapeutics shown here have a TRL between 4 – 7. Technologies surpassing a TRL of 8 are transferred to the practical applications of progressive medicine landscape overview.



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DEEP KNOWLEDGE  
LIFE SCIENCES

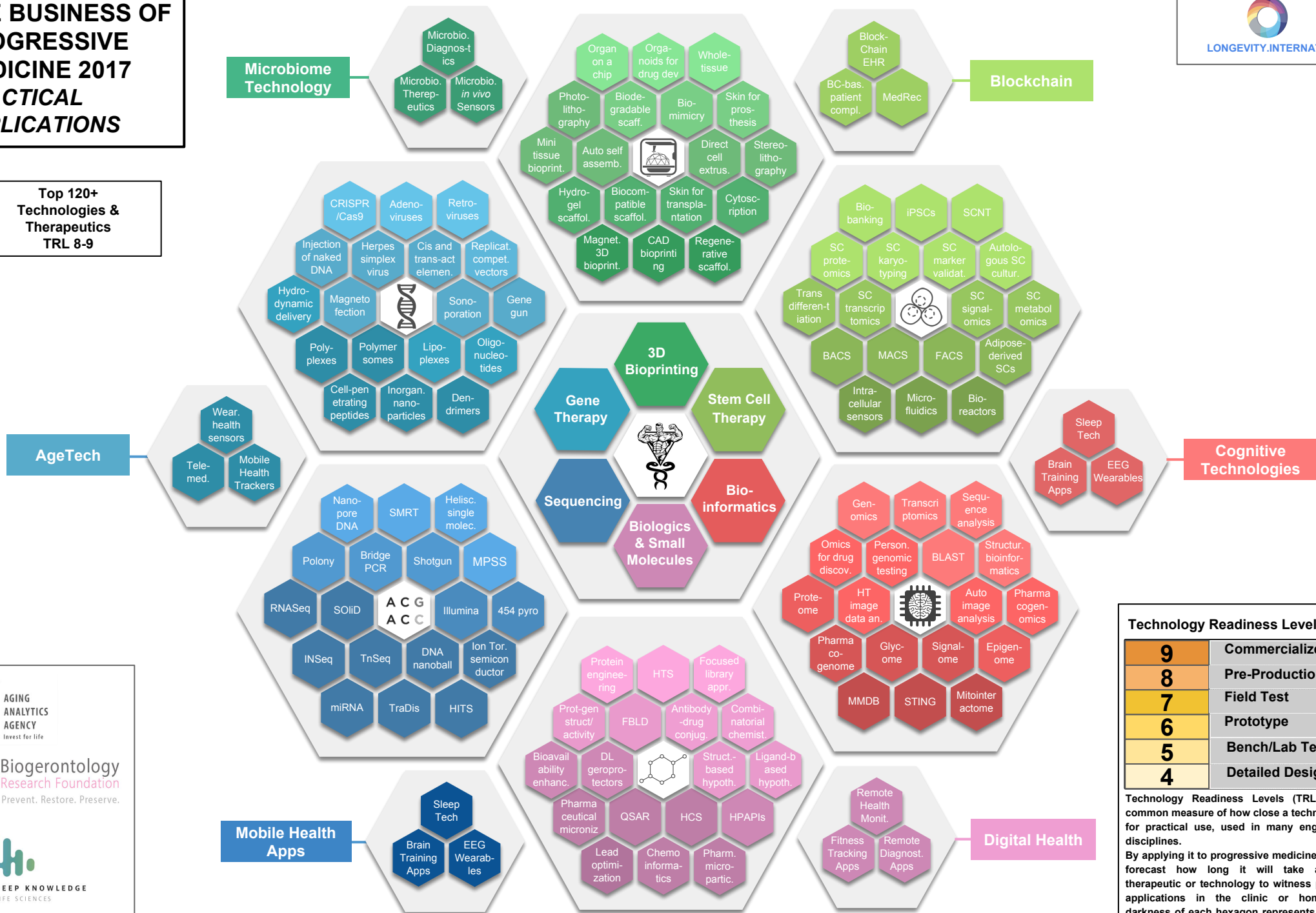


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# THE BUSINESS OF PROGRESSIVE MEDICINE 2017

## PRACTICAL APPLICATIONS

Top 120+ Technologies & Therapeutics TRL 8-9



### Technology Readiness Level (TRL)

9	Commercialized
8	Pre-Production
7	Field Test
6	Prototype
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All technologies and therapeutics shown here have a TRL between 8-9.



AGING  
ANALYTICS  
AGENCY  
Invest for life



Biogerontology  
Research Foundation  
Prevent. Restore. Preserve.



DEEP KNOWLEDGE  
LIFE SCIENCES



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## Exponential acceleration of further progress

We have barely scratched the surface when it comes to the applications of technology in healthcare.

Technology grows exponentially: according to Moore's Law, computer processing speed doubles every 18 months. Although the healthcare industry is typically slow to progress, the growth driven by innovative tech should accelerate the progress exponentially.

Another factor enabling this acceleration is the growth of outside players: big and small companies looking to capitalize on gaps in the market will drive advances in diagnostics and treatments faster than traditional medical institutions. According to Mary Meeker's latest report, venture capitalists in Silicon Valley are increasingly hiring bio experts to help guide their investments.

Artificial Intelligence, for instance, is expected to reach \$6.6 billion in 2021, at a compound annual growth rate of 42%. By 2020, it is expected that conditions such as cancer and diabetes will be diagnosed in minutes using cognitive systems. By 2025, AI systems are expected to be implemented in 90% of the U.S., and 60% of the global hospitals and insurance companies will have implemented AI systems, which will be able to deliver quality care to 70% of patients at a reduced cost.

Innovation in immunotherapy, such as checkpoint inhibitors - a type of drug that boosts the immune response against cancer cells - is growing at 139% CAGR. Scientists are still trying to nail down an algorithm for its effective use. Once realized, the market for checkpoint inhibitors could reach \$21.1 billion by 2020.

Now that the media hype dust has settled, 3D Printing for organ or tissue repair carries huge potential in healthcare. The 3D printing business for healthcare is expected to reach approximately \$6 billion in 2025.

# Conclusion

The whole will become bigger than the sum of its parts when the following 5 technology megatrends converge:

- AI in biomedicine
- The adoption of blockchain
- Progress in longevity and geroscience
- New financial systems and AgeTech.

These megatrends are going to converge **very fast** in the coming 5 years. Therefore the window for startups to enter this new market will be closing swiftly over the course of the next few years.

By 2022, the big companies will openly begin to embrace these new trends, and leave behind the old technologies still in use at present, whereupon governments and financial institutions will adapt to work with the transformed industries.

**“Given the increasing cost of drug discovery, development and clinical evaluation, it is clear that the clinical translation of geroprotective interventions will be increasingly led by the private sector, and by parties who have the resources to sustain the increasing financial burden of bringing truly effective longevity therapeutics to market.”**

*- Dmitry Kaminskiy, Managing Partner of Deep Knowledge Life Sciences*