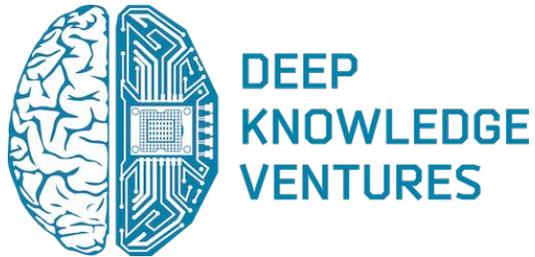


ANALYTICAL REPORT SAMPLE

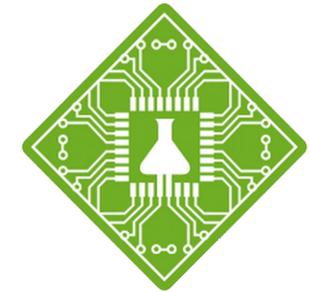
AI FOR DRUG DISCOVERY, BIOMARKER DEVELOPMENT AND ADVANCED R&D LANDSCAPE OVERVIEW 2018 / Q1

Companies - 80
Investors - 180
Corporations - 25
R&D Centers - 20

Contributing Partners



PHARMACEUTICAL
ARTIFICIAL
INTELLIGENCE



IN SILICO MEDICINE



DEEP KNOWLEDGE
LIFE SCIENCES



Young.AI



PHARMA.AI

CHEMISTRY.AI

September 12-13, 2017 ■ BASEL LIFE EMBO ■ Congress Center, Basel, Switzerland

ARTIFICIAL INTELLIGENCE
AND BLOCKCHAIN
FOR HEALTHCARE

Executive Workshop
AI & BLOCKCHAIN
Applications in Pharma R&D

AI for Drug Discovery, Biomarker Development and Advanced R&D Landscape Overview 2018 / Q1

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AI for Drug Discovery, Biomarker Development and Advanced R&D Landscape / 2018 Q1

Companies - 80
Investors - 180
Corporations - 25

SPECIALIZATION



AI for Drug Discovery, Biomarker Development and Advanced R&D Landscape / 2018 Q1

USA

Companies - 80
Investors - 180
Corporations - 25

Regional
Position

Investors

AI Companies

Corporations

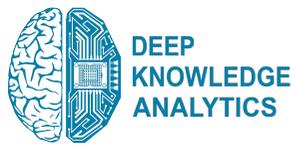


UK

Other Regions

EU

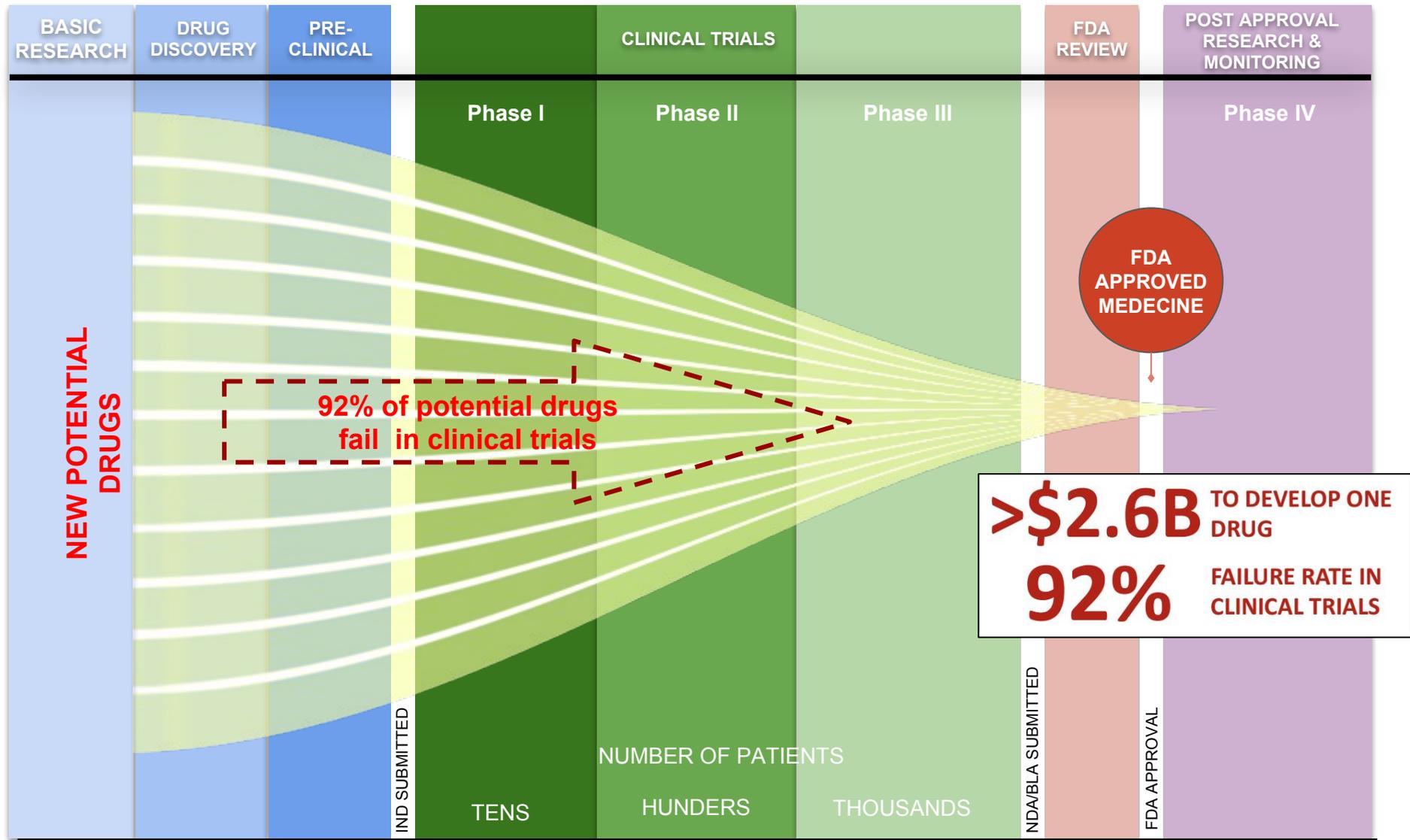
Asia



DEEP
KNOWLEDGE
ANALYTICS

The Biopharmaceutical R&D Process

GLOBAL SALES: >\$1 Trillion
GLOBAL R&D: >\$150 Billion



AI for Advanced R&D and Drug Discovery 2018 / Q1

In 2017 our analytical department released our inaugural report on the state of the AI for Drug Discovery industry, entitled AI for Drug Discovery Landscape Overview 2017, and in January 2018 we released AI for Drug Discovery, Biomarker Development and Advanced R&D 2017.

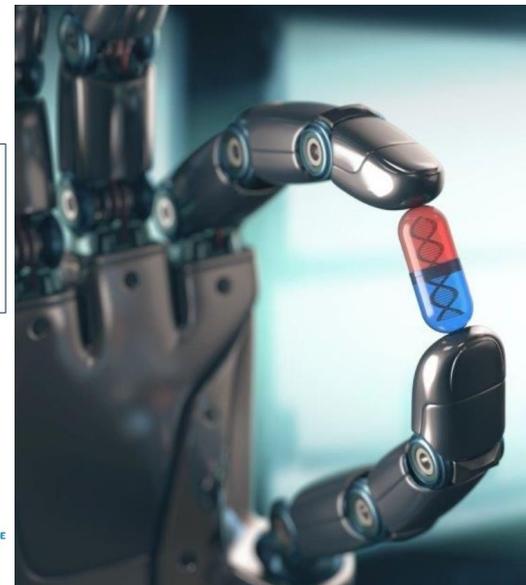
Now, nearing the end of the first financial quarter of 2018, the state of the field had advanced so rapidly, that we are compelled to release a second, updated edition, not one year later, but one quarter later.

The first quarter of 2018 saw major changes, significant investments, acquisitions, and the establishment of substantial joint ventures. This serves as a stark reminder of how fast the AI for drug discovery, biomarker development and advanced R&D sector is advancing.



**AI FOR DRUG DISCOVERY,
BIOMARKER DEVELOPMENT
AND ADVANCED R&D
LANDSCAPE OVERVIEW 2017**

www.dkv.global



**AI for Drug Discovery
Landscape Overview 2017**

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AI for Advanced R&D and Drug Discovery 2018 / Q1

- The report's Executive Summary charts the major trends and significant developments that have occurred in the industry during the first quarter of 2018.
- Chapter I gives a more comprehensive overview of the specific developments underlying and shaping the major trends outlined in the Executive Summary.
- Chapter II compares the top AI companies for drug discovery and advanced R&D side by side according to a variety of metrics including technology, assets and employees.
- Chapter III discusses the major occurrences happening in the BioPharma sector, and outlines how the entire BioPharma industry is now actively participating in the AI for drug discovery and biomarker development space via internal R&D, investment and acquisition, in contrast to 2017, during which time they remained skeptical of the disruptive impact of AI.
- Chapter IV details how IT & Tech Giants are continuing to enter the space; this was already a major trend in 2017, and it is continuing apace into 2018, remaining one of the strongest hallmarks of the subsector's exponential dynamic of development.
- Chapter V focuses specifically on the largest investments and joint ventures that were launched in the first quarter of 2018.

AI for Advanced R&D and Drug Discovery 2018 / Q1

- Chapter VI covers an emerging niche within the AI for drug discovery and advanced R&D subsector, namely, AI for Longevity, showing that Longevity is an increasingly prominent niche within the space, and one that has perhaps the most disruptive potential for BioPharma and healthcare in general.
- Chapter VII outlines the convergence of AI, Digital Medicine and Blockchain. The beginnings of this unifying trend could already be seen in 2017, but 2018 will mark the year in which the synergetic integration of AI with Digital Medicine and Blockchain becomes a major trend in the subsector, approaching the status of a standard industry hallmark that any serious company will need to begin implementing in order to stay competitive in the rapidly growing AI in healthcare industry.
- Chapter VIII serves as a short primer and introduction into deep learning, and its application to drug discovery and biomarker development.
- Chapter IX presents a comparative analysis of various leading players and companies in the AI for drug discovery industry, and which presents a classification system whereby different companies can be grouped into different classes and compared with one another.
- The report concludes with a detailed appendix profiling the top 80 companies, 20 leading R&D centers, AI leading 10 BioPharma giants, top 15 IT&Tech giants, and 180 investors in the AI for drug discovery and advanced R&D subsector.

AI for Advanced R&D and Drug Discovery 2018 / Q1

This extended second edition considers the industry landscape in greater depth than our previous reports, and provides updated profiles of the top companies, investors and influencers comprising the industry. Additionally, this report gives an in-depth analysis of the significant role that tech giants and IT corporations have started to play in the exponentially-advancing AI for drug discovery industry. IT giants already begun to venture into this sphere in order to reap the significant gains that are to be had in the years to come

BioPharma giants will need to commit significant resources (and perhaps even more importantly, significant will and the implementation of AI-focused strategies) to the acquisition of AI specialists and AI for drug discovery companies. However, several BioPharma giants have already begun to do just this, and might jump ahead of other BioPharma companies in the AI race.

One prime example of the major changes that have occurred in just the past several months is the current state of what we referred to in our previous reports as the **Big Gap**, i.e., the fact that throughout 2016 and 2017 IT giants recognized and supported AI for healthcare startups, in terms of both investment and acquisitions, while BioPharma lagged behind, still skeptical of the impact that AI could make upon drug discovery, biomarker development and other BioPharma niches. Our most recent analysis seems to indicate that this Big Gap is now to a large extent **neutralized**, and the BioPharma industry now has significant interest in AI, and belief in its ability to facilitate fundamental paradigm shifts in their traditional modes of operation. Some BioPharma companies have now become actively involved in the AI for drug discovery sector, while others still lag behind, skeptical of the sector's potential for impact and disruption, or finding themselves unable to acquire or implement these novel technologies in any relevant capacity.

All indications point to the conclusion that 2018 will mark the year that will test the strength, resolve and foresight of BioPharma as a whole. Those BioPharma companies that commit significant will and resources to acquiring strong AI specialists, technologies and acquisitions will flourish, and those that do not will stagnate, and by the time their profit margins force them to realize the disruptive potential of AI for drug discovery and other biomedical niches, they will have missed the boat, with the majority of talent, technology and companies having already been acquired by their competitors.

AI for Advanced R&D and Drug Discovery 2018 / Q1

Meanwhile, within that last financial quarter, Chinese IT and Tech giants, such as Alibaba, Baidu and TenCent, have made significant investments and acquisitions in the AI for Drug Discovery sector, showing that the number of IT giants committing to the sector is growing not just regionally but also globally.

At the same time, the lack of AI specialists that was alluded to in our previous reports is still present. The majority of talented AI specialists in general have been acquired by traditional IT giants and have been applied for purposes other than AI in healthcare, creating a lack of enough specialists to support the activities of AI for drug discovery companies.

And it is not just traditional BioPharma companies that are suffering from this lack of specialists; indeed, even companies specializing specifically in **AI for drug discovery are feeling the effects of this lack, as can be seen on page 29 of this report, which shows that on average, AI specialists make up only 19.7% of such companies staff.** One of the central aims of this report is to summarize this gap, and chart the possible ways forward in order to neutralize it.

Overall, the AI in healthcare and BioPharma subsector is growing at an exponential rate, both in terms of new companies, investments and acquisitions, and in terms of the extent with which it is disrupting the traditional modes of operation on BioPharma as a whole.

What is now a subsector and niche is poised to grow into perhaps the leading subsector in BioPharma in the next 2-3 years, one that will have the greatest transformational impact on the industry, and one that will distinguish the leaders of the industry from the stagnators.

By the end of 2018, we can predict that there will be intensive competition between the largest BioPharma companies and the largest IT and tech giants for the acquisition of new AI specialists, technologies and startups, in much the same way that 2014 – 2016 saw intense competition between IT-giants and Tech corporations to acquire the best AI assets and resources.

The Application of AI for Advanced R&D

Generate Novel Drug Candidates

- Analyze data sets, form hypotheses and generate novel insights
- Identify novel drug candidates
- Analyze data from patient samples in both healthy and diseased states to generate novel biomarkers and therapeutic targets
- Predict binding affinity and other pharmacological properties of molecules
- Allow filtering for drug-like properties of molecules
- Reduce complexity in protein design

Aggregate and Synthesize Information

- Extract knowledge from literature
- Generate insights from thousands of unrelated data sources
- Improve decision-making
- Eliminate blind spots in research
- Identify competitive whitespace

Repurpose Existing Drugs

- Rapidly identify new indications for many known drugs
- Match existing drugs with rare diseases
- Conduct experimental biology at scale by testing 1000+ of compounds on 100+ of cellular disease models in parallel
- Generate novel biomarkers and therapeutic targets

Design and Run Preclinical Experiments

- Reduce time, money, and uncertainty in planning experiments
- Decode open- and closed-access data on reagents and get actionable insights
- Automate selection, manipulation, and analysis of cells
- Expedite development of cell lines and automate manufacturing of cellular therapeutics
- Automate sample analysis with a robotic cloud laboratory

Clinical Trials

- Optimize clinical trial study design
- Transform diverse streams of biomedical and healthcare data into computer models representative of individual patients
- Deliver personalized medicine at scale, by revealing optimal health interventions for individual patients
- Analyze medical records to find patients for clinical trials
- Automate matching cancer patients to clinical trials through personal medical history and genetic analysis
- Improve pathology analysis
- Identify patients that would benefit from novel therapies

Chapter II Comparison of Leading AI Companies

Chapter II compares the top AI companies for drug discovery and advanced R&D side by side according to a variety of metrics including technology, assets and employees.

In this chapter we present comparison tables of AI for Drug Discovery Companies according to criteria such as:

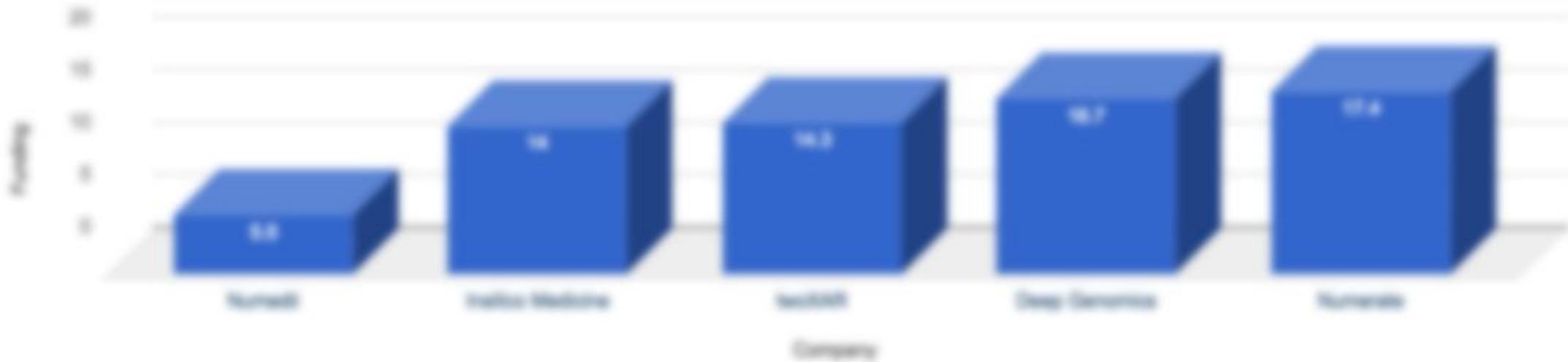
- Funding of 10 AI leading companies in Drug Discovery industry.
- Number of Publications
- Number of Patents
- AI experts
- BioTech experts

As well, in Chapter II we show the diversification of AI applications for R&D and Drug Discovery process step by step. This section includes comparisons of Drug Discovery companies focusing on Artificial Intelligence, based on funding, number of publications and patents. Also we provide a comparison analysis based on how many AI and BioTech experts activate within the company.

Chapter II features a comprehensive valuation analysis of the diversification of the AI in R&D and Drug Discovery process, presenting AI startups which are focused on repurpose of existing drugs, design on a new drugs, validation of drug candidates. AI startups which are focused on: Design, Optimization and Run of preclinical trials. As well, AI startups which provide services on recruitment for clinical trials, also support in publishing data.

Comparison of AI for Drug Discovery 10 leading Companies

Funding*, \$m (as of 1 April 2018)

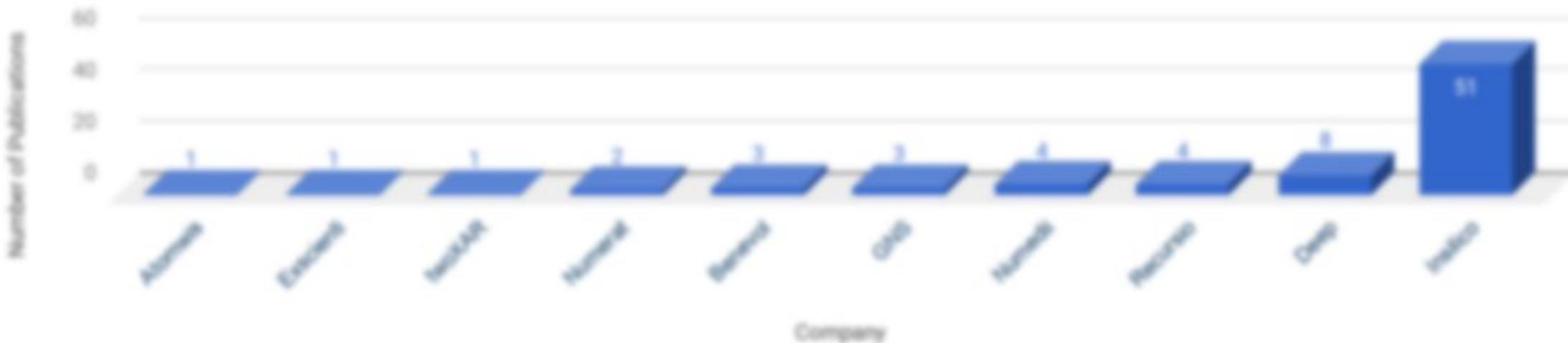


Source: Crunchbase or Company Website

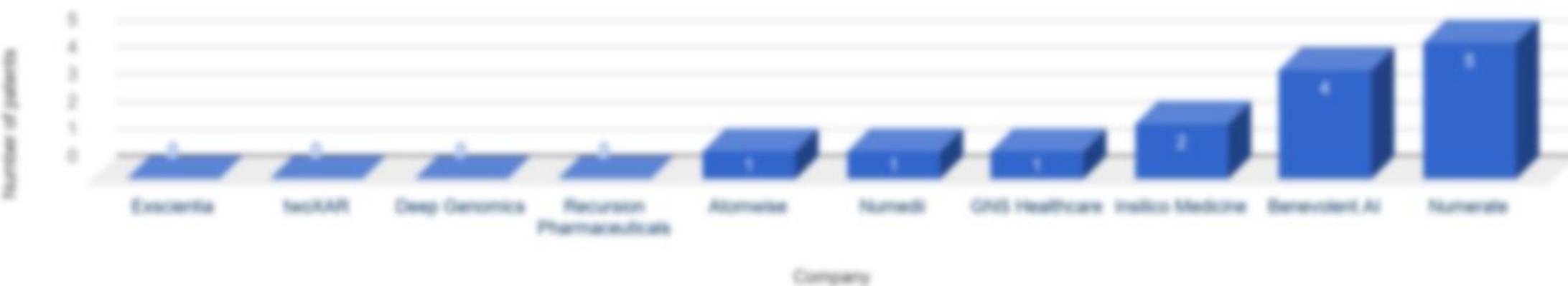
Comparison of AI for Drug Discovery 10 leading Companies

(as of 1 April 2018)

Number of Publications (PubMed)

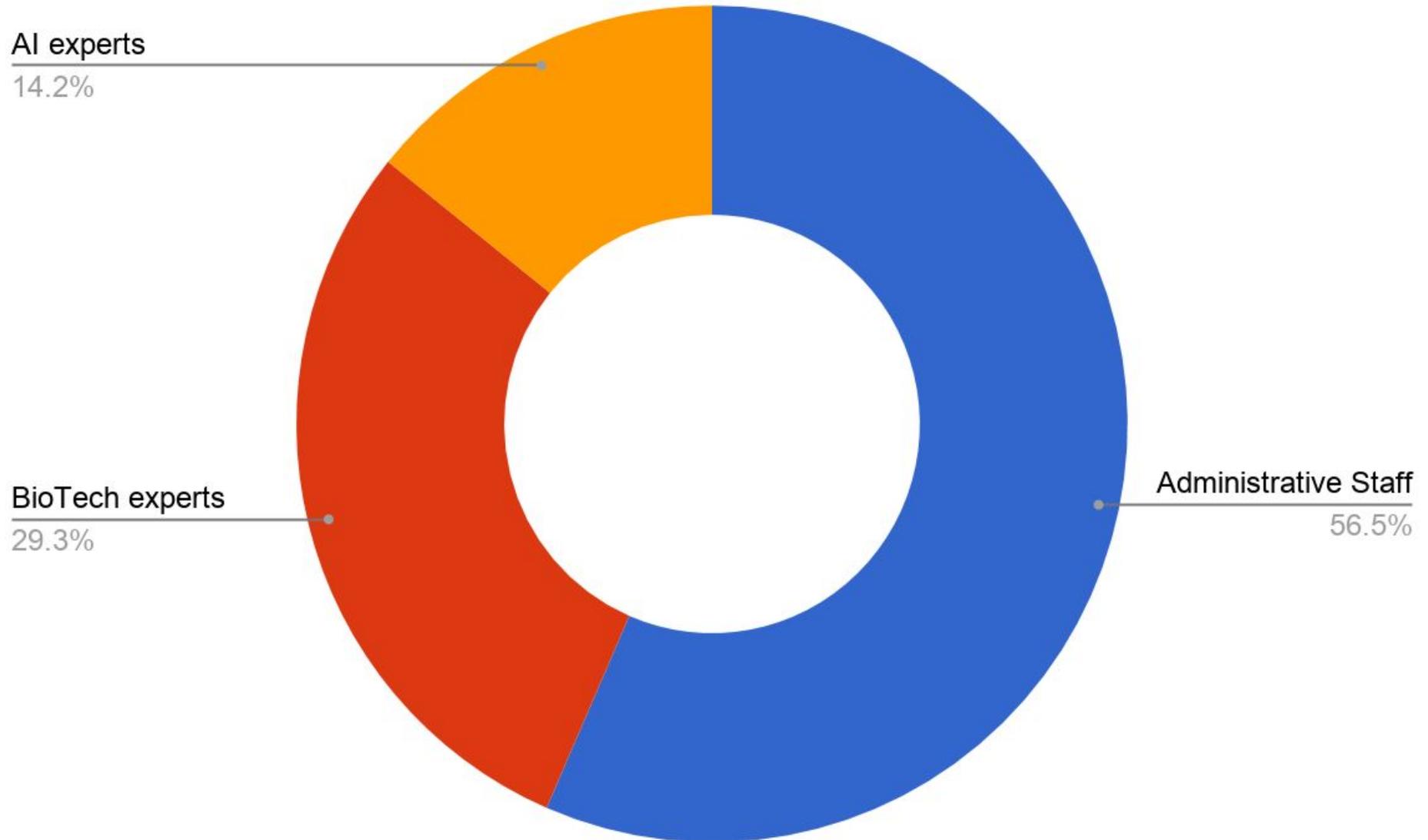


Number of Patents (Google Patents)



Ratio of Experts in HealthTech AI R&D Startups

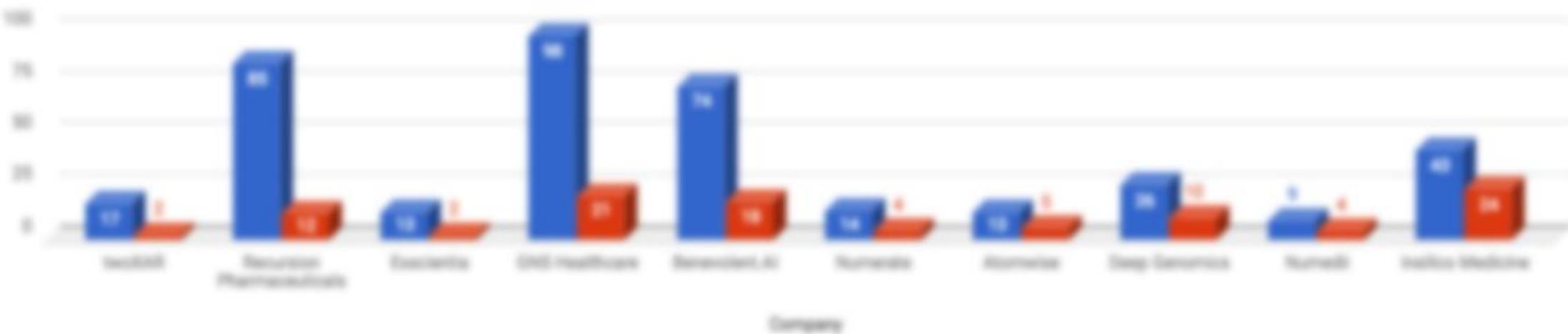
AI experts vs BioTech experts vs Administrative Staff



Comparison of AI for Drug Discovery 10 leading Companies

Total Number of Employees / AI experts

(as of 1 April 2018)



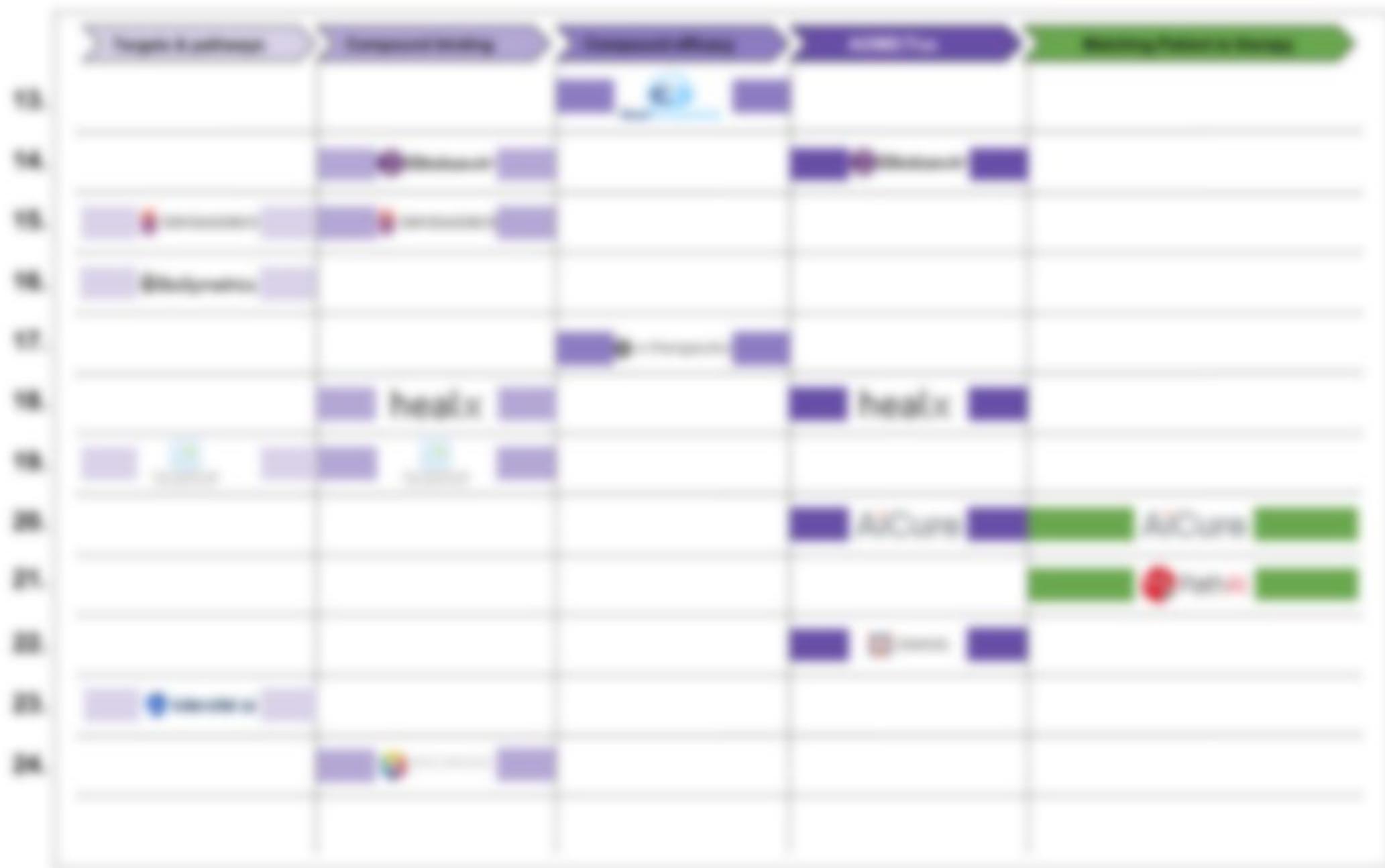
True AI companies
 The ratio: **AI experts vs**
Total Number of Employees



Diversification of AI applications for R&D and Drug Discovery process



Diversification of AI applications for R&D and Drug Discovery process



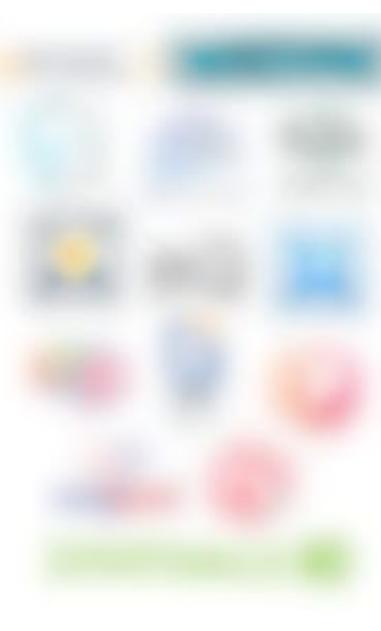
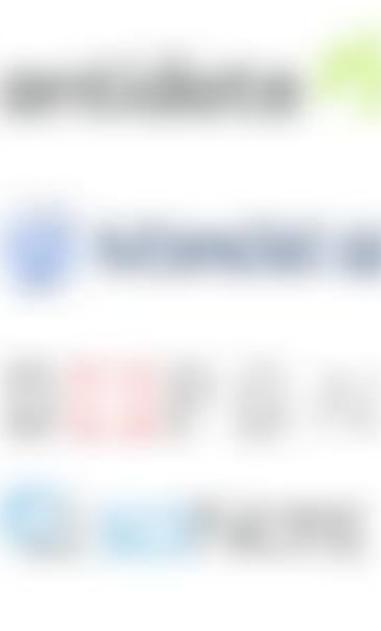
Comparison of AI for Drug Discovery Companies

Company	Scientific publications covering AI for drug discovery	Number of AI experts in the team / total number of employees	Public talks on AI for drug discovery	Validation	Use GANs/RL
1. Atomwise	•	11/13	•	n/a	n/a
2. Cloud Pharmaceuticals	•	n/a	•	n/a	n/a
3. Benevolent AI	•	18/74	•	n/a	n/a
4. Globevir	-	14	-	n/a	n/a
5. Envisagenics	-	n/a	•	n/a	n/a
6. Numerale	-	4/15	•	•	n/a
7. NuMedi	•	49	•	n/a	n/a
8. TwoXor	•	1/15	•	n/a	n/a
9. Exscientia	•	2/12	•	•	n/a
10. BioAge Labs	•	1/5	•	n/a	n/a
11. Insilico Medicine	•	24/43	•	•	•

Comparison of AI for Drug Discovery Companies

Company	Scientific publications covering AI for drug discovery	Number of AI experts in the team / total number of employees	Public talks on AI for drug discovery	Validation	Use cases/ML
12. Cyclize	•	727	•		
13. Deep Genomics	•	1026	•		
14. Biogenomics	•	57	•		
15. e Therapeutics	•	425	•		
16. Healt	•	520	•		
17. ONO Healthcare	•	2156	•		
18. AI Cure	•	943	•		
19. PathAI	•	1337	•		
20. Ocular	•	922	•		
21. Mendel.ai	•	66	•		

Diversification of the AI in R&D and Drug Discovery process

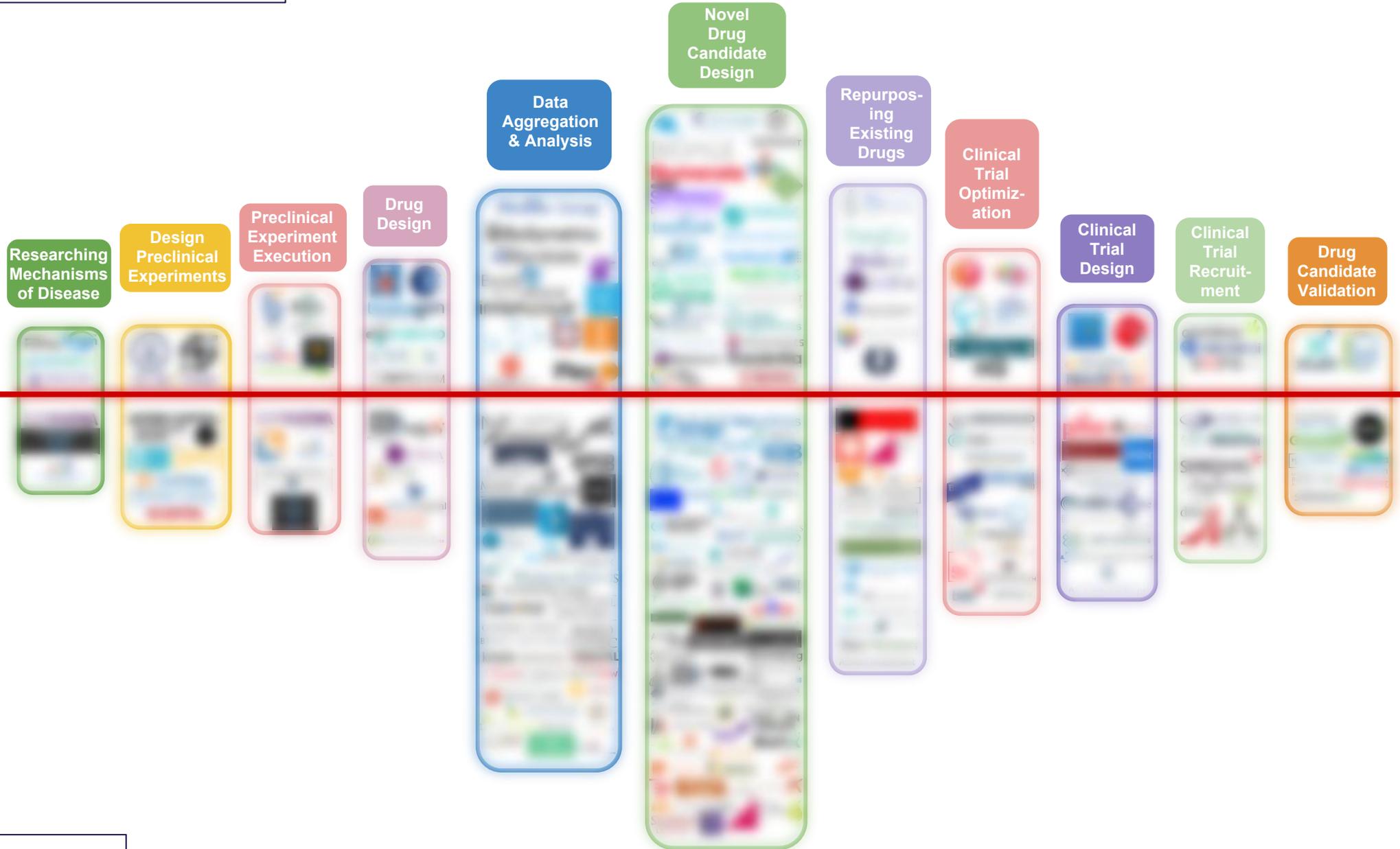
Disease Research	Data aggregation	Drug Discovery	Medical Trials	Collateral Services
<p>These companies are mainly focused on understanding of mechanisms of disease and its evolution.</p>	<p>Organizations of this group are collecting and systematize information about patients, preclinical and clinical experiments and drugs.</p>	<p>AI startups, which are working on Drug Discovery field, are focused on repurpose of existing drugs, design on a new drugs, validation of drug candidates.</p>	<p>AI startups which are focused on trials: Design, Optimization and Run of preclinical trials.</p>	<p>These AI startups provide services on recruitment for clinical trials as well as support in publishing data.</p>
				

Diversification of AI in R&D and Drug Discovery process

Companies - 80
Investors - 180

Companies

Investors



Chapter III BioPharma Transformation

From Denying and Scepticism to active Cooperation

Chapter III discusses the major occurrences happening in the BioPharma sector, and outlines how the entire BioPharma industry is now actively participating in the AI for drug discovery and biomarker development space via internal R&D, investment and acquisition, in contrast to 2017, during which time they remained skeptical of the disruptive impact of AI.

Chapter III includes the following topics:

- AI in BioPharma R&D: Pharma Companies Started to Close “The Big GAP”
- BioPharma: The Road Forward
- BioPharma’s Failure is Strategy, Not Capital
- Main acquisitions / big collaborations between big Pharma companies and AI startups

In this Chapter is mentioned that the number of experts in the field of AI for drug discovery is insufficient to meet the demand of all big pharma companies, so only those few pharma companies and investors who will partner with the best AI for drug discovery companies in time will benefit from these collaborations and increase their capitalization accordingly.

Meanwhile others, even with substantial budgets and the will to succeed in this area, will fail if they are even 1 year late to the race because all of the top AI specialists and AI in healthcare start-ups will have been acquired by then.

Another idea underlined in Chapter III is that the pharmaceutical industry has accumulated capital but remains conservative, bureaucratic and risk-averse in their investment strategy. As government budgets become ever more constrained, it is increasingly urgent that the roadblocks to medical advancement be eliminated. Biopharma must recruit advanced deep learning teams (as Google did with Deep Mind).

Chapter IV Tech Corporations and advanced AI in Healthcare

Chapter IV details how IT & Tech Giants are continuing to enter the space; this was already a major trend in 2017, and it is continuing apace into 2018, remaining one of the strongest hallmarks of the subsector's exponential dynamic of development.

The topics introduced in this Chapter are:

- Tech Giants and Drug Discovery
- Google, Apple, Alibaba and Amazon
- L'Oreal, Baidu, Tencent, Intel and Hitachi
- IBM, Huawei, Samsung, NVIDIA, Microsoft, Nestle

In Chapter IV we established that the interest and application of AI is relatively faster in healthcare and life sciences as many giant tech corporations like Google, Apple, IBM, Qualcomm, AT&T, GE, Amazon, and Microsoft have shown interest by investing, acquisitions and partnering with life sciences companies in this space. Tech Giants are more flexible than BioPharma companies, they do have much more capabilities to implement new technologies in advanced R&D and drug discovery sectors.

In this section, 10 Tech Giants and their involvement in advanced R&D and drug discovery were analysed. It's important to mention that every and each company has its own vision and the level of involvement differs from one company to another.

Chapter V Investment and Joint Ventures

Chapter V focuses specifically on the largest investments and joint ventures that were launched in the first quarter of 2018.

Chapter V consists of the following subjects:

- Investments and industry capitalization
- AI R&D startups investors and investments in 2017-18
- Awards / grants , Collaborations, Acquisitions between Pharma and AI start-ups
- Most Promising Players

By the beginning of 2017 a lot of problems were resolved and new benchmark methods for the application of AI were established, and new collaborations between Pharma and AI startups yielded much better results. Since then the race for the acquisition of the best AI startups began. By the end of 2018 the growth of the industry capitalization will be from 5x to 10x. If there are major breakthroughs (e.g. from highly-disruptive trends and technologies like blockchain), we could expect growth in industry capitalization approaching even 20x.

Chapter V presents the awards / grants offered by Pharma companies to the individuals or teams who submit the best ideas, technologies, or solutions that are using artificial intelligence to advance healthcare, as well collaborations and acquisitions made to use deep learning to develop new drugs, treat diseases, improve health outcomes.

Investments and industry capitalization

2013-2015: During these years the first scalable AI approaches for Drug Discovery and Advanced R&D were developed and several big industry players with talented strategic managers started launching pilot projects, collaborations and making small investments.

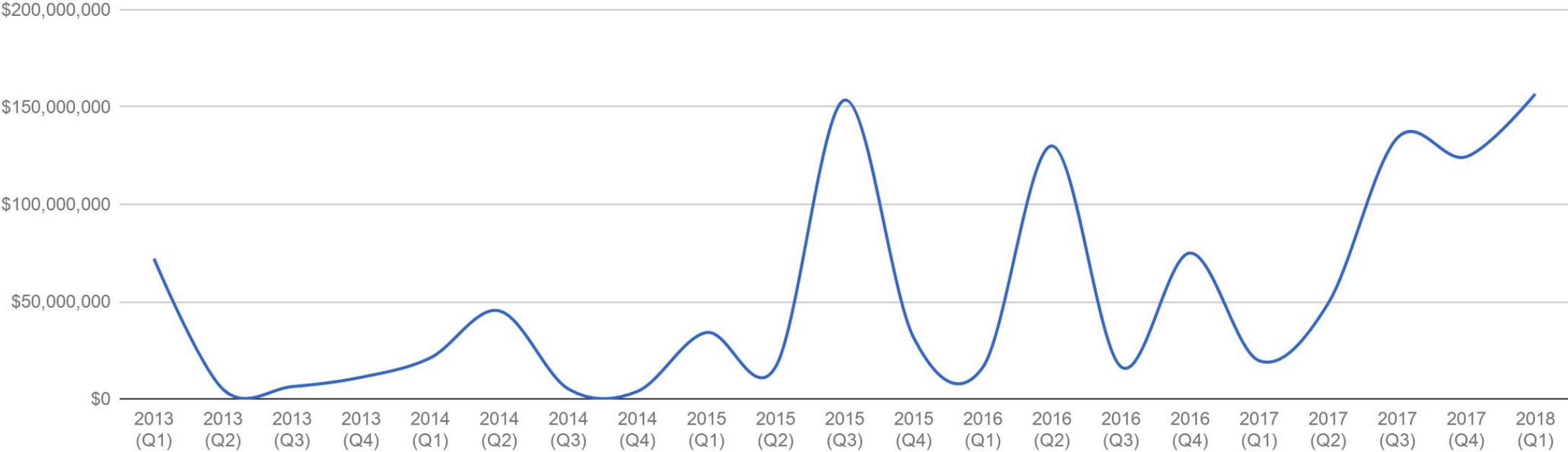
2016-2017: As AI is rapidly penetrating many areas of science, and as its application to some niches is still new, many pilot projects failed and there was a lot of criticism towards the use of deep learning for Drug Discovery and Advanced R&D. This resulted in a general pessimism and a decrease in investments in the industry. By the beginning of 2017 a lot of problems were fixed and new benchmark methods for the application of AI were established, and new collaborations between Pharma and AI startups yielded much better results. Since then the race for the acquisition of the best AI startups began.

2018: Now the capitalization of the industry is continuously growing. By the end of 2018 the growth of industry capitalization can be expected to reach 5x - 10x. If there are major breakthroughs (in disruptive niches such as blockchain), we could expect the growth of industry capitalization to approach even 20x.

Conclusions:

1. **Diversification.** In 2015 and 2016, 26 and 22 investment rounds were conducted, respectively, and in 2017 the number of investment rounds increased to 30. While this is not a substantial increase, the amount of money raised in each *individual* investment round increased significantly.
2. **Increased amount of investments.** 2017 and 2018 showed significant growth in investments. Compared to 2015 and 2016, when AI R&D startups raised \$231M and \$230M accordingly, 2017 showed significant growth to \$691M. In Q1 of 2018 AI R&D startups raised more than \$156M.
3. **Consistency.** During 2013-2016 there was some growth in the amount of capital raised by the industry players, however the trend was not stable or consistent. In 2017-2018 we observed stable growth of the investments in the industry.

Investments in 80 AI Companies in R&D and Drug Discovery



Chapter VI AI and Advanced R&D in Longevity

Chapter VI covers an emerging niche within the AI for drug discovery and advanced R&D subsector, namely, AI for Longevity, showing that Longevity is an increasingly prominent niche within the space, and one that has perhaps the most disruptive potential for BioPharma and healthcare in general.

Chapter VI includes information about:

- Insilico Medicine
- Atomwise
- BioAge
- Biomarkers of Aging

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

We also show that biomarkers of age-related pathologies could be used to evaluate senescence modifications based on the connection between age-related pathologies at the signaling pathway level.

However, most of these biomarkers are not representative of the health state of the entire organism or individual systems and are not easily measured or targeted with known interventions.

We focused on Insilico Medicine, Atomwise, BioAge and their missions, collaborations to extend healthy longevity through innovative AI solutions for drug discovery and research.

Chapter VII Next Generation AI for Drug Discovery and Biomarker Development Convergence with Blockchain and Digital Medicine

Chapter VII outlines the convergence of AI, Digital Medicine and Blockchain. The beginnings of this unifying trend could already be seen in 2017, but 2018 will mark the year in which the synergetic integration of AI with Digital Medicine and Blockchain becomes a major trend in the subsector, approaching the status of a standard industry hallmark that any serious company will need to begin implementing in order to stay competitive in the rapidly growing AI in healthcare industry.

Chapter VII comprises information regarding the following topics:

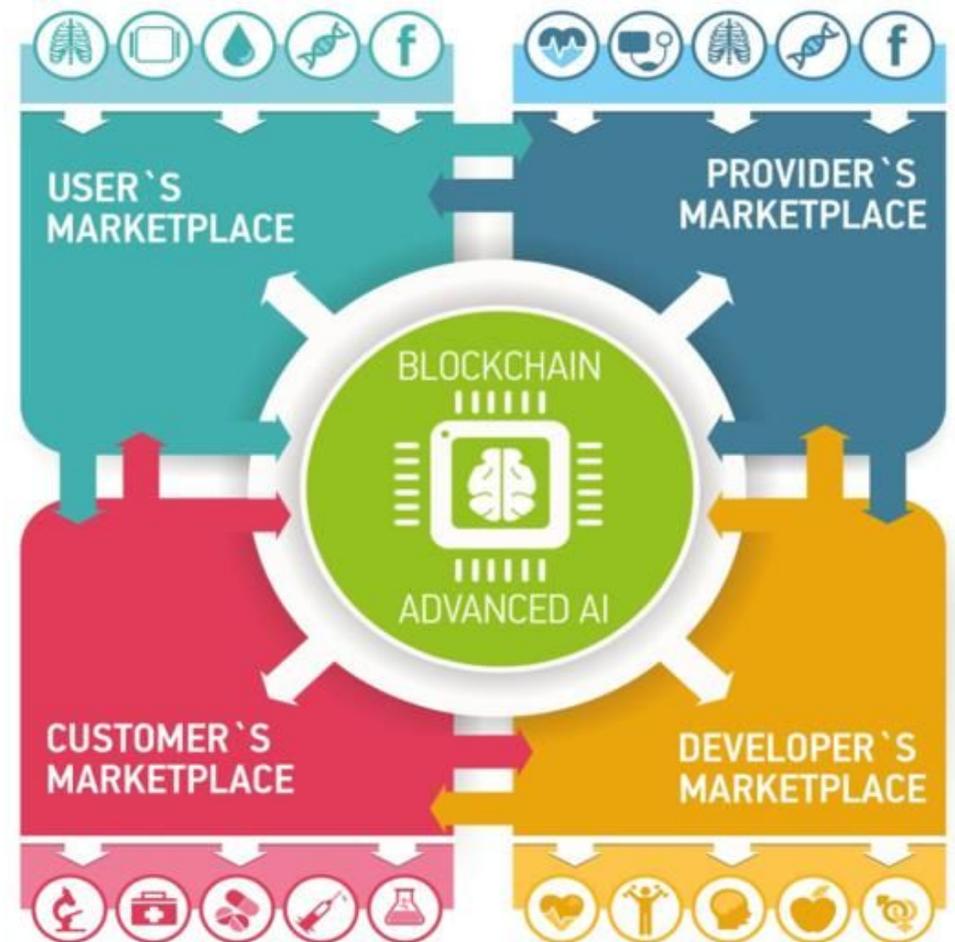
- Next Generation AI for Drug Discovery and Biomarker Development Convergence with Blockchain and Digital Medicine
- Convergence of Technological MegaTrends
- Digital Health
- Artificial Intelligence
- Blockchain
- P3 medicine
- AgeTech
- Objective forecasting for 2018 - 2022 (applying TRLs)
- Exponential acceleration of further progress

The BioPharma and BioMedicine industry is on the edge of a major shift which will happen in 2018-2019. AI will be able to accelerate drug development and make it more cost effective.

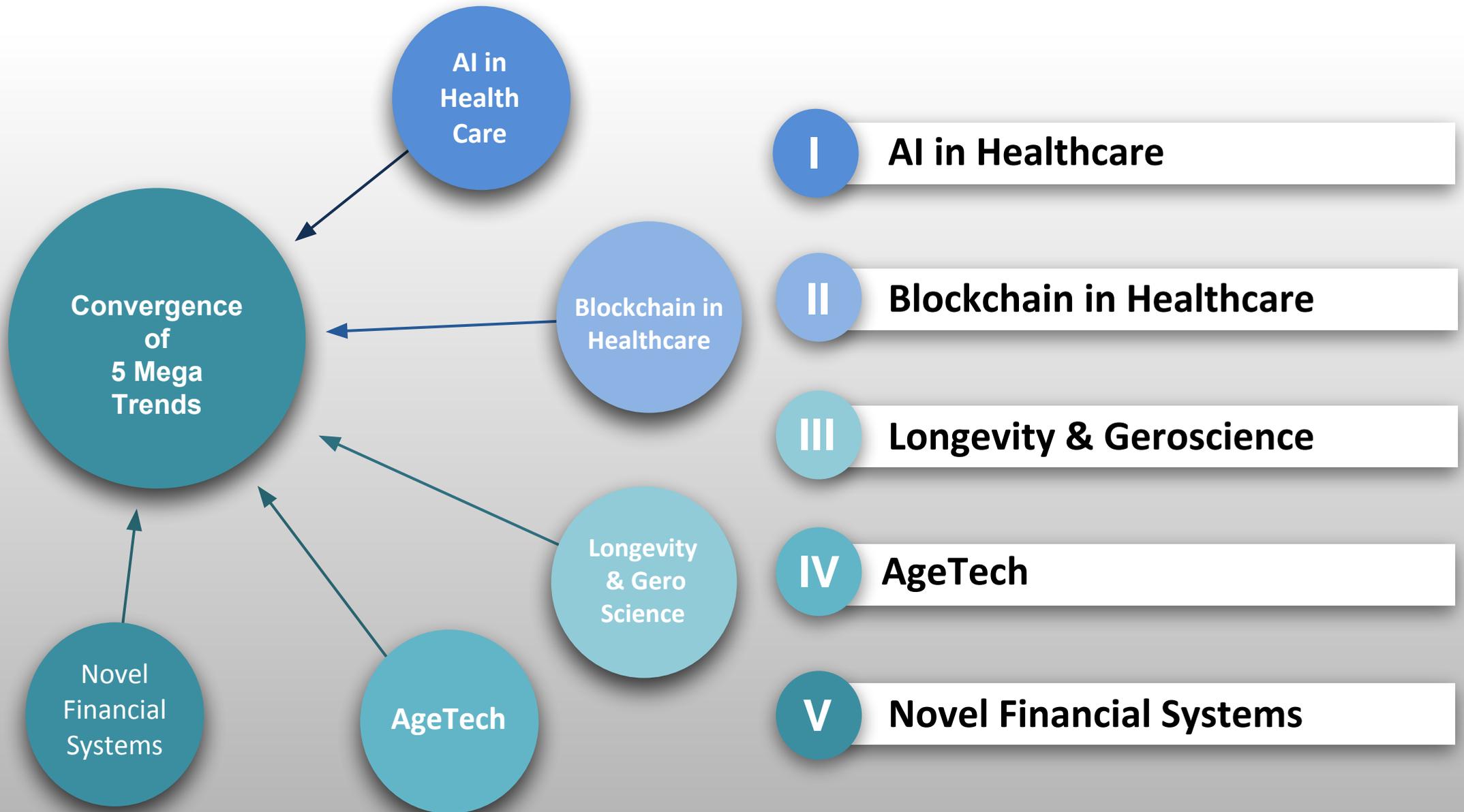
We concluded that the window for startups to enter this new market will be closing swiftly over the course of the next few years. By 2022, the big companies will openly begin to embrace these new trends, and leave behind the old technologies still in use at present, whereupon governments and financial institutions will adapt to work with the transformed industries.

Next Generation AI for Drug Discovery and Biomarker Development Convergence with Blockchain and Digital Medicine

- In 2018, even more extreme challengers and disruptors will arrive with the convergence of next generation AI, blockchain and precision medicine.
- Longgenesis is a revolutionary blockchain-based personalized medicine Data Marketplace platform built by Insilico Medicine and Bitfury that provides modular toolsets coupled with integrated advanced.
- Artificial Intelligence systems to store, manage, and trade life data: social network data, health data and medical records.
- Longgenesis will redefine the relationships between healthcare companies and patients. By facilitating a fast and easy way to contribute or purchase data along with an integrated deep learning AI, enterprises can save much money on R&D while users will for the first time be compensated for their Life data efficiently and ethically.



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 nowadays.

2017

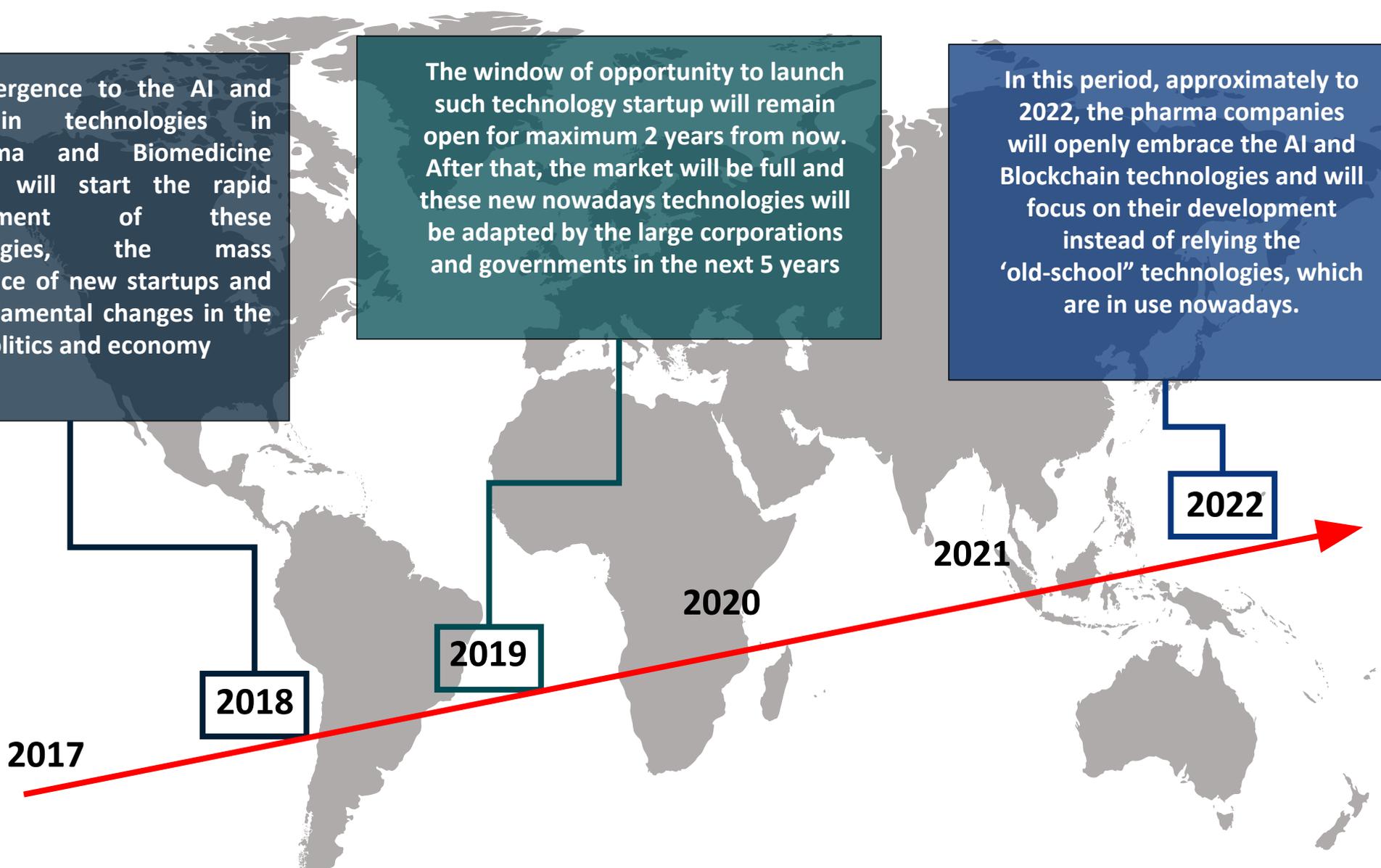
2018

2019

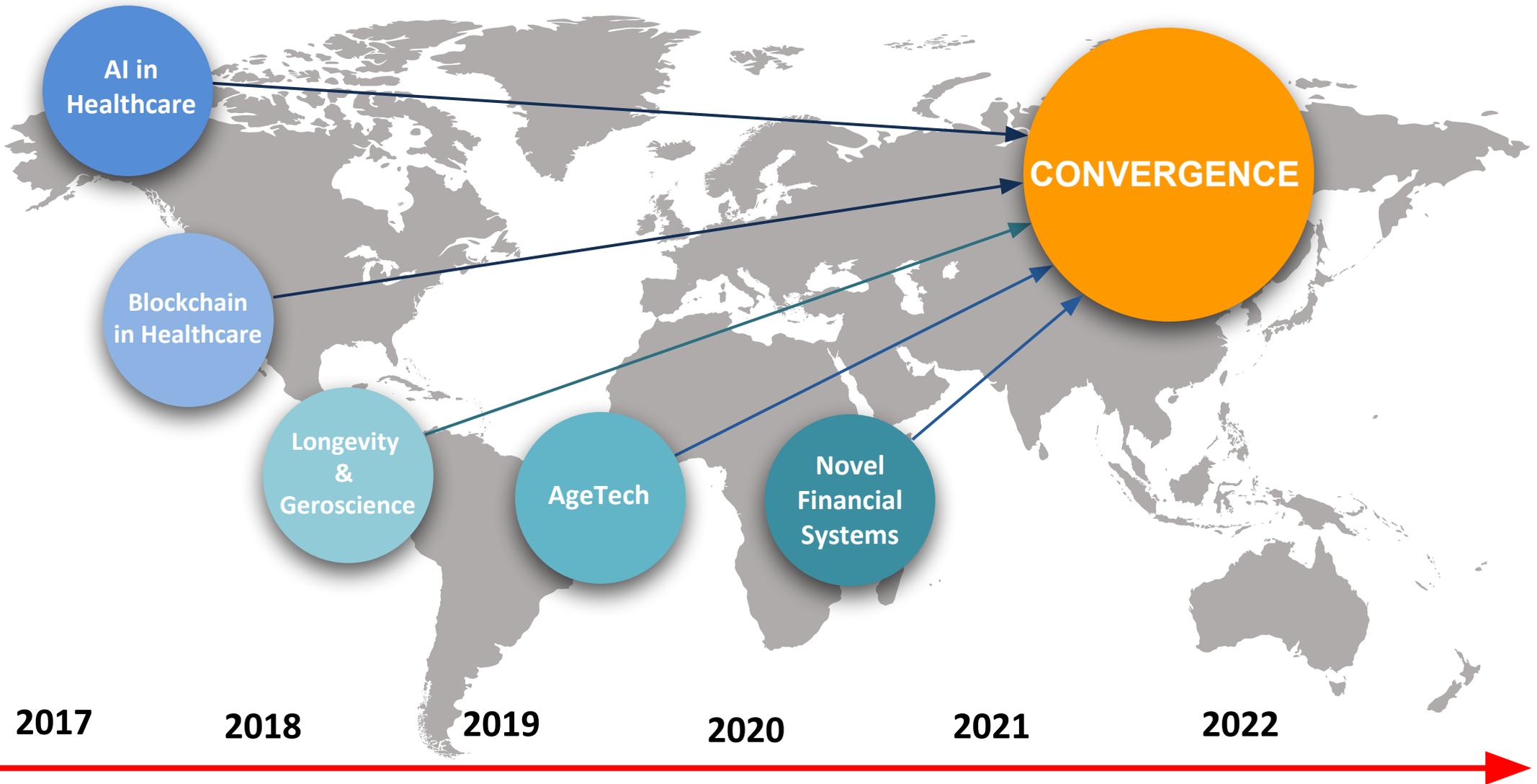
2020

2021

2022



Convergence of 5 Mega Trends



Chapter VIII

Chapter VIII outlines subjects as:

- Methodology of Ratings/Classification of Advanced R&D and Drug Discovery Companies
- AI in Drug discovery
- Basic AI for R&D and Drug Discovery
- Advanced AI
- Types of AI in Advanced R&D and Drug Discovery Based on 80 companies

In this Chapter we outlined the rapid growth of the AI industry, and demonstrated how companies and startups conceal the amount of AI specialist and the technologies they use in their activity. Due to these considerations, we can consider that the level of AI development in in any given company can be evaluated not only by “researching the code”, but based on various circumstantial evidences cited in this section.

AI in Drug discovery

Artificial Intelligence has become extremely popular these days, with many companies using the term in order to increase their perceived significance and to find investors. The AI industry is developing very fast, and companies and startups increasingly try to conceal the amount of AI specialists and the technologies they use in their activities. The AI market is very competitive, and thus companies are trying to secure their assets and trade secrets.

Thus, it is impossible to get inside companies' actual AI and Deep Learning algorithms to scrutinize the level of AI development and, moreover, the involvement of Machine Learning algorithms into, for instance, their Drug Discovery process. However, we believe that the level of AI development in one's company can be evaluated not only by "researching the code", but based on various forms of circumstantial evidence, such as:

1. Amount of AI specialists and their positions in the company;
2. Amount of articles and patents;
3. Visible AI application;
4. AI application of the AI product shows the flexibility of it and the ability of the IT team to apply

Each level is defined by a set of characteristics:

	Amount of AI specialists	Application of the AI	Visible AI application	Deep Learning
Level I	<5%	One niche	*	*
Level II	10%	1-2 niches	+	*
Level III	>10% Leading role in the company	More than 2 niches	+	+

II Level

Companies in this section are using Artificial Intelligence in order to

They can be found in all sectors from data collection to drug discovery.

1. These organizations are operating on one or two directions of Advanced R&D and Drug Discovery.
2. These companies do have their own **AI products**, which are used in order to one niche.
3. Average percentage of AI specialists employed by the company is 10% or above the total number of employees, or are part of the company's core executive team;
4. The company's patent list is available for the past 2 years.
5. The company's record of applying AI for Drug Discovery, R&D or other activities can be easily found and demonstrated.

1	Company Name	2	Company Name	3	Company Name	4	Company Name	5	Company Name
6	Company Name	7	Company Name	8	Company Name	9	Company Name	10	Company Name
11	Company Name	12	Company Name	13	Company Name	14	Company Name	15	Company Name
16	Company Name	17	Company Name	18	Company Name	19	Company Name	20	Company Name
21	Company Name	22	Company Name	23	Company Name	24	Company Name	25	Company Name
26	Company Name	27	Company Name	28	Company Name	29	Company Name	30	Company Name
31	Company Name	32	Company Name	33	Company Name	34	Company Name	35	Company Name
36	Company Name	37	Company Name	38	Company Name	39	Company Name	40	Company Name
41	Company Name	42	Company Name	43	Company Name	44	Company Name	45	Company Name
46	Company Name	47	Company Name	48	Company Name	49	Company Name	50	Company Name

III Level

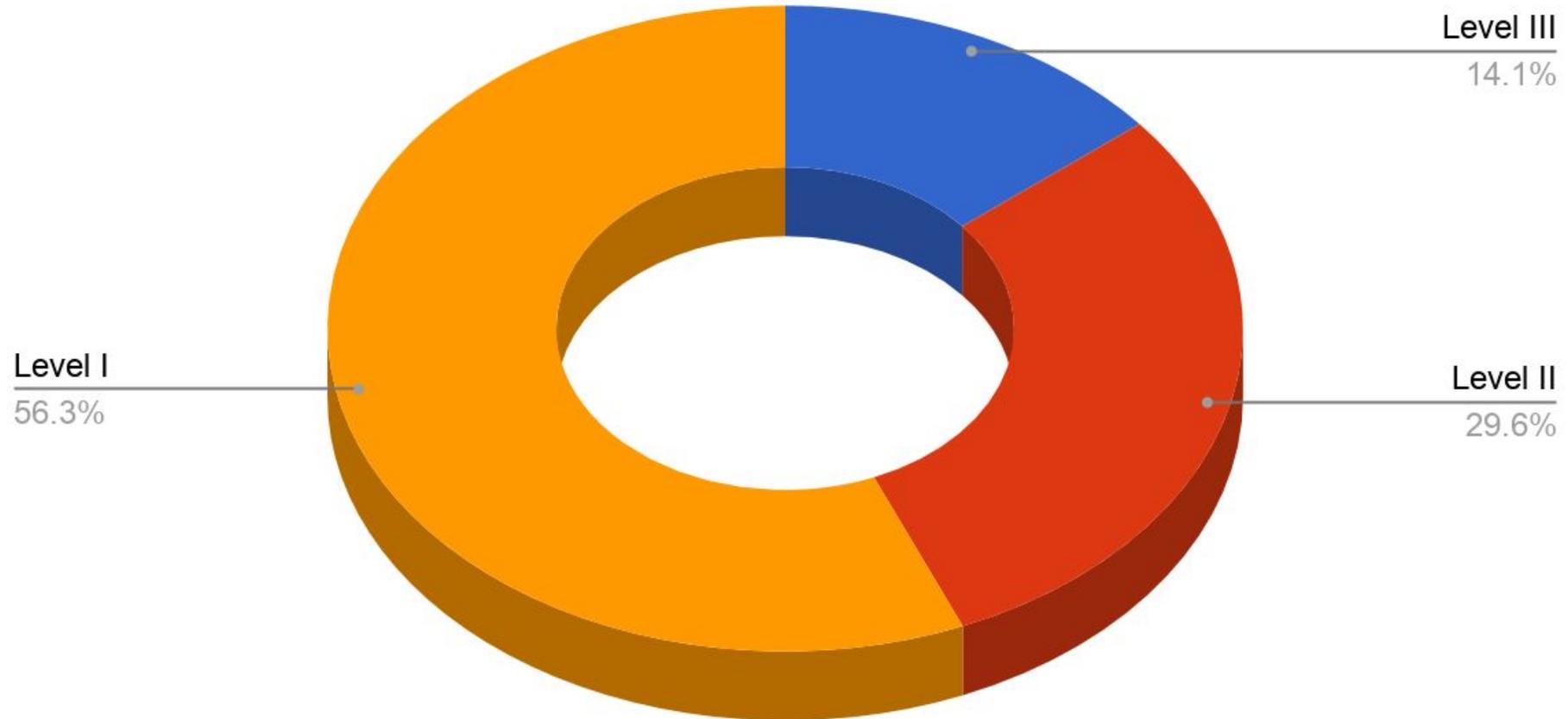
Companies within this category are among the leaders of the industry for AI for R&D and drug discovery. Their contributions have a more promising potential than AI companies.

The difference between Level III and Level II is subtle, but important. Companies within this class have the following characteristics:

1. The company has multiple directions of research and AI (i.e. more than 3)
2. The majority of the company's products are AI driven.
3. The company operates according to two or more directions of Advanced R&D and Drug Discovery, thus their product and IT team are flexible and are able to apply their technologies to various tasks.
4. AI specialists make up more than 15% of the company's team and hold key positions (i.e. director and/or executive-level positions) in the company.
5. The company promotes AI in their descriptive or promotional and marketing materials.



Types of AI in Advanced R&D and Drug Discovery Based on 80 companies



Chapter IX Deep Learning in Drug Discovery

Chapter IX is an introductory chapter that presents an overview on the use of deep learning in the drug discovery industry.

It elaborates on the growth of artificial intelligence and machine learning tools, such as deep learning algorithms, and provides a detailed discussion regarding their potential applications in solving some of the key challenges faced by the healthcare industry.

The chapter also gives an overview on the rise of big data and its role in providing personalized and evidence based care to patients.

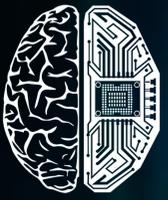
The chapter concludes that deep learning technologies are developing rapidly, and provides projections related to the growth of the deep learning industry in healthcare from 2017 to 2035.

Chapter IX examines the current landscape and future outlook of the growing market of deep learning solutions within the healthcare domain.

One of the key objectives of this chapter was to identify the various deep learning solutions that are currently available and the potential it represents.

The main conclusion drawn from our analysis is the following. Deep learning algorithms have enabled computers to see, read and write.

As a result, the deep learning solutions discussed here have shown the capacity to significantly reduce the cost and time spent in bringing a drug to the market. Deep learning models are likely to save as much as 50% of the cost and save a significant amount of time, which means that deep learning is changing the very rules of the game.



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