

INVESTMENT DIGEST

ARTIFICIAL INTELLIGENCE (AI) FOR DRUG DISCOVERY,
BIOMARKER DEVELOPMENT
AND ADVANCED R&D LANDSCAPE
OVERVIEW 2020

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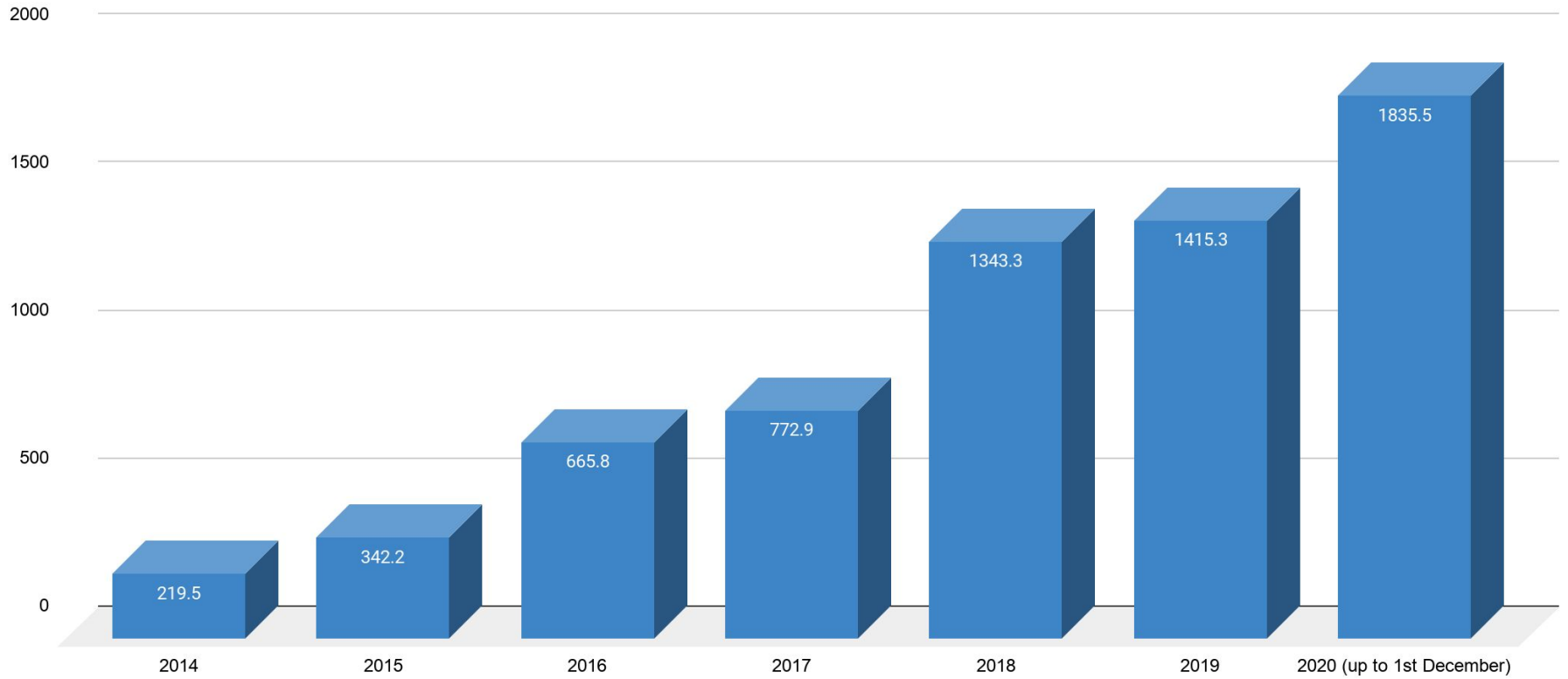
Investment Digest at a Glance

This Investment Digest is summarizing key players and observations in the private equity and venture capital ecosystem, focusing on the pharmaceutical artificial intelligence (AI). Here we have summarized information about key industry trends, 240 promising AI-driven biotech startups, and 50 leading biotech investors in this sector, outlining major investment rounds and relevant R&D partnerships illustrating the industry traction and readiness of institutional investors (big pharma/biotech) to potentially acquire most successful AI-vendors.

It is also found that the ongoing COVID19 pandemics catalyzed further interest toward pharmaceutical AI technologies, and generally created favorable investment climate in the area of pharmaceutical artificial intelligence.

This Investment Digest is based on the 130 page industry report "[AI for Drug Discovery, Biomarker Development and Advanced R&D Landscape Overview 2020](#)", which is a comprehensive overview of the pharmaceutical AI sector, including 240 AI biotechs, 600 investors, 90 pharma corporations and 35 R&D centers across the globe. The report also summarizes

Dynamics of Investments in AI-driven Biotechs (in millions of USD per year)



Source: [BioPharmaTrend](#)

Investment landscape at a glance (Q4 2019 — 2020)

The total amount of VC funding in AI-biotech startups increased in 2020 (as of November) by around 23%, compared to 2019, approaching a total of \$1.9B, which is also more than in 2015, 2016 and 2017 combined.

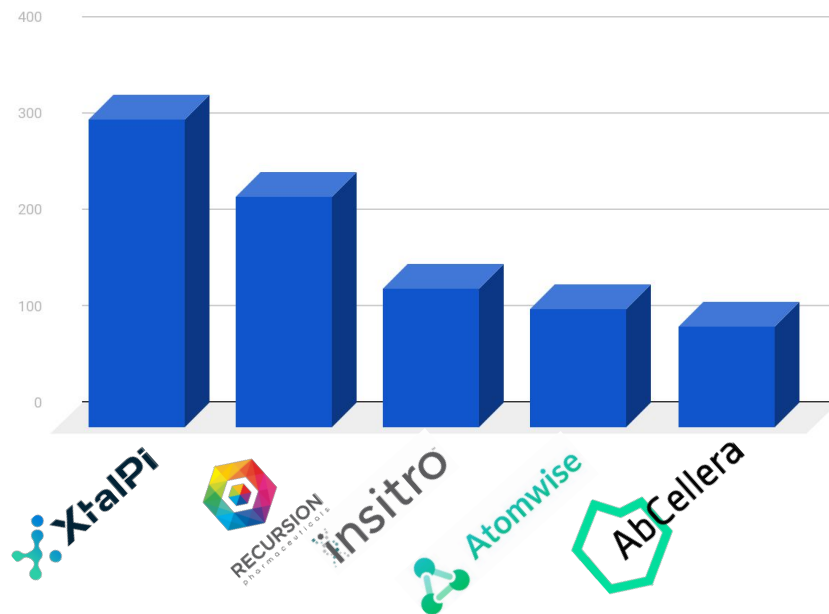
There is an increasing number of late-stage mega-rounds (e.g. B, C), including hundreds of millions. The apparent trend is sector consolidation, where a number of AI-startups have achieved substantial leadership and grown in resources and technology, while others have lagged behind and had to focus on niche service-oriented segments of drug discovery. Several AI startups also went out of business.

Some of the major deals included:

- insitro with their \$143 million (Series B);
- XtalPi with \$319 million (Series C);
- Atomwise with \$123 million (Series B);
- Recursion Pharmaceuticals with \$239 million (series D);
- AbCellera with the sum of \$105 million (Series B).

An important driver of growth for the sector is a substantial shift in Big Pharma's interest in AI technology from "nice to try" to "strategically important". Such increasing market demand will drive more exits in future, and is important for heating up the investor's interest in this sector.

Top 5 Investment Deals in 2020 (in million US dollars)



AI for Drug Discovery, Biomarker Development and Advanced R&D Landscape / 2020

AI Companies - 240
Investors - 600
Corporations - 90

End-to-end Drug Development

AI Companies
Investors
Corporations

Early drug development

Preclinical Development

Clinical Development

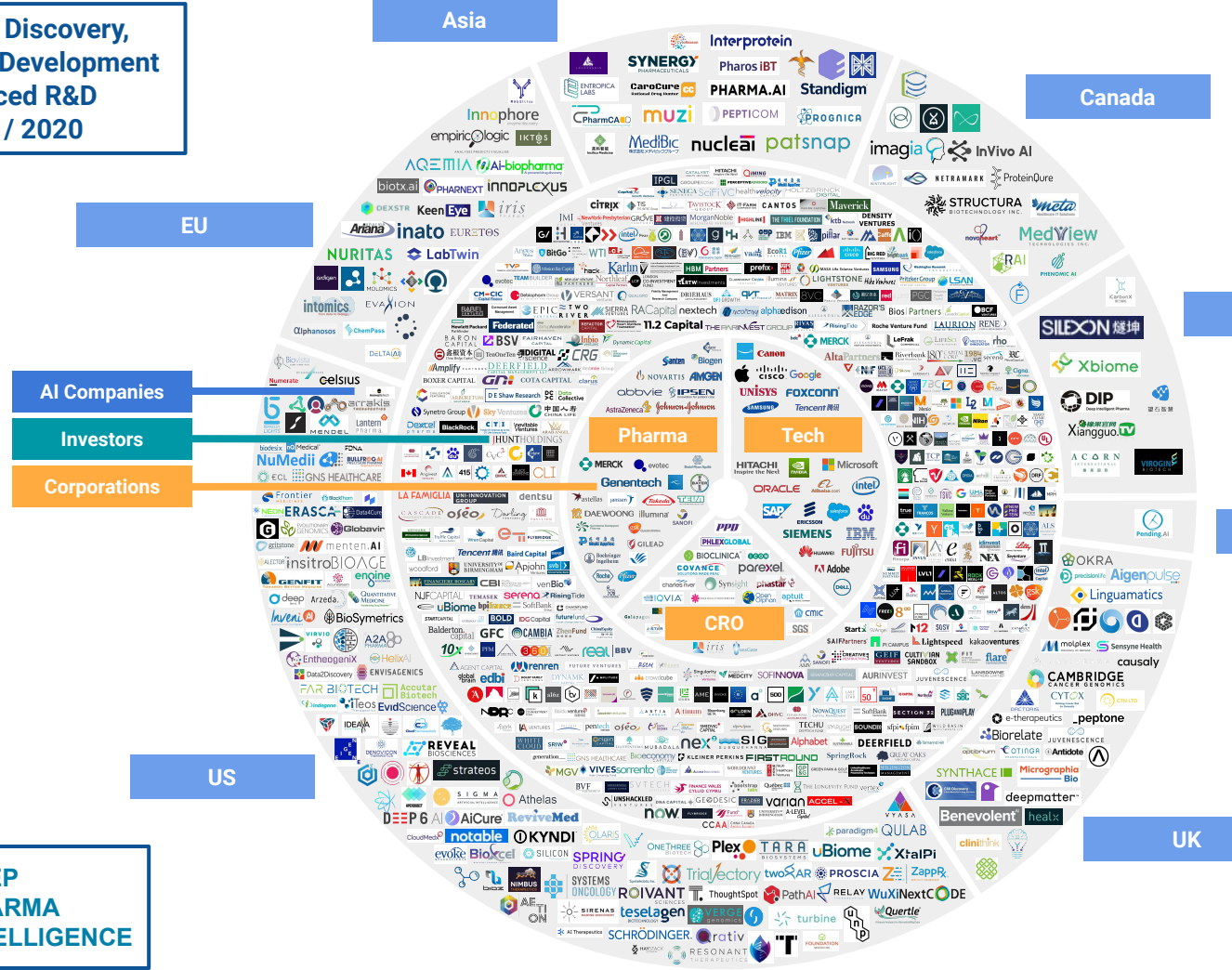
Drug Repurposing

Early And Preclinical Drug Development



AI for Drug Discovery, Biomarker Development and Advanced R&D Landscape / 2020

AI Companies - 240
Investors - 600
Corporations - 90



AI Companies
Investors
Corporations

EU

US

Asia

Canada

China

Australia

UK

Pharma

Tech

CRO



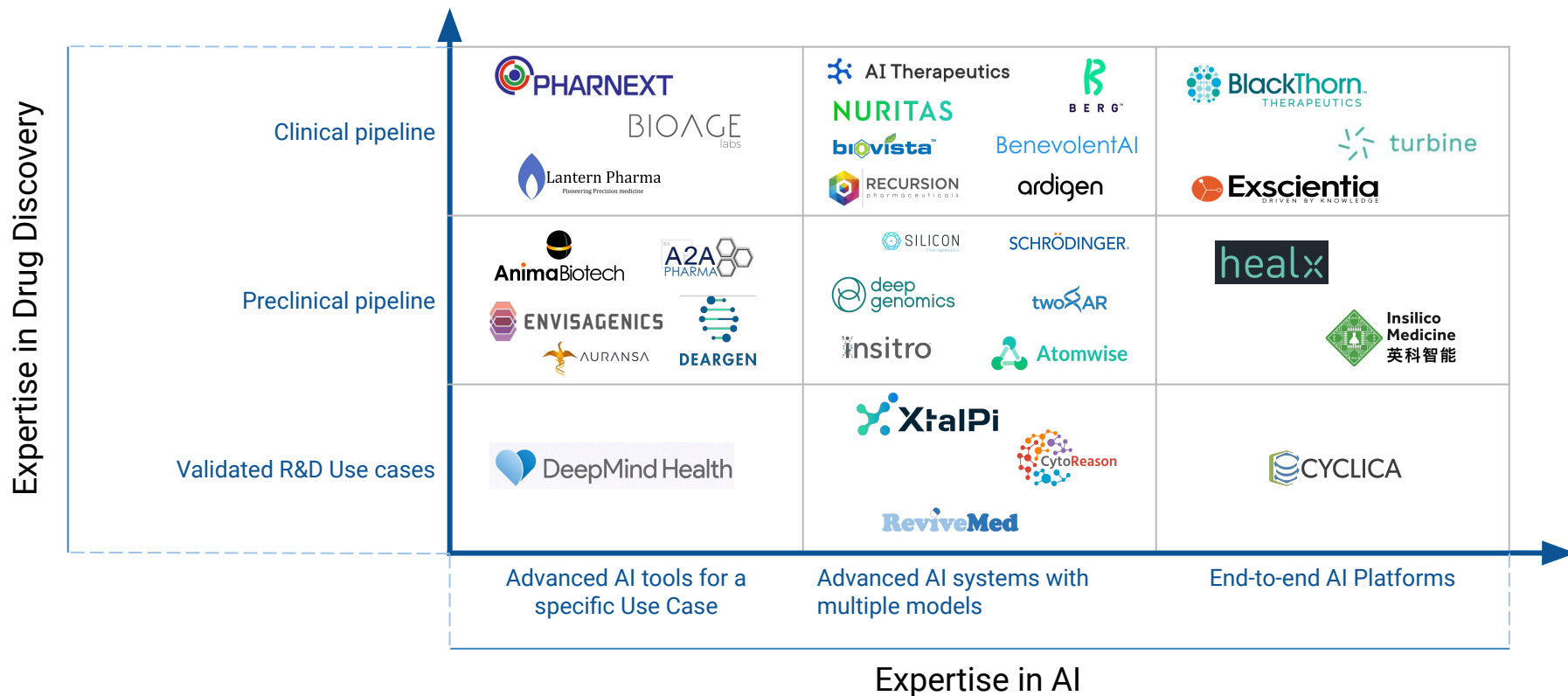
30 Leading Companies in AI for Drug Discovery Sector

1	Acellera
2	Ardigen
3	Atomwise
4	Benevolent.AI
5	Biovista
6	C4X discovery
7	Cyclica
8	CytoReason
9	Deep Genomics
10	DeepMind Health
11	e-Therapeutics
12	Exscientia
13	GNS Healthcare
14	iCarbonX
15	Insilico Medicine

16	Insitro
17	Lantern Pharma
18	Nimbus Therapeutics
19	Numerate
20	Nuritas
21	PathAI
22	Pharnext
23	Recursion Pharmaceuticals
24	Saama Technologies
25	Schrödinger
26	Turbine.AI
27	twoXAR
28	Vyasa Analytics
29	WuXi NextCODE
30	XtalPi

Comparison of Top-30 Leading AI for Drug Discovery Companies

Expertise in Drug Discovery R&D / AI



50 Leading Investors in Pharmaceutical AI



50 Leading Investors in AI for Drug Discovery Sector

1	GV
2	Casdin Capital
3	Creative Destruction Lab
4	Y Combinator
5	Alexandria Venture
6	WuXi AppTec
7	Andreessen Horowitz
8	EASME - EU Executive Agency for SMEs
9	Lilly Asia Ventures
10	OS Fund
11	AME Cloud Ventures
12	ARCH Venture Partners
13	Felicis Ventures
14	National Institutes of Health
15	StartX (Stanford-StartX Fund)

16	Third Rock Ventures
17	ZhenFund
18	500 Startups
19	Bill & Melinda Gates Foundation
20	Celgene
21	Data Collective DCVC
22	F-Prime Capital
23	Foresite Capital
24	Founders Fund
25	Inovia Capital
26	Intel Capital
27	Khosla Ventures
28	Perceptive Advisors
29	SoftBank Vision Fund
30	UK Innovation & Science Seed Fund

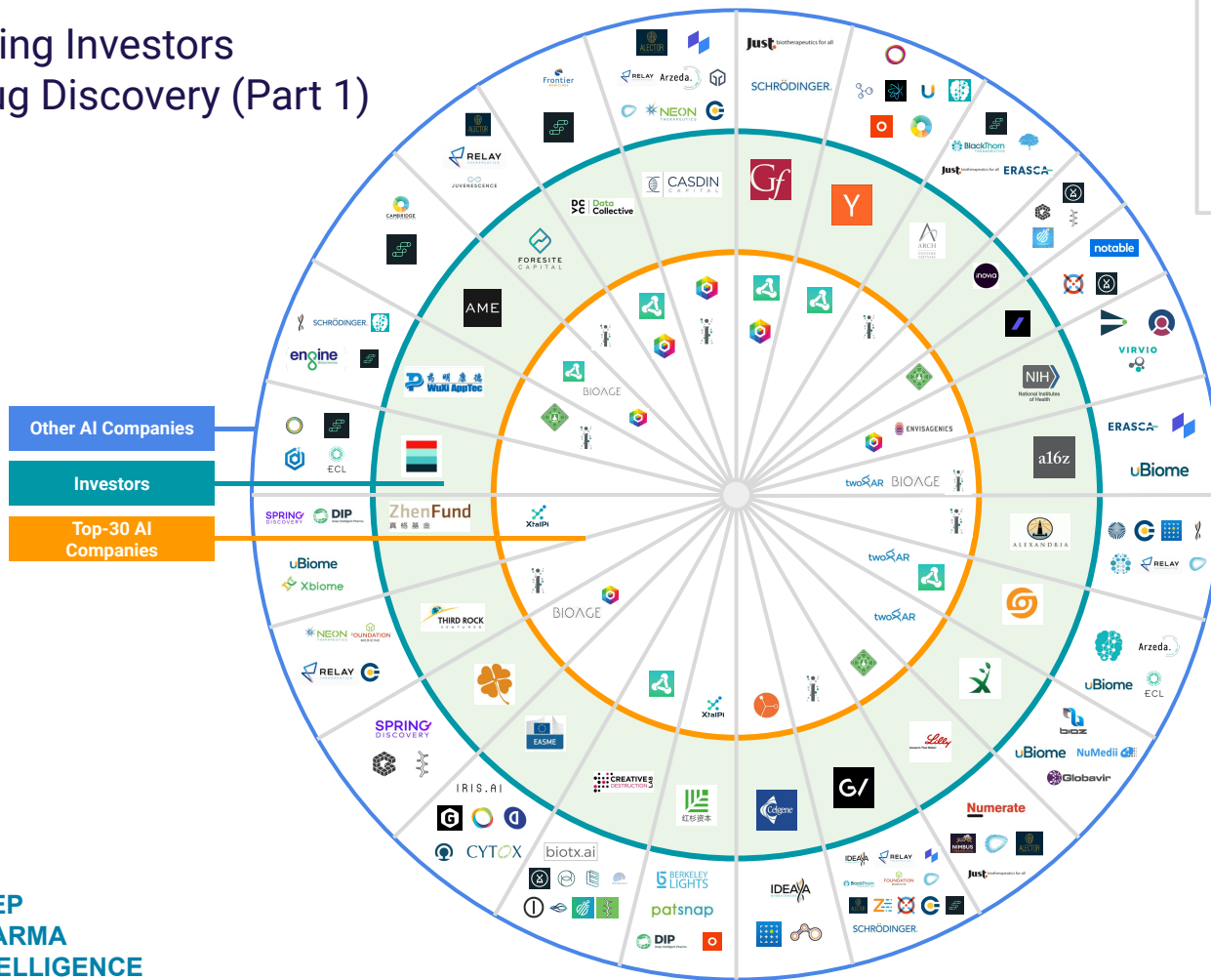
50 Leading Investors in AI for Drug Discovery Sector

31	8VC
32	Alexandria Real Estate Equities
33	Vertex Ventures
34	Atlas Venture
35	Baidu Ventures
36	Baillie Gifford
37	General Catalyst
38	IA Ventures
39	Johnson & Johnson Innovation
40	Luminous Ventures

41	Mubadala Capital Ventures US
42	Nextech Invest
43	Obvious Ventures
44	Qiming Venture Partners
45	RA Capital Management
46	Refactor Capital
47	Sequoia Capital
48	SOSV
49	Tencent Holdings
50	Two Sigma Ventures

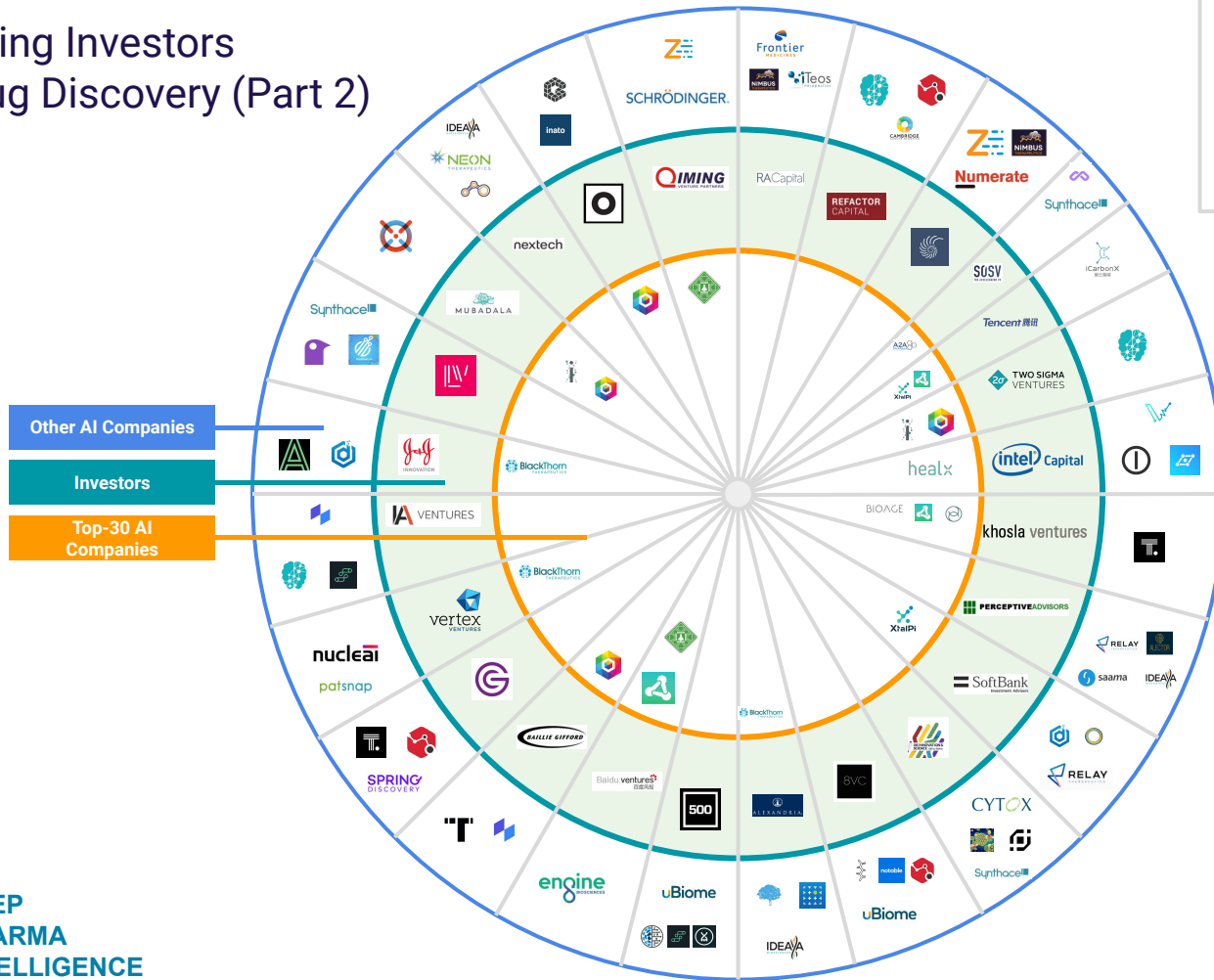
50 Leading Investors AI in Drug Discovery (Part 1)

Portfolios of leading
biotech investors
include startups from
the list of Top 30




50 Leading Investors AI in Drug Discovery (Part 2)

Portfolios of leading biotech investors include startups from the list of Top 30



Top-50 AI for Drug Discovery Investors

 **Alexandria Real Estate Equities**
Pasadena, California, US

 **Intel Capital**
Santa Clara, California, US

 **Refactor Capital**
Burlingame, California, US

Other

 **Sequoia Capital**
Menlo Park, California, US

 **Andreessen Horowitz**
Menlo Park, California, US

 **Felicis Ventures**
Menlo Park, California, US


 **Khosla Ventures**
Menlo Park, California, US

Menlo Park

California

Palo Alto

 **StartX**
Palo Alto, California, US

 **AME Cloud Ventures**
Palo Alto, California, US

 **Vertex Ventures**
Palo Alto, California, US

Mountain View

 **Y Combinator**
Mountain View, California, US

 **GV**
Mountain View, California, US

 **BVC**
San Francisco, California, US

 **Founders Fund**
San Francisco, California, US


 **Foresite Capital**
San Francisco, California, US

 **500 Startups**
San Francisco, California, US

 **Alexandria Venture**
San Francisco, California, US

 **Obvious Ventures**
San Francisco, California, US

 **Data Collective DCVC**
San Francisco, California, US

 **Mubadala Capital | Ventures US**
San Francisco, California, US

San Francisco



United States

Illinois

 **OS Fund**
Park Ridge, Illinois, US

 **ARCH Venture Partners**
Chicago, Illinois, US

 **Perceptive Advisors**
New York, New York, US


 **IA Ventures**
New York, New York, US

 **Two Sigma Ventures**
New York, New York, US

 **Casdin Capital**
New York, New York, US


New York


Other States

 **Bill & Melinda Gates Foundation**
Seattle, Washington, US

 **Lili Ventures**
Indianapolis, Indiana, US

 **SOSV**
Princeton, New Jersey, US

 **Celgene**
Summit, New Jersey, US


 **National Institutes of Health**
Bethesda, Maryland, US

 **Johnson & Johnson Innovation**
New Brunswick, New Jersey, US



Canada

 **Inovia Capital**
Montréal, Quebec, Canada

 **Creative Destruction Lab**
Toronto, Ontario, Canada



Belgium

 **EASME - EU Executive Agency for SMEs**
Brussels, Brussels Hoofdstedelijk Gewest, Belgium



China

 **Tencent Holdings**
Shenzhen, China

Beijing

 **ZhenFund**
Beijing, China

 **Baidu Ventures**
Beijing, China

Shanghai

 **WuXi AppTec**
Shanghai, China

 **Lilly Asia Ventures**
Shanghai, China

 **Qiming Venture Partners**
Shanghai, China



Switzerland

 **nextech**
Zürich, Zurich, Switzerland




United Kingdom

 **SoftBank Vision Fund**
London, England, United Kingdom


 **Amadeus Capital Partners**
London, England, United Kingdom


 **Baillie Gifford**
Edinburgh, Edinburgh, United Kingdom


 **UK Innovation & Science Seed Fund**
Harwell, Oxfordshire, United Kingdom

 **Luminous Ventures**
London, England, United Kingdom


 **Atlas Venture**
Cambridge, Massachusetts, US

 **General Catalyst**
Cambridge, Massachusetts, US











 **SR One**
Cambridge, Massachusetts, US

 **Third Rock Ventures**
Boston, Massachusetts, US








 **F-Prime Capital**
Cambridge, Massachusetts, US

 **RA Capital Management**
Boston, Massachusetts, US











Top-50 Investors in AI Companies

INVESTORS		AI Companies	Investments overall	
GV		13 AI for Drug Discovery Companies	24	Alector, BlackThorn Therapeutics, Celsius Therapeutics, Flatiron Health, Foundation Medicine, Gritstone Oncology, Ideaya Biosciences, Insitro, Relay Therapeutics, Owkin, Schrödinger, Strateos, ZappRx
Casdin Capital		10 AI for Drug Discovery Companies	11	Alector, Arzeda, Celsius Therapeutics, Flatiron Health, Foundation Medicine, Gritstone Oncology, Insitro, Neon Therapeutics, Recursion Pharmaceuticals, Relay Therapeutics
Creative Destruction Lab		10 AI for Drug Discovery Companies	10	Atomwise, BenchSci, Biotx.ai, Deep Genomics, Entropica Labs, Kyndi, NetraMark, Phenomic AI, ProteinQure, WinterLight Labs
Y Combinator		9 AI for Drug Discovery Companies	14	Athelas, Atomwise, Cambridge Cancer Genomics, CloudMedX, PostEra, Reverie Labs, Strateos, uBiome, Verge Genomics
Alexandria Venture		8 AI for Drug Discovery Companies	11	Relay Therapeutics, TARA Biosystems, BlackThorn Therapeutics, Celsius Therapeutics, GNS Healthcare, Gritstone Oncology, Ideaya Biosciences, Insitro
WuXi AppTec		7 AI for Drug Discovery Companies	8	Engine Biosciences, Insilico Medicine, Insitro, Schrödinger, Strateos, Verge Genomics, Ideaya Biosciences
Andressen Horowitz		6 AI for Drug Discovery Companies	9	BioAge Labs, Erasca, Flatiron Health, Insitro, TwoXAR, uBiome
EASME - EU Executive Agency for SMEs		6 AI for Drug Discovery Companies	6	Accutar Biotech, Cytos, Genialis, Iris.ai, Mind the Byte, omicX
Lilly Asia Ventures		6 AI for Drug Discovery Companies	9	Alector, Gritstone Oncology, Insilico Medicine, Just Biotherapeutics, Nimbus Therapeutics, Numerate
OS Fund		6 AI for Drug Discovery Companies	9	Arzeda, Atomwise, Emerald Cloud Lab, TwoXAR, uBiome, Verge Genomics






Top-50 Investors in AI Companies

INVESTORS		AI Companies		Investments overall
AME Cloud Ventures		5 AI for Drug Discovery Companies	11	Atomwise, BioAge Labs, Cambridge Cancer Genomics, Recursion Pharmaceuticals, Strateos
ARCH Venture Partners		5 AI for Drug Discovery Companies	10	Arbor Biotechnologies, BlackThorn Therapeutics, Erasca, Insitro, Just Biotherapeutics
Felicis Ventures		5 AI for Drug Discovery Companies	10	BioAge Labs, LabGenius, ProteinQure, Recursion Pharmaceuticals, Spring Discovery
National Institutes of Health		5 AI for Drug Discovery Companies	6	Envisagenics, Recursion Pharmaceuticals, Sangamo BioSciences, SEngine Precision Medicine, Virvivo
StartX (Stanford- StartX Fund)		5 AI for Drug Discovery Companies	7	Bioz, Globavir Biosciences, NuMedii, TwoXAR, uBiome
Third Rock Ventures		5 AI for Drug Discovery Companies	11	Celsius Therapeutics, Foundation Medicine, Insitro, Neon Therapeutics, Relay Therapeutics
ZhenFund		5 AI for Drug Discovery Companies	8	Deep Intelligent Pharma, Spring Discovery, uBiome, Xbiome, XtalPi
Sequoia Capital China		5 AI for Drug Discovery Companies	8	Athelas, Berkeley Lights, Deep Intelligent Pharma, PatSnap, XtalPi
Bill & Melinda Gates Foundation		4 AI for Drug Discovery Companies	5	Atomwise, Just Biotherapeutics, Recursion Pharmaceuticals, Schrödinger
Celgene		4 AI for Drug Discovery Companies	5	Arrakis Therapeutics, Exscientia, GNS Healthcare, Ideaya Biosciences










Top-50 Investors in AI Companies

INVESTORS	AI Companies	Investments overall	
Data Collective DCVC 	4 AI for Drug Discovery Companies	12	Atomwise, Frontier Medicines, Recursion Pharmaceuticals, Strateos
F-Prime Capital 	4 AI for Drug Discovery Companies	5	BenchSci, Insilico Medicine, Notable, Owkin
Foresite Capital 	4 AI for Drug Discovery Companies	10	Alector, Insitro, Juvenescence AI, Relay Therapeutics
Founders Fund 	4 AI for Drug Discovery Companies	6	Datavant, Emerald Cloud Lab, Roivant Sciences, Strateos
Inovia Capital 	4 AI for Drug Discovery Companies	7	BenchSci, LabGenius, Phenomic AI, ProteinQure
Intel Capital 	4 AI for Drug Discovery Companies	4	Healx, Kyndi, Reveal Biosciences, VERISIM Life
Khosla Ventures 	4 AI for Drug Discovery Companies	8	Atomwise, BioAge Labs, Deep Genomics, ThoughtSpot
Perceptive Advisors 	4 AI for Drug Discovery Companies	4	Alector, Ideaya Biosciences, Relay Therapeutics, Saama
SoftBank Vision Fund 	4 AI for Drug Discovery Companies	5	Datavant, Relay Therapeutics, Roivant Sciences, XtalPi
UK Innovation & Science Seed Fund 	4 AI for Drug Discovery Companies	6	Antiverse, Cytox, Desktop Genetics, Synthace

Top-50 Investors in AI Companies

INVESTORS	AI Companies	Investments overall
8VC 	4 AI for Drug Discovery Companies	6 Notable, PathAI, ProteinQure, uBiome
Alexandria Real Estate Equities 	4 AI for Drug Discovery Companies	5 Arbor Biotechnologies, BlackThorn Therapeutics, GNS Healthcare, Ideaya Biosciences
500 Startups 	4 AI for Drug Discovery Companies	5 Massive Bio, Strateos, uBiome, BenchSci
Baidu Ventures 	3 AI for Drug Discovery Companies	4 Atomwise, Engine Biosciences, Insilico Medicine
Baillie Gifford 	3 AI for Drug Discovery Companies	5 Flatiron Health, Recursion Pharmaceuticals, Tempus
General Catalyst 	3 AI for Drug Discovery Companies	6 PathAI, Spring Discovery, ThoughtSpot
Vertex Ventures 	3 AI for Drug Discovery Companies	6 Nucleai, PatSnap, BlackThorn Therapeutics
IA Ventures 	3 AI for Drug Discovery Companies	4 Flatiron Health, Strateos, Verge Genomics
Johnson & Johnson Innovation 	3 AI for Drug Discovery Companies	4 Aetion, BlackThorn Therapeutics, Datavant
Luminous Ventures 	3 AI for Drug Discovery Companies	4 Phenomic AI, Sparrho, Synthace

Top-50 Investors in AI Companies

INVESTORS	AI Companies	Investments overall	
Mubadala Capital Ventures US 	3 AI for Drug Discovery Companies	5	Insitro, Owkin, Recursion Pharmaceuticals
Nextech Invest 	3 AI for Drug Discovery Companies	4	Arrakis Therapeutics, Ideaya Biosciences, Neon Therapeutics
Obvious Ventures 	3 AI for Drug Discovery Companies	8	Inato, LabGenius, Recursion Pharmaceuticals
Qiming Venture Partners 	3 AI for Drug Discovery Companies	3	Insilico Medicine, Schrödinger, ZappRx
RA Capital Management 	3 AI for Drug Discovery Companies	3	Frontier Medicines, iTeos Therapeutics, Nimbus Therapeutics
Refactor Capital 	3 AI for Drug Discovery Companies	4	Cambridge Cancer Genomics, PathAI, Verge Genomics
Atlas Venture 	3 AI for Drug Discovery Companies	9	Nimbus Therapeutics, Numerate, ZappRx
SOSV 	3 AI for Drug Discovery Companies	10	A2A Pharmaceuticals, MendelAI, Synthace
Tencent Holdings 	3 AI for Drug Discovery Companies	6	Atomwise, iCarbonX, XtalPi
Two Sigma Ventures 	3 AI for Drug Discovery Companies	5	Recursion Pharmaceuticals, Verge Genomics, Antiverse

AI for Drug Discovery Market Timeline

The first AI approaches

- The first scalable AI approaches for Drug Discovery and Advanced R&D were developed and several industry players with forward-thinking executives started launching pilot collaborations and making small investments.
- However, only few market players believed in the technology.

Criticism

- Because AI is still a young approach within the life sciences, many pilot projects failed, creating a lot of criticism towards the use of deep learning for Drug Discovery and Advanced R&D.
- Since then the race for the acquisition of the best, AI startups began.
- Testing of the technology began.

Market cap growth

- Capitalization of the industry was continuously growing.
- Many bets of early investors appeared to be justified.
- Over the next several years, we can expect to see VC firms and subsidiary funds focused exclusively on the AI for Drug Discovery subsector, and funds that invest in a maximally-diverse number of AI for Drug Discovery companies.

Transition from quantity to quality

- It is going to be an important milestone in transitioning from the quantity of AI-related collaborations, investments, and M&As to qualitative gains – first practical validations of previously conducted research might be appearing during this year.
- Competition for the most successful pharma AI companies will increase drastically.

Intensive competition

- Pretty much all big players in pharma industry are concerned with AI adoption, the tech has become a strategic priority, among other things.

2013-2015

2016-2017

2018

2019

2020-2021

Big Pharma's Focus on AI

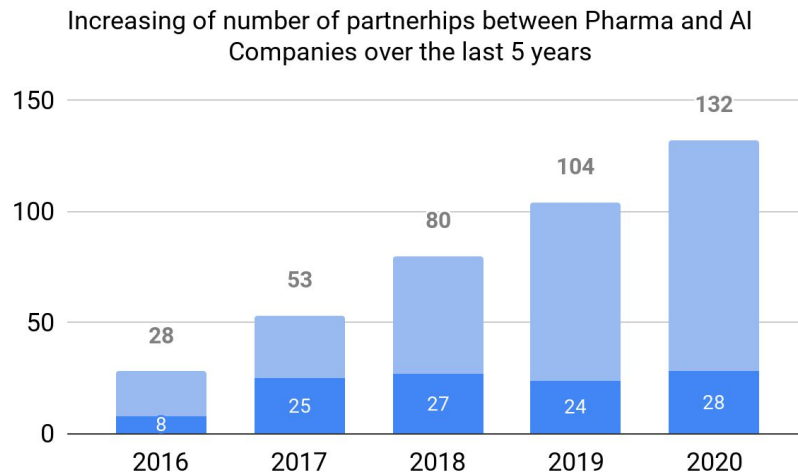


A growing number of collaborations involving AI for drug discovery

Summarizing industry observations over the last five years, we can observe a fundamental shift in perception of top executives at leading pharmaceutical organizations about the need of advanced AI technologies. Since 2015, there has been an obvious shift in the perception from skepticism and cautious interest, all the way to a realization of a strategic role AI has to play in the emerging “data-centric” model of innovation. This change in perception was underpinned by a number of factors:






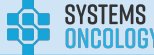














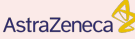


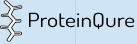










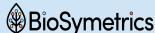







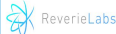




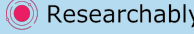








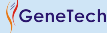







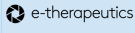




























- a wave of proof-of-concept studies and research breakthroughs in a wide range of AI application use cases;
- A number of commercial successes and successfully reached milestones, involving AI as a central element of research
- Substantial advances in democratizing AI technology, where machine learning and deep learning algorithms become available at scale to non-AI experts.
- Substantial increase in the overall understanding of AI “mechanics”, due to increasing efforts in the education and professional development with a focus on AI-driven tools and approaches.

Pharmaceutical companies of all sizes start competing for AI-expertise, talent, and partnerships. In this report we summarize some of the most high-profile such collaborations, involving top-20 pharma giants. Even though, we can see a clear uprising trend in the number of collaborations, focused on AI-drug design, and other aspects of data mining and analytics.

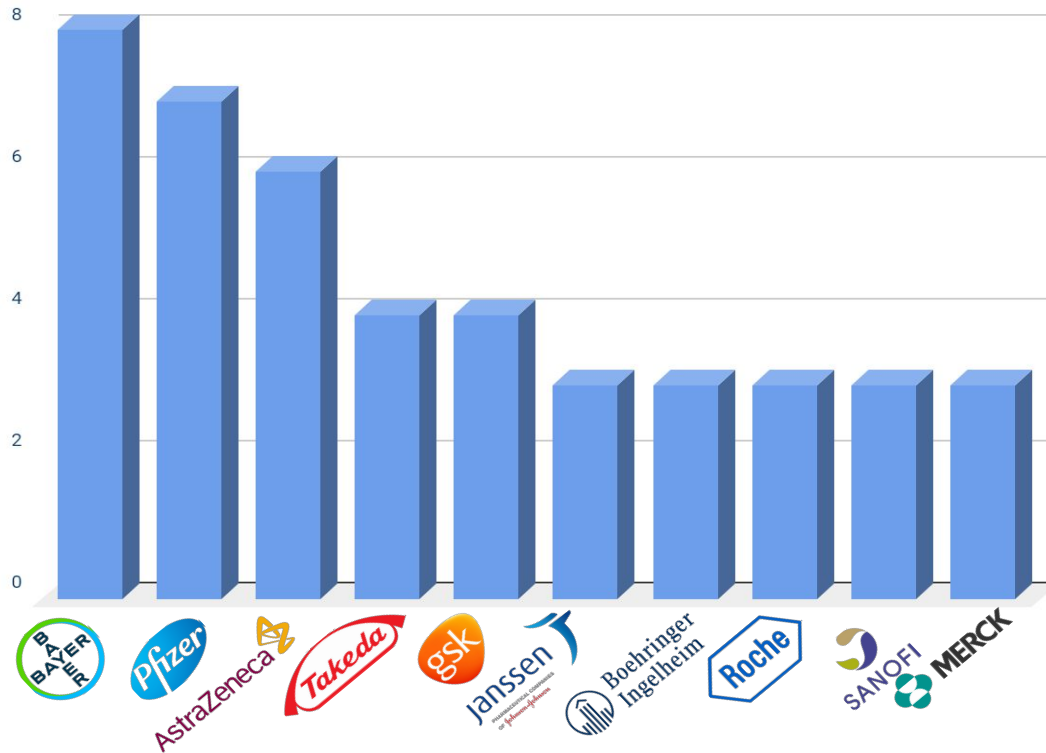


The rising interest of leading pharma and contract research organizations towards AI-driven biotech startups is a major driver for the area to become more attractive for investors, since the industry is becoming well-suited for successful exit strategies in future.

Pharma AI Deals Structure 2020

AI Companies				Pharma Corporations	Pharma Corporations	AI Companies			
 Exscientia <small>DRIVEN BY KNOWLEDGE</small>	 Atomwise <small>Better medicines faster.</small>	 turbine	 CYCLICA	 BAYER		 SYSTEMS ONCOLOGY	 RECURSION <small>DRUG PHARMACEUTICALS</small>	 SCHRÖDINGER.	 5 LIGHTS
 saama	 5 LIGHTS	 XtalPi	 Biovista <small>to seek - to know - to act</small>	 Pfizer		 Atomwise <small>Better medicines faster.</small>	 CytoReason	 Insilico Medicine 英科智能	
 BERG	 Alibaba Group	 Tencent 腾讯		 AstraZeneca		 Benevolent ^{AI}	 Bluebird bio	 ProteinQure	
 FOUNDATION MEDICINE [®]	 RECURSION <small>PHARMACEUTICALS</small>	 Insilico Medicine 英科智能	 WAVE	 Takeda	 gsk	 Exscientia <small>DRIVEN BY KNOWLEDGE</small>	 CloudPharmaceuticals	 Insilico Medicine 英科智能	 CytoReason
 BioSymetrics	 RESONANT	 DATAVANT		 Janssen <small>BY JANSSEN PHARMACEUTICALS</small>	 Boehringer Ingelheim	 Insilico Medicine 英科智能	 BERG	 NANNA THERAPEUTICS	
 ReverieLabs	 Genialis	 Exscientia <small>DRIVEN BY KNOWLEDGE</small>		 Roche	 SANOFI	 Researchably	 Exscientia <small>DRIVEN BY KNOWLEDGE</small>	 BERG	
 Atomwise <small>Better medicines faster.</small>	 IKTOS	 CYCLICA		 MERCK	 AMGEN	 GNS HEALTHCARE	 GeneTech		
	 sirenas	 Concerto HealthAI		 Bristol-Myers Squibb	 abbvie	 WuXi AppTec	 Atomwise <small>Better medicines faster.</small>		
	 5 LIGHTS	 e-therapeutics		 Novo Nordisk	 NOVARTIS	 Benevolent ^{AI}	 Biovista <small>to seek - to know - to act</small>		
		 turbine		 Johnson & Johnson	 Celgene	 Exscientia <small>DRIVEN BY KNOWLEDGE</small>			
		 Bluebird bio		 evotec	 astellas	 Biovista <small>to seek - to know - to act</small>			
		 CYCLICA		 AUM BIOSCIENCES	 IIVA	 SCHRÖDINGER.			
		 Genialis		 OncXerna	 ImmunoPrecise	 EVQLV			
		 CYCLICA		 YUHAN	 almirall	 IKTOS			
	 Atomwise <small>Better medicines faster.</small>			 HANSOH PHARMA	 GC	 Atomwise <small>Better medicines faster.</small>			

Top 10 Leading Corporations by The Number of Major Pharma AI Deals



The leading players by the amount of major industry partnerships are **Bayer, Pfizer and AstraZeneca**.

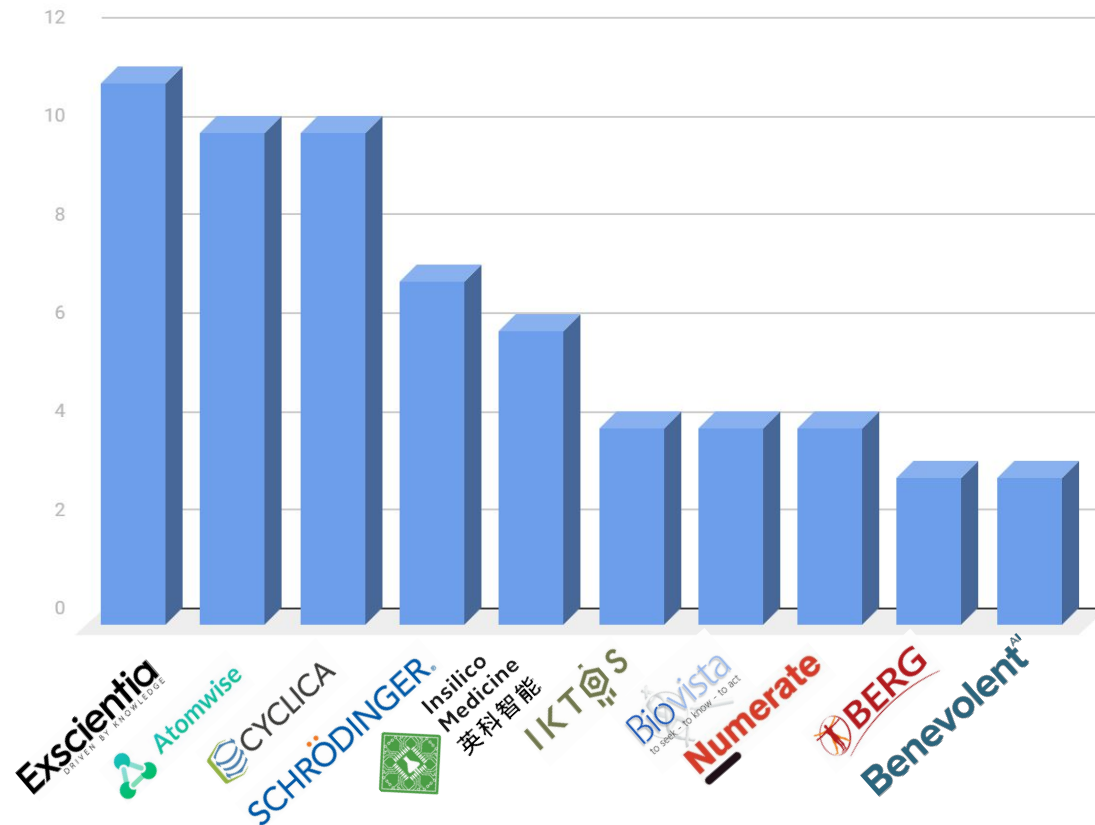
Implications

These companies demonstrate increasing commitment to probing the grounds in the AI space – by investing into internal programs, as well as partnering with external AI vendors to pilot programs in drug discovery and other research areas.

The most common type of deals are **true partnerships** and **saving the costs deals**.

The leading big pharma brands are increasingly open to partnerships with AI startups and biotechs to get competitive edge, and mitigate **the problem of declining R&D efficiency**.

Top AI and Tech Partners by the Number of Pharma AI Deals



Implications

The **biggest number** of AI in Drug Discovery deals was conducted by **Exscientia**.

The company engages in **small molecule drug discovery, selective single target molecules, bispecific small molecules, and phenotypic drug design**.

All of the deals concluded with this company were categorized as the ones aiming at **saving costs and increasing operational efficiency** due to the character of the services provided.

Key Takeaways



DEEP
PHARMA
INTELLIGENCE



Major Observations for 2020: Key Business Takeaways

1. **The segment of pharmaceutical AI continues consolidation** with the increasing number of later stage mega-rounds, including those of Insitro (\$143M), Recursion Pharmaceuticals (\$239M), XtalPi (\$319M) and others. The AI startups pack is clearly differentiating into the leaders, who developed substantial resources, financial leverage, and technological advantage, and others lagging behind – companies with less resources or less mature technology and scientific assets. The latter are usually focused on narrow therapeutic or technological niches, and are following service-oriented business models.
2. **Pharmaceutical AI sector is “heating up”**, and becomes a lucrative area for specialized biotech investors as well as investor organizations just entering the pharma space with a goal of including high-risk/high-return companies in their investment portfolios. This is backed by several observations, including an overall increasing investment activity in this sector in 2020, the increasing rush among leading pharma and contract research organizations (CROs) to compete for partnerships with AI-driven companies, and the increasing amount of proof-of-concept breakthroughs, confirming that AI technology has achieved substantial maturity to be able to bring tangible value for drug discovery – far beyond a simple optimization gain.
3. **Big pharma and contract research organizations increasingly compete for AI partnerships**, and continue building in-house AI workflows – driven by rapidly emerging evidence of the AI tech feasibility and innovation potential. A number of highly notable proof-of-concept results has been announced in 2019-2020.
4. **COVID-19 pandemics appears to be a positive catalyst for the acceleration of the AI adoption** by the pharmaceutical organizations. This is primarily stipulated by the necessity to rapidly process vast amounts of data, and come up with innovations under strict deadlines. Therefore, this urgency pushed companies and investors into more opportunistic projects than ever before.

Major Observations for 2020: Key Financial and Investment Takeaways

1. Due to global COVID19 pandemics, **the overall biotech and drug discovery sectors are on the rise**. During 2020 we have observed multiple medium and large funding rounds for biotech and drug design companies, especially those focused on antiviral therapies and vaccines.
2. A number of successful **AI-driven companies closed large-sum late-stage venture capital rounds (B, C, and D)** over 2019-2020 and several of them are now developing clinical stage drug candidates. We expect some of them go public to 2021-2022.
3. 2020 was marked by a notable IPO in the AI-driven drug design space – New York-based **Schrödinger closed its initial public offering in February, raising a total of \$232.3 million** in proceeds – more than originally planned.
4. The year 2020 is marked by **a general “biotech IPO boom”** (non-AI sectors), catalyzed in part by the coronavirus pandemics – directly and indirectly.
5. When some of the companies complete IPOs in the nearest future, **it will attract significant number of non-biotech investors to enter the Life Sciences sector**.
6. The growing industry traction, reflected in the increasing number of R&D partnerships between big pharma and CROs with AI-startups, is a sign that **the market is maturing for rapid increase in the M&A activity** in the nearest future.

Key Technology Takeaways

1. AI is regarded by some top executives at big pharma ([GSK and others](#)) as **a tool to uncover not only new molecules, but also new targets**. Ability of deep neural networks to build ontologies from multimodal data (e.g. “omics” data) is believed to be among the most disruptive areas for AI in drug discovery, alongside with data mining from unstructured data, like text (using natural language processing, NLP).
2. There is **a considerable trend for “AI democratization”** where various machine learning/deep learning technologies become available in pre-trained, pre-configured “of-the-shelf” formats, or in relatively ready-to-use formats – via cloud-based models, frameworks, and drag-and-drop AI-pipeline building platforms (for example, KNIME). This is among key factors in the acceleration of AI adoption by the pharmaceutical organizations – where a non-AI experts can potentially use fairly advanced data analytics tools for their research.
3. **Proof-of-concept projects keep yielding successful results** – in research studies, and in the commercial partnerships alike. For example, companies like Recursion Pharmaceuticals and Exscientia achieved important research milestones using their AI-based drug design platforms.

Obstacles That Still Remain

1. **Global shortage of AI talent** continues to be a serious challenge for the biopharma industry, repeating the trend from our previous reports. While big pharmaceutical companies invest substantial capital in recruitment of AI specialists, still the majority of them are acquired by large tech corporations (Google, Amazon, Alibaba, Tencent, Baidu etc.) However, a growing wave of specialized university programs and courses, geared towards data science and AI application, is projected to address this issue to certain extent in the coming years.
2. **Lack of available quality data is still a challenge for the unleashing full potential of deep learning technologies**. Numerous variations of deep learning (DL) are believed to be the most lucrative area of AI for applications such as drug discovery and clinical research. The key challenge is that DL algorithms are “data-greedy”, while big data in biotech is not always well-versed for modeling, or is inaccessible due to privacy reasons.
3. **Ethical, legal, and regulatory issues for AI adoption in the pharmaceutical sciences**. This set of challenges is related to the previous point, but also includes other questions – AI explainability, patentability of AI-generated results, non-optimal regulations in various countries, slowing down the progress and adoption of AI technologies in general, and in the pharmaceutical industry in particular.

AI in the global context

US is a main player in AI industry. In the beginning of AI implementation, US was a pioneer and then the main player with the greatest number of companies using AI to force R&D, research centres and institutes, and investments. However, we observe the increased level of the UK and EU activity through big corporations that use AI to reorganise drug discovery and in launching government initiatives. It is also important to note a great increase in activity from the Asia-Pacific region generally, and particular from China – AI superpower.

China engages in extensive investment activity. In particular, it has promised to invest \$5 billion in AI. Tianjin, one of the biggest municipalities, is going to invest \$16 billion in its local AI industry, and the Beijing authorities will build \$2.12 billion AI development project. China also has at least ten privately owned AI startups valued at more than US\$1 billion. Moreover, China has been heavily investing in biotech R&D, although lately a serious decrease in Chinese investment in US biotech startups has been observed which can be explained by the trade conflicts between the US and China.

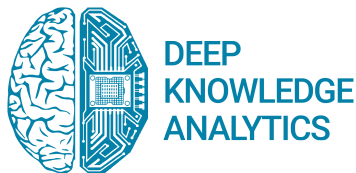
China plans to become the world AI leader by 2030, according to the AI Strategic Plan released in July 2017. The analysis of the the Asia-Pacific region has shown that the main forciers of AI implementation include Saama Technologies, Inc., a leading clinical data analytics company. It has announced a collaboration with researchers at the Tufts Center for the Study of Drug Development to ascertain how biopharmaceutical companies optimize automation and information technologies, including machine learning and neural networks, to support the research and development of new therapeutics. Moreover, XtalPi provides a huge number of talent to work with machine learning, create drug discovery and development applications that predict the properties of small molecules. Another innovators of Asian AI industry are Cytlimic and Fujitsu that offer software for predicting how well compounds will bind with each other and proteins.

Europe has traditionally been a strong breeding ground for biopharma activity, with some recent large valuations and mega deals. The UK and EU activity in the pharmaceutical AI race is mainly boosted by Novartis that announced an important step in reimagining medicine by founding the Novartis AI innovation lab and by selecting Microsoft Corp. as its strategic AI and data-science partner for this effort. Furthermore, GlaxoSmithKline has announced a few deals with companies such as Exscientia, Insilico Medicine, Insilico Biotechnology to use new computer modelling systems. BenevolentAI, a global leader in the application of AI for scientific innovation, also has several high-profile research collaborations, including AstraZeneca, and licensed in a group of drugs to develop from Janssen in 2016. This all demonstrate that Pharma is increasingly turning to AI to transform the drug discovery process.

About Deep Pharma Intelligence



Deep Pharma Intelligence is producing regular analytical reports on major areas of high-potential in the pharmaceutical and healthcare industries, maintaining ratings of companies and governments based on their innovation potential and business activity in the BioTech space, and providing strategic consulting and investment intelligence services to top-tier clients, including major investment funds and banks, family offices, insurance companies, government organizations, and big pharma companies among others. The company is a joint venture between the two highly specialized UK-based market intelligence hubs in Pharma / BioTech space:



Pharma Division of Deep Knowledge Analytics (PD-DKA), a specialized subsidiary of Deep Knowledge Analytics (DKA), the leading analytical entity specifically focused on deep intelligence of the high-potential areas in the pharma industry, including artificial intelligence (AI) for drug discovery sector.

Deep Knowledge Analytics Pharma Division serves as the main source of investment intelligence and analytics for AI-Pharma, a specialized index hedge fund for the AI in the drug discovery sector. PD-DKA's insights are frequently covered by top media such as Forbes and the Financial Times, and are acknowledged by top pharma executives.

Recently, MIT named this division a top technology think-tank, acknowledging the AI ranking framework it developed.

**Bio
Pharma
Trend**

BPT Analytics (BiopharmaTrend) - a rapidly growing analytical portal and media resource, dedicated to tracking emerging companies (startups/scaleups), innovations, investments, and trends in the pharma and biotech space.

BiopharmaTrend's reports and articles were referenced by Deloitte, Forbes, and other high profile media and consulting companies.

BiopharmaTrend is a media partner to a number of top-tier conferences and symposia in preclinical and clinical research, and healthcare research.

Overview of Proprietary Analytics by Pharma Division of **Deep Pharma Analytics**

Deep Pharma Intelligence (DPI) is a strategic partner to the leading Life Science organizations, investment institutions (VC funds, investment banks), and governments across the globe – in matters related to investments, strategic positioning, and policy development in the areas of pharmaceutical and biotech research, and healthcare tech.

While Deep Pharma Intelligence is regularly producing open industry reports covering high-growth sectors in the Life Sciences, including artificial intelligence (AI), digital health, and new therapies, some of the more in-depth research is only available to our clients and strategic partners under the “Proprietary Analytics” category.

Our range of proprietary services includes custom consulting projects, based on the specific customer needs, as well as a collection of pre-produced “ready-to-use” proprietary reports, produced by our research team, covering general trends and specific action ideas and strategy insights related to the most promising investment prospects (e.g. new technologies, biotech startups), M&A prospects (e.g. pipeline development targets), and strategic growth ideas (trends profiling, industry overviews etc).

Services:

- Investment landscape profiling, identifying investment ideas in the biotech/healthcare tech space.
- Preliminary due-diligence (business, science and technology, intellectual property (IP) profiling, freedom of operation assessment, legal assessment etc).
- Comprehensive due-diligence (deep business, science and technology assessment, IP and legal assessment, growth potential assessment etc).
- Infringement analysis of technology (i.g. If you plan to partner or invest in a data-analytics biotechs, or AI-development vendors, it is essential to understand their technological assets, both in terms of innovation potential and in terms of legal protection and non-infringement risk management).
- SWOT analysis of companies and technological sectors, competitive profiling.
- Industry profiling and growth strategy development for top-tier companies and governments.

Overview of Proprietary Analytics by Pharma Division of **Deep Pharma Analytics**

Proprietary Reports

There are a few 40+ page reports delivering practical answers to these specific questions in order to optimize the short and long-term strategies of biopharma corporations and other institutions related to the industry, with a newly updated edition being released each quarter, incrementally increasing the precision, practicality and actionability of its technological and financial analysis.

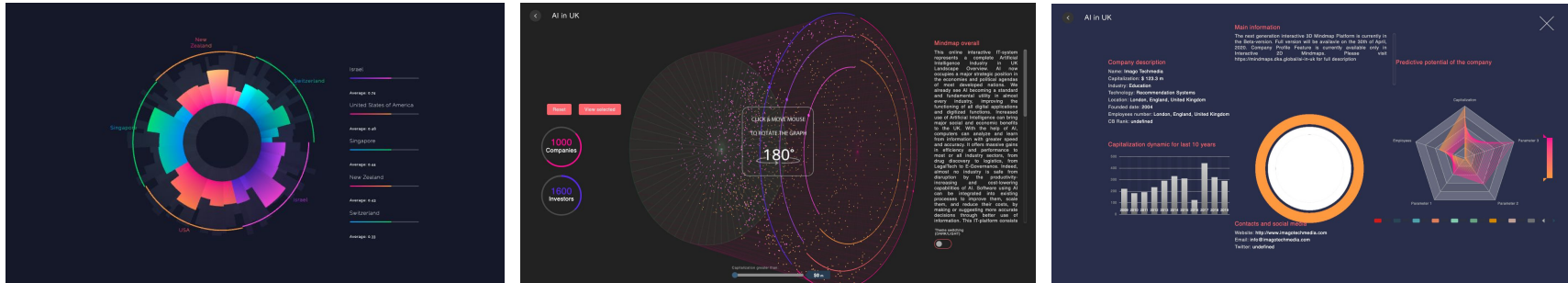
Our reports are supported by our rapidly developing data mining engine, data visualization platform and analytics dashboards.

The value our reports can deliver:

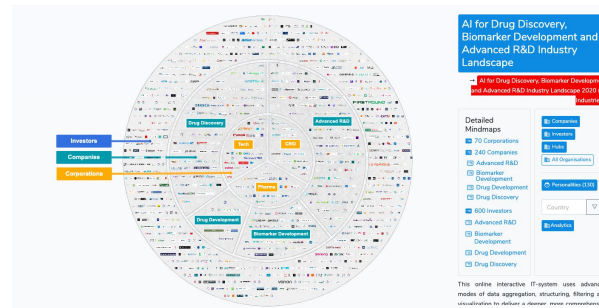
- Deep analysis of the deal-making prospects in the biotech and healthcare tech space, identification of top mini-trends and larger tendencies in innovations and technology adoption (e.g. AI, blockchain, eHealth tech, longevity biomarkers, new therapeutics and therapies etc.);
- Tangible forecasts on the 3-5 years horizon, providing an overview of future scenarios of the development of various technologies in the pharma industry;
- Practical guides for adopting various technological solutions and best practises, vendor profiling and contract research strategy building;
- Analysis of key market players in the emerging and high-growth areas of the pharmaceutical and biotech industries.

The parties who gain early access to these reports will have deep expertise on how their strategic agendas can be optimized in order to leverage novel research, new technologies, and emerging market opportunities, and stay competitive in a rapidly-changing technological environment, and taking into account shifting global priorities and trends.

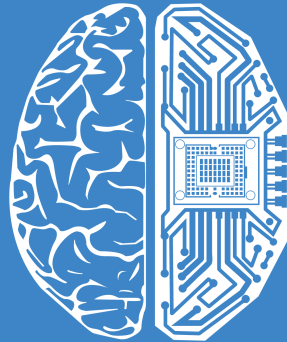
Deep Pharma Intelligence: Upcoming Projects and Analytical Tools



3D Visualisation Prototypes



Deep Pharma Intelligence Big Data Analytics Dashboard



[Link to Full Report: AI for Drug Discovery, Biomarker Development and Advanced R&D Landscape Overview 2020](#)

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