

Section III

**Comparative Industry Analysis
& Classification Framework
(Investor and M&A Guide)**

Section III: Comparative Industry Analysis & Classification Framework (Investor and M&A Guide) is devoted to an in-depth comparative and quantitative analysis of the entire AI for Drug Discovery landscape, specifically tuned for investors and business analysts who wish to gain a deeper understanding of the industry in Q2 of 2018.

- **Chapter XI: Classification/Ratings of AI for Advanced R&D and Drug Discovery Companies** performs a quantitative analysis of many of the AI for Drug Discovery companies covered and profiled in this report using a variety of tangible metrics that can be used to acquire an understanding of their level of scientific validation and industry activity, including the proportion of AI specialists among their total staff, number of publications, number of patents, etc. It then uses these metrics to rank AI for Drug Discovery companies side by side, and to build a classification framework by which these companies can be better categorized according to their specific focus, application and industry segmentation.
- **Chapter XII: 2010 - 2016 - Investment Rounds, M&A Deals and Notable Events** summarizes some of the most notable investment rounds, M&As and other notable events from 2010-2016, including but not limited to Benevolent AI's \$87M raise, ThoughtSpot's \$100M raise and Meta's \$23M raise.
- **Chapter XIII: 2017 - Investment Rounds, M&A Deals and Notable Events** summarizes some of the most notable investment rounds, M&As and other notable events in 2017, including but not limited to Exscientia's €250M raise, AICure's \$15M raise and Insilico Medicine's \$10M raise.
- **Chapter XIV: Q1 2018 - Investment Rounds, M&A Deals and Notable Events** summarizes some of the most notable investment rounds, M&As and other notable events in Q1 of 2018, including but not limited to AtomWise's \$45M raise, XtalPi's \$15M raise, and twoXAR's \$10M raise.
- **Chapter XV: Q2 2018 - Investment Rounds, M&A Deals and Notable Events** summarizes the major investments, M&As and other notable events (e.g. joint ventures, public announcements, etc.) that have occurred within the AI for Drug Discovery space specifically in Q2 of 2018, including but not limited to ThoughtSpot's \$145M raise, Benevolent.AI's \$115M raise, Celsius Therapeutics' \$65M raise, and Datavant's \$40.5M raise

Chapter XI

Comparison of Leading AI Companies

Methodology

This chapter aims to better contextualize the AI for Drug Discovery company landscape by comparing some of the industry's leading companies side by side according to several tangible metrics. In order to ascertain each company's degree of scientific validation, we have analyzed several parameters including:

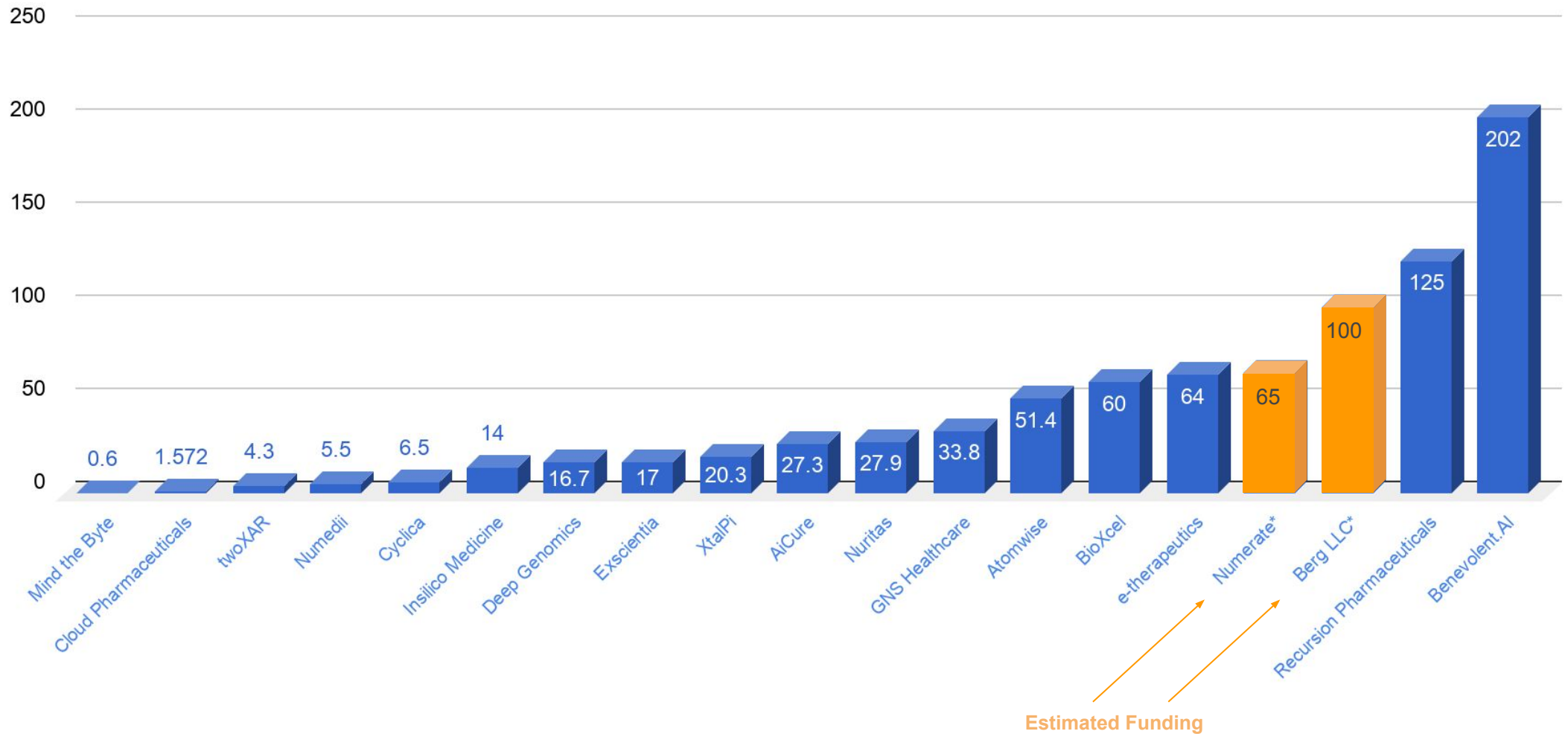
- Level of funding
- Number of scientific publications
- Number of patents
- Ratio of AI experts vs. Life Sciences experts vs. Administrative staff
- Number of public talks at AI for Drug Discovery conferences
- Type of AI utilized (e.g. core AI or complimentary AI; DL and GANs vs. legacy ML, etc.)
- Number of distinct types of AI utilized by company in their R&D process
- Publicly-disclosed AI applications
- Number of distinct forms of research activity (e.g. Data Mining, Biology Research, Compound Generation, Compound Binding, ADME/Toxicity Prediction, Drug Development Biomarker Discovery)

Types of AI for Drug Discovery Companies:

- **Core AI:** Developing AI as a core technological advantage and know-how (Insilico Medicine, BenevolentAI, Numerate etc). Companies in this category typically have state-of-the-art AI technology at the core of their R&D activities and IP, including sophisticated, state-of-the-art and proprietary DL architectures, GANs+RL, etc.
- **Complimentary AI:** Applying AI as a tool to complement primary area of activity and expertise in biology/chemistry (Recursion Pharmaceuticals, Berg Health, Cloud Pharmaceuticals, etc). Companies in this category develop AI resources on top of existing primary expertise in experimental chemistry/biology/drug discovery and can have various levels of AI sophistication, but typically without advanced AI know-how (simpler symbolic AI methods, statistics/cheminformatics/bioinformatics with elements of ML, legacy ML algorithms, less sophisticated DL architectures etc.).

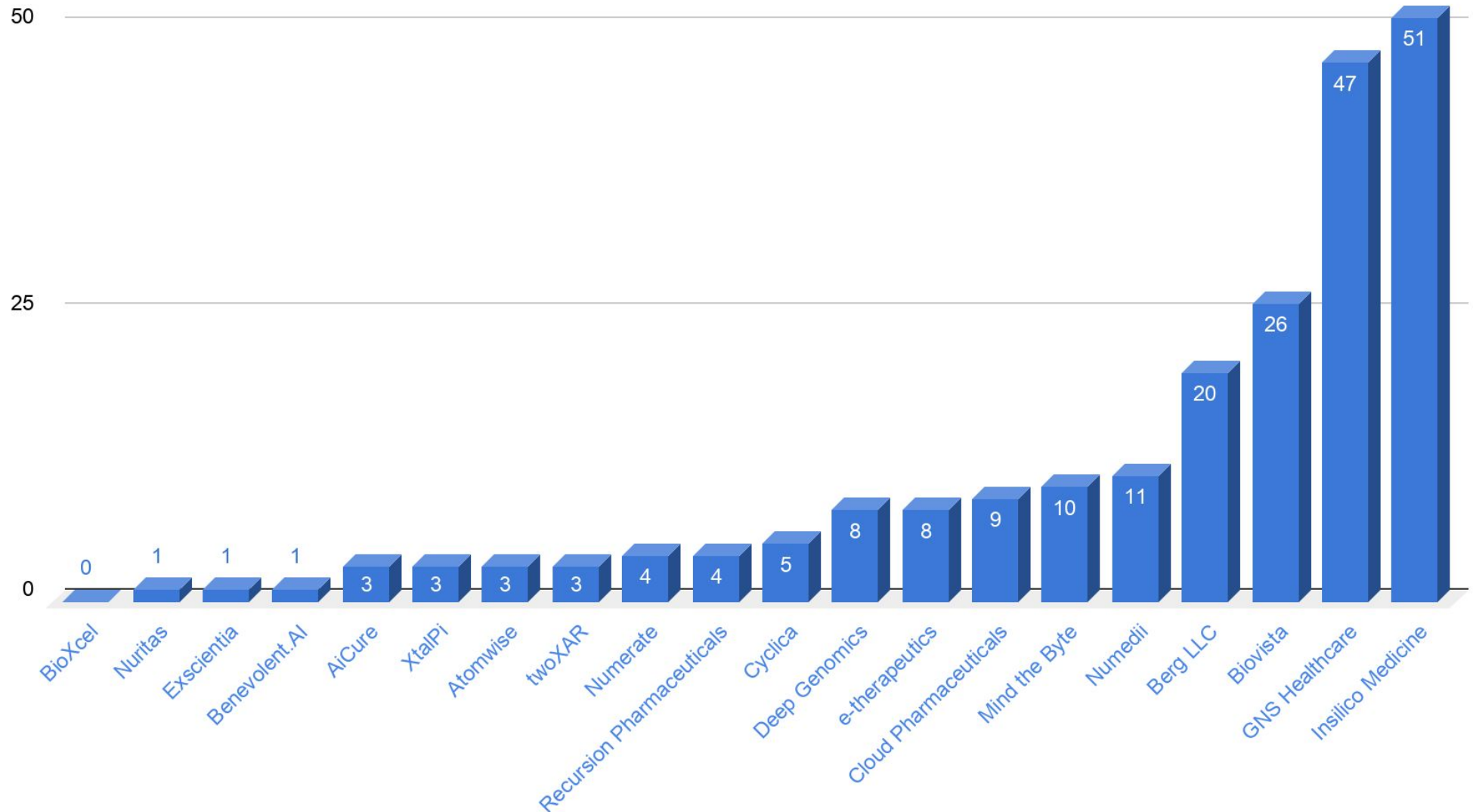
Comparison of Top-20 AI for Drug Discovery Companies

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



Comparison of Top-20 AI for Drug Discovery Companies

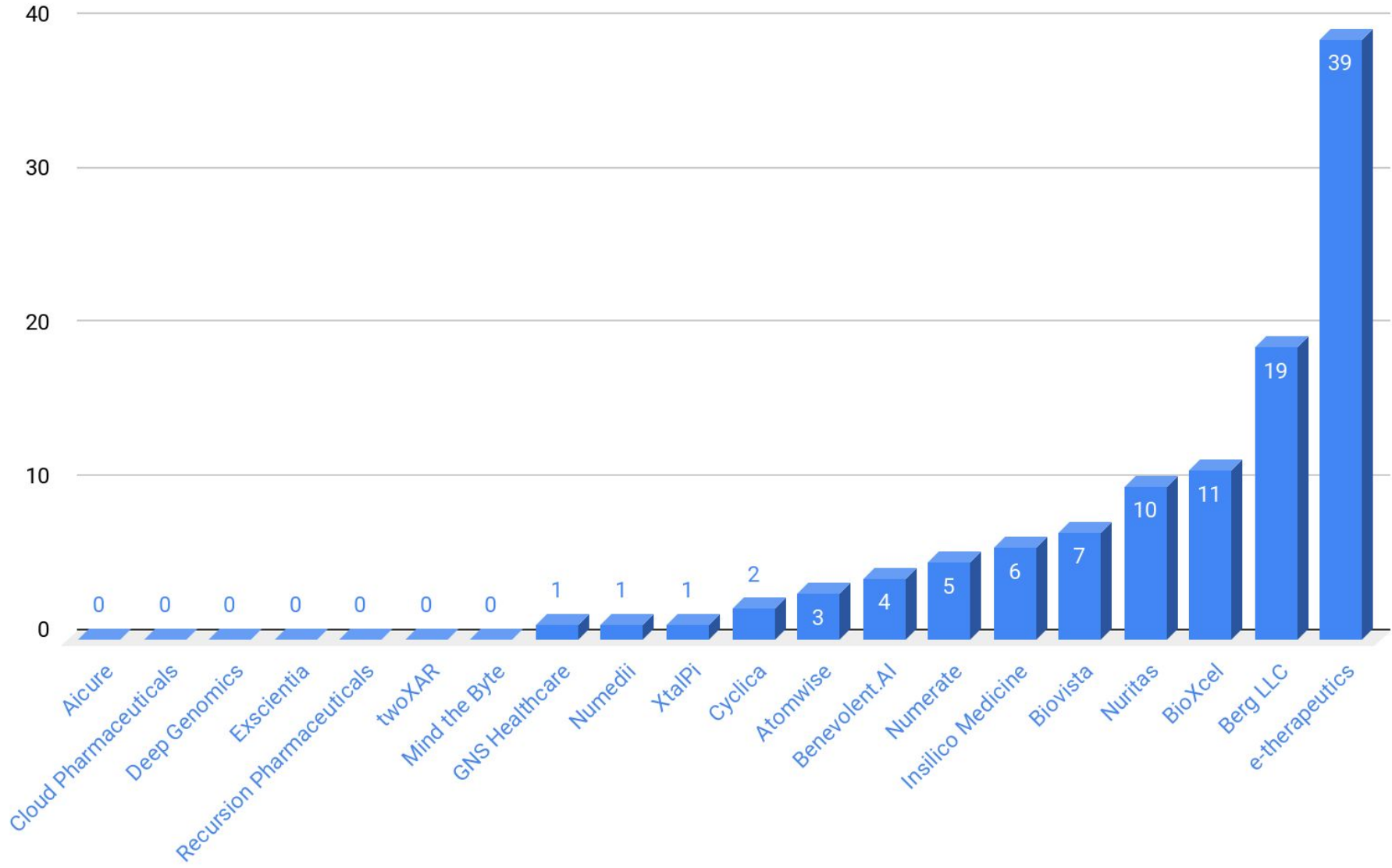
Number of Scientific Publications



Source: Company Website and PubMed

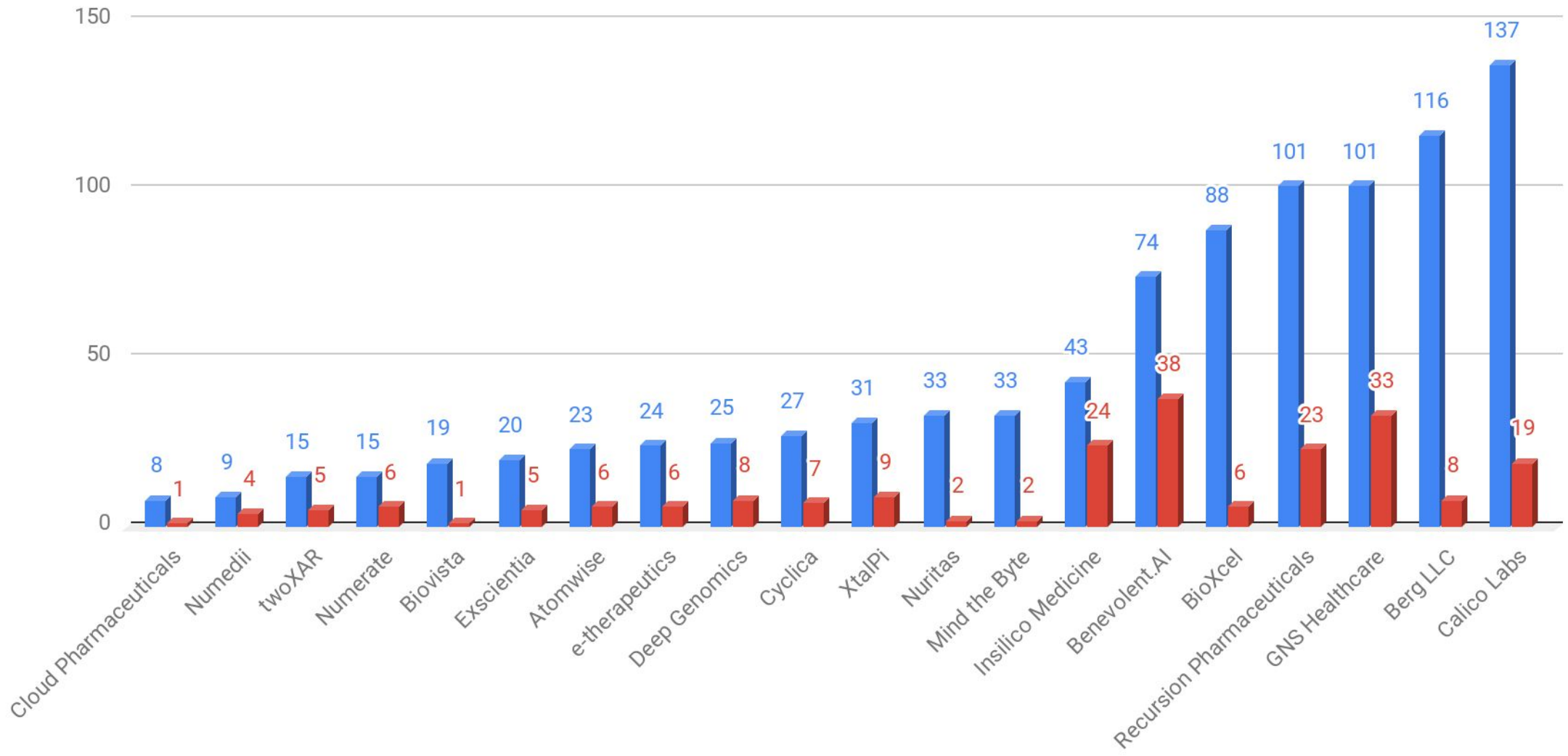
Comparison of Top-20 AI for Drug Discovery Companies

Number of Patents



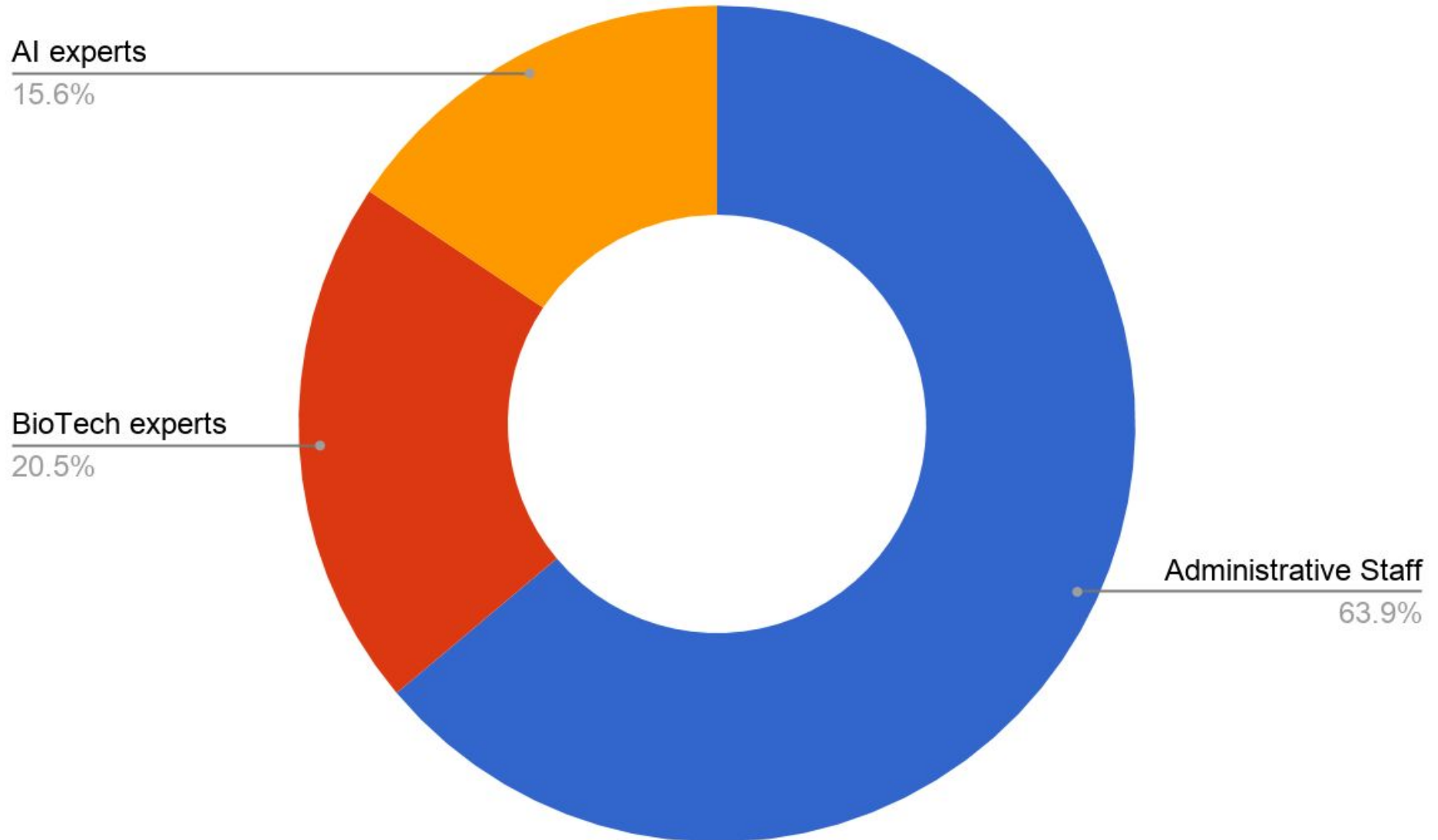
Comparison of Top-20 AI for Drug Discovery Companies

Total Number of Employees / AI experts



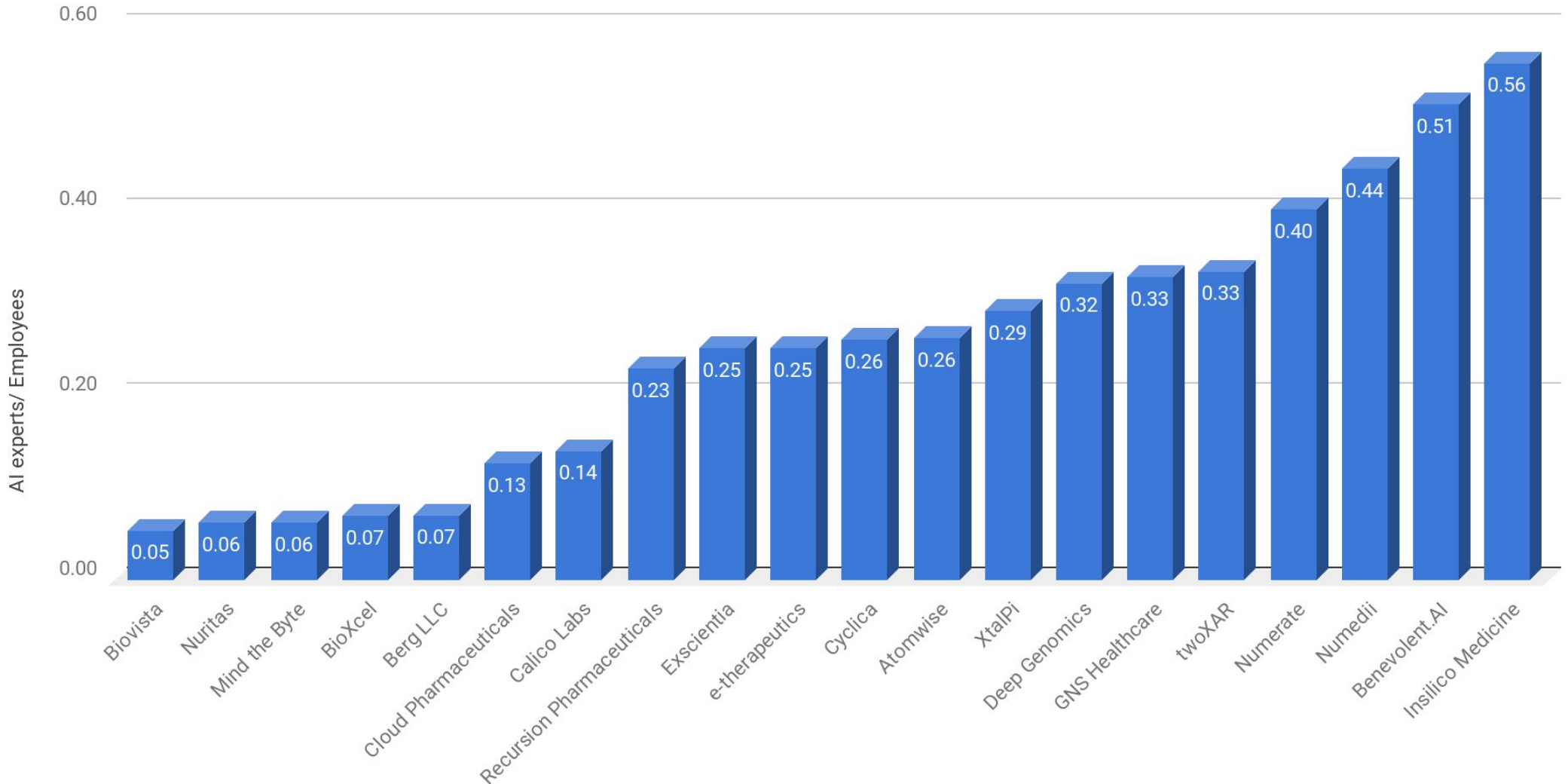
Source: According to LinkedIn

AI experts vs BioTech experts vs Administrative Staff



Comparison of Top-20 AI for Drug Discovery Companies

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



Source: According to LinkedIn

Comparison of Top-20 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
Atomwise	+	11/13	+	n/a
Benevolent.AI	+	18/74	+	n/a
Deep Genomics	+	10/26	-	n/a
Exscientia	+	2/12	+	+
GNS Healthcare	+	21/98	-	n/a
Insilico Medicine	+	24/43	+	+
NuMedii	+	4/9	+	+
Numerate	-	4/15	+	+
Recursion Pharmaceuticals	+	85/12	+	+
twoXAR	+	1/15	+	+

Comparison of Top-20 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
Berg LLC	-	3/11	+	n/a
Mind the Byte	-	2/33	+	n/a
Biovista	+	1/19	+	+
AiCure	-	9/43	+	+
Cloud Pharmaceuticals	+	1/8	+	n/a
e-therapeutics	+	4/25	+	n/a
Nuritas	-	2/33	+	+
XtalPi	-	1/25	+	n/a
Cyclica	-	7/27	+	+
BioXcel	-	4/88	+	+

Comparison of Top-20 AI for Drug Discovery Companies

Companies	Computation method	Data Type
Atomwise	DL	Chemical notations; QSAR
Benevolent.AI	ML, DL, symbolic AI	Text; images; EHRs; omics
Deep Genomics	n/a	n/a
Exscientia	ML	Chemical notations; high-content screening; SAR
GNS Healthcare	ML	n/a
Insilico Medicine	DL, GANs, GANs + RL, symbolic AI	Omics; EHR
NuMedii	Big data analysis, DL, ML	Raw human, biological, pharmacological and clinical data, normalized and annotated.
Numerate	AI, cloud computing	Chemical notations; screening; high-content screening;
Recursion Pharmaceuticals	n/a	Images, high content screening data
twoXAR	n/a	Omics data, high content screening

Comparison of Top-20 AI for Drug Discovery Companies

Companies	Computation method	Data Type
Berg LLC	DL	Human Data
Mind the Byte	Big Data	protein ligand interactions
Biovista	ML	correlations between drugs, molecular targets, pathways, adverse events and diseases
AiCure	ML	n/a
Cloud Pharmaceuticals	legacy ML, cheminformatics	Chemical notations
e-therapeutics	Big Data	Chemical notations
Nuritas	DL	n/a
XtalPi	Quantum physics; machine learning; cloud computing	n/a
Cyclica	AI	Chemical notations
BioXcel	ML	n/a

Comparison of Top-20 AI for Drug Discovery Companies


Expertise in AI for Drug Discovery R&D / AI

Expertise in Drug Discovery

Advanced R&D know-how, Own Drug discovery projects

Advanced Expertise, strong R&D team

General R&D Expertise

Machine Learning

Neural Networks, Deep Learning

GANs + Reinforcement Learning

Expertise in AI























Comparison of Top-20 AI for Drug Discovery Companies

Expertise in AI for Drug Discovery Chemistry / Biology



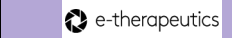












Expertise in Biology








































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

Data Mining	Biology Research	Drug Discovery			Drug Development	Biomarker Discovery
		Compound Generation	Compound Binding	ADME/Tox Predictions		
		 Atomwise Better medicines faster.	 Atomwise Better medicines faster.			
 benevolent.ai				 benevolent.ai		
 deep genomics						 deep genomics
		 e ^x scientia	 e ^x scientia	 e ^x scientia		
					 GNS HEALTHCARE Driving Intelligent Innovation	
	 INSILICO MEDICINE	 INSILICO MEDICINE	 INSILICO MEDICINE	 INSILICO MEDICINE	 INSILICO MEDICINE	 INSILICO MEDICINE
						 NuMedii
		 Numerate		 Numerate		
		 RECURSION pharmaceuticals				
	 twoXAR	 twoXAR				

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

Data Mining	Biology Research	Drug Discovery			Drug Development	Biomarker Discovery
		Compound Generation	Compound Binding	ADME/Tox Predictions		
						
						
						
						
						
						
						
						
						
						

Competitive Landscape

Hypothesis Knowledge Discovery	Target ID Biology	Compound Generation	Compound Binding	ADME Tox	Clinical Trials	Personalized Medicine	Real World Insights
 INSILICO MEDICINE BenevolentAI  IBM Watson  SPARKBEYOND nference	 INSILICO MEDICINE  IBM Watson twoAR  NuMedii BIOAGE  Standigm  BERG  deep genomics  RECURSION PHARMACEUTICALS  WuXiNextCODE  healx  iCarbonX 碳云智能	 INSILICO MEDICINE BenevolentAI inSili.com	 INSILICO MEDICINE Exscientia  Atomwise  CYCLICA SCHRÖDINGER  XtalPi	 INSILICO MEDICINE Exscientia  Numerate	 INSILICO MEDICINE BenevolentAI  IBM Watson  SPARKBEYOND WuXiNextCODE  DEEP 6  Mendel.ai  trials.ai  OWKIN	 INSILICO MEDICINE  IBM Watson  FOUNDATION MEDICINE  flatiron  freenome  GRAIL verily  iCarbonX 碳云智能 Over 1000 companies worldwide	 INSILICO MEDICINE  IBM Watson nference  Qrative  iCarbonX 碳云智能  SPARKBEYOND

10 Companies in Data Mining Companies

Company Name	Technology Abstract	Total Raised, \$m	Product focus	Field Focus
BenchSci	Decode open- and closed-access data on reagents such as antibodies and present published figures with actionable insights. Allows researchers to: Reduce time, money, and uncertainty in planning experiments.	9.7	biologics	biology
BenevolentAI	Evolved from text mining and semantic linking into knowledge graphs. Recent small efforts into DL and computational chemistry mostly for PR.	202	various	chemistry / biology
Biorelate	Create curated databases from the analysis of published scientific literature. Allows researchers to: Extract structured biological knowledge to power drug discovery applications.	0.13		
BioSymetrics	Process raw phenotypic, imaging, drug, and genomic data sets. Allows researchers to: Integrate rapid analytics and machine learning capabilities into existing business processes to improve care, enhance discoveries, gain insight into business, and enable fast data-driven decisions.	0	small molecules	biology
Datavant		40.5	-	-
Euretos	Direct access to the cloud based Euretos discovery platform via user friendly application; - API Integration of the discovery platform in your company's IT environment/workflows; - Integration of company proprietary data and public data in a secure environment.	0	-	-
FDNA	Link phenotypic traits to genetic mutations. Allows researchers to: Discover new clinical signs, symptoms, and genes for biomarkers, and access data to develop, test, and market precision Medicines.	0	therapies	biology
GNS Healthcare	GNS moves beyond analytical and machine learning approaches that rely on data correlations to match treatments to patients.	54.2	therapies	biology
IBM Watson Health		40	various	chemistry / biology
Nference	nferX - uses state-of-the-art Neural Networks - (shallow and deep learning models) for real-time, automated extraction of knowledge from the commercial, scientific, and regulatory body of literature.	3	-	-

10 Companies in Biology Research

Company Name	Technology Abstract	Total Raised, \$m	Product focus	Field Focus
Berg Health	Analyze data from patient samples in both healthy and diseased states to generate novel biomarkers and therapeutic targets. Allows researchers to: Generate therapeutic targets from biological data in an unbiased way, and implement personalized medicine at scale.	1.3	various	biology
e-Therapeutics	Analyze complex networks of molecular interactions in cells utilizing big data, and AI-powered analysis to come up with novel drug candidates for in-licensing.	66.8	small molecules	chemistry-biology
Engine Biosciences	Uncover gene interactions and biological networks underlying diseases, and test therapies that target them. Allows researchers to: Make analyses and predictions for precision medicine applications.	10	biologics	
Envisagenics	Analyze RNA data from patients to identify new biomarkers and drug targets. Allows researchers to: Accelerate discovery of RNA therapeutics.	4.1	biomarkers	
Euretos	Direct access to the cloud based Euretos discovery platform via user friendly application; - API Integration of the discovery platform in your company's IT environment/workflows; - Integration of company proprietary data and public data in a secure environment.	0	-	-
FDNA	Link phenotypic traits to genetic mutations. Allows researchers to: Discover new clinical signs, symptoms, and genes for biomarkers, and access data to develop, test, and market precision medicines.	0	therapies	
Insilico Medicine	Comprehensive DL pipeline. Biology: Signaling pathways, DNNs for target ID and HTS analysis. Chemistry: GANs-RL for novel molecule generation..	14	small molecules	chemistry-biology
Mind the Byte	Our prototype system is able to discriminate binders and non-binders from docking results based on AI with striking results. It uses AI to minimize the conformational energies and extracts interaction patterns from the Protein Data Bank.	0.58	small molecules	chemistry
Resonant Therapeutics	Assess and prioritize a library of drug candidates derived from analyzing tumor microenvironments. Allows researchers to: Simultaneously discover novel targets and functional antibodies for cancer.	1.96	biologics	biology
ReviveMed	Our platform for the first time enables the rapid, high- throughput, and cost-effective application of metabolic data to discover new disease mechanisms for drug discovery and, simultaneously metabolomic biomarkers.	1.5	various	biology

10 Companies in Early Drug Discovery

Company Name	Technology Abstract	Total Raised, \$m	Product focus	Field Focus
Arbor Biotechnologies	Arbor's platform employs a diverse set of technologies and techniques – including artificial intelligence, genome sequencing, gene synthesis and high-throughput screening – for accelerating the discovery of proteins for improving human health and sustainability.	27.8	biologics	
Atomwise	AtomNet is the first drug discovery algorithm to use a deep convolutional neural network. It excels at understanding complex concepts as a combination of smaller and smaller pieces of information. AtomNet has been predicting new potential treatments for two years. It has already explored questions in cancer, neurological diseases, antivirals, antiparasitics, and antibiotics.	51.57	small molecules	chemistry
BenevolentAI	Evolved from text mining and semantic linking into knowledge graphs. Recent small efforts into DL and computational chemistry mostly for PR.	202	various	chemistry-biology
Berg Health	Analyze data from patient samples in both healthy and diseased states to generate novel biomarkers and therapeutic targets. Allows researchers to: Generate therapeutic targets from biological data in an unbiased way, and implement personalized medicine at scale.	1.3	various	biology
Biovista	Drug repositioning specialist Biovista Inc. has tapped Hewlett Packard Enterprise Co. (HPE) to add greater computing power to Project Prodigy, a personalized medicine platform that leverages artificial intelligence (AI) to help doctors identify novel drugs for hard-to-treat patients.	0	therapies	chemistry-biology
BioXcel	Find applications for existing approved drugs or clinically validated candidates. Allows researchers to: Develop a pipeline of product candidates in immuno-oncology, neuroscience, and rare diseases.	60	small molecules	
CloudPharmaceuticals	We use a proprietary design process that combines AI and cloud computing to search virtual molecular space and applies along sophisticated molecular modeling to design novel drugs that are well-qualified for development from the outset and have original composition of matter IP.	1.5	small molecules	chemistry
Cyclica	Provide insight and analysis into a drugs' polypharmacology via its AI-powered platform LignadExpress utilizing structure based drug discovery approach.	6.5	small molecules	chemistry
Deep Genomics	Search 69 billion molecules with the goal of generating a library of 1,000 compounds to manipulate cell biology. Allows researchers to: Unlock new classes of antisense oligonucleotide therapies.	16.7	small molecules	chemistry-biology
e-Therapeutics	Analyze complex networks of molecular interactions in cells utilizing big data, and AI-powered analysis to come up with novel drug candidates for in-licensing.	66.8	small molecules	chemistry-biology

10 Companies in Drug Development

Company Name	Technology Abstract	Total Raised, \$m
AiCure	Visually confirm medication ingestion via smartphone. Allows researchers to: Improve medication adherence in clinical trials.	27.3
Antidote	Make sense of unorganized and unstructured data about clinical trials. Allows researchers to: Enrol more patients in appropriate trials.	28.9
Athelas	Analyze cancer biomarkers in 60 seconds from a drop of blood using an at-home device slightly bigger than an Amazon Echo. Allows researchers to: Optimize oncology drug development with a biomarker monitoring platform and millions of patient datapoints.	3.62
BenchSci	Decode open- and closed-access data on reagents such as antibodies and present published figures with actionable insights. Allows researchers to: Reduce time, money, and uncertainty in planning experiments.	9.7
Berkeley Lights	Automate selection, manipulation, and analysis of cells. Allows researchers to: Expedite development of cell lines and automate manufacturing of cellular therapeutics	86.2
Brite Health	Analyze structured and unstructured clinical trial participant data. Allows researchers to: Reduce clinical trial dropout rates through personalized communication.	0
BullFrog AI	BullFrog AI platform is based on a graph analytics tool designed to discover patterns and relationships in large scale and complex data sets. It harnesses valuable clinical data to solve challenges with patient targeting in clinical development.	0
Deep 6 AI	Analyze medical records to find patients for clinical trials. Allows researchers to: Accelerate patient recruitment to complete clinical trials faster.	0.24
Desktop Genetics	Determine biological variables influencing CRISPR guide design. Allows researchers to: Improve activity and reduce experimental bias in the selection of guides for CRISPR libraries.	6.8
GNS Healthcare	GNS moves beyond analytical and machine learning approaches that rely on data correlations to match treatments to patients. We reverse engineer the complex causal mechanisms that determine which therapies will produce the best outcomes for each patient	54.2

5 Companies in Biomarker Discovery

Company Name	Technology Abstract	Total Raised, \$m
Bioage Labs	Analyze omics data related to aging. Allows researchers to: Develop biomarkers and drugs that impact human aging.	10.9
Cotinga Pharmaceuticals	CHEMSAS® is a multi-staged computational platform technology based upon a hybrid of machine learning technologies and proprietary algorithms that allows prediction of biological activity from molecular structures. COTI-2 and COTI-219 are the first compounds derived with the benefit of CHEMSAS to be developed by Cotinga. ROSALINDTM is a simulation platform designed to provide better personalized treatment options based on the genetic profile of the patient's cancer.	0
Envisagenics	Analyze RNA data from patients to identify new biomarkers and drug targets. Allows researchers to: Accelerate discovery of RNA therapeutics.	4.1
Euretos	Direct access to the cloud based Euretos discovery platform via user friendly application; - API Integration of the discovery platform in your company's IT environment/workflows; - Integration of company proprietary data and public data in a secure environment.	0
Imagia	Analyze radiological images to produce clinically actionable information. Allows researchers to: Predict a patient's disease progression and treatment response, for clinical trial stratification and companion diagnostics.	0

Most Promising Players

Corporations



AI companies



BenevolentAI



Chapter XII

**2010-2016 - Investment Rounds,
M&A deals and Notable Events**







AI Company Name	Date	Amount	Type of Deal	Industry/Academia partner	Description
Meta	28 January 2015	\$23M	Investment	Horizon Ventures; BOE Optoelectronics; Y Combinator.	Meta's mission is to build natural machines that seamlessly unite the real world with the virtual world.
Antidote	5 February 2015	\$13.5M	Investment	Smedvig Capital; Octopus Ventures; Amadeus Capital Partners.	Antidote is accelerating the breakthroughs of new treatments by bridging the gap between medical research and the people who need them.
Atomwise	3 June 2015	\$6M	Investment	OS Fund; Khosla Ventures; Draper Associates; AME Cloud Ventures	Atomwise develops artificial intelligence systems using powerful deep learning algorithms and supercomputers for drug discovery.
Benevolent AI	26 August 2015	\$87M	Investment	Woodford Investment Management, Lundbeck, Upsher Smith Laboratories, Lansdowne Partners.	Benevolent AI develops and applies artificial intelligence to enhance and accelerate scientific innovation.
Cytox	3 April 2014	£1.5M	Investment	Seneca Partners; Wren Capital; Walking Ventures; Midven	The money allowed Cytox to extend the clinical research programme and more rapidly access potentially valuable utility claims.

AI Company Name	Date	Amount	Type of Deal	Industry/Academia partner	Description
Deep Genomics	18 November 2015	\$3.7M	Investment	True Ventures; Bloomberg Beta; 11.2 Capital	Deep Genomics plans to use the funds to grow its team of machine learning and genome biology experts and to further develop and validate its proprietary deep learning technology.
GNS Healthcare	8 December 2015	\$10M	Investment	Mitsui & Co; Heritage Provider Network; Celgene; Cambia Health Solutions; Alexandria Real Estate Equities; Gi Global Health Fund	The financing will be used to accelerate the development of new, cloud-based big data solutions at the intersection of precision medicine and population health.
NuMedii	26 June 2013	\$3.5M	Investment	Claremont Creek Ventures; Lightspeed Venture Partners	NuMedii raised funding to further develop its proprietary technology and prepare its first three internal drug development programs for clinical testing.
Nuritas	11 April 2014	€100K	Investment	NDRC	Nuritas combines artificial intelligence and genomics to discover and unlock natural bioactive peptides with extraordinary health benefits.






AI Company Name	Date	Amount	Type of Deal	Industry/Academia partner	Description
Recursion Pharmaceuticals	3 October 2016	\$12.9M	Investment	Lux Capital; Wild Basin Investments; Obvious Ventures; EPIC Ventures; Data Collective; AME Cloud Ventures	With its funding, Recursion will develop its next-generation “Platform 2.0” – to scale its endeavor from the exploration of dozens of targets and diseases per year to thousands.
Synthace	11 February 2015	£2.2M	Investment	UK Innovation & Science Seed Fund; Sofinnova Partners; Bioeconomy Capital	The new financing was used to expand automation and to further develop and disseminate its Antha language.
ThoughtSpot	19 May 2016	\$50M	Investment	Geodesic Capital; General Catalyst; Khosla Ventures; Lightspeed Venture Partners; Quentin Clark	With the investment, ThoughtSpot will fuel continued growth through three areas: global expansion, hiring, and technology advancement.
Transcriptic	17 November 2016	\$13.4M	Investment	Data Collective; ZhenFund; WuXi AppTec; Holtzbrinck Digital; Digital Science; AME Cloud Ventures	Transcriptic will utilize the new capital to drive the company’s product, team and expansion plans.

AI Company Name	Date	Amount	Type of Deal	Industry/Academia partner	Description
twoXAR	19 November 2015	\$3.4M	Investment	Andreessen Horowitz; CLI Ventures; StartX	twoXAR will use these funds to expand its engineering and commercial teams and advance the progress of new and existing partnerships focused on drug candidates for metabolic and neurological diseases.
Verge Genomics	29 October 2015	\$4M	Investment	IA Ventures; Two Sigma Ventures; Slow Ventures; Refactor Capital; OS Fund; Karlin Ventures; Great Oaks Venture Capital; Draper Associates	Verge will use the proceeds to expand development on its leading algorithmic platform while advancing lead drug candidates through further preclinical proof-of-concept experiments.


AI R&D startups investments 2010-2016

AI startups	Investment description	Investor name
<p>Meta</p> 	<p>Horizons Ventures invested \$23 000 000 in 2015</p> <p>Meta secured \$23M in Series A led by Horizons Ventures, Tim Draper and Y-Combinator partners. Meta is developing augmented reality glasses. Meta glasses are the first holographic, see-through display that allow users to see, create and interact with digital objects shown in physical space.</p>	<p>Horizons Ventures</p>  <p>Horizons Ventures is a venture capital firm based in Hong Kong with a focus on disruptive and technology-focused start-ups. It manages the private investment of Sir Li Ka-shing in the technology, media and telecommunications sector.</p>
<p>Antidote</p> 	<p>Smedvig Capital invested \$13 500 000 in 2015</p> <p>Antidote is accelerating the breakthroughs of new treatments by bridging the gap between medical research and the people who need them. The Series B was led by Amadeus Capital Partners, Octopus Ventures and Smedvig Capital on February 5th, 2015.</p>	<p>Smedvig Capital</p>  <p>Smedvig Capital is a growth capital firm that invests in U.K & Nordic based businesses, with a focus on those that are technology enabled. Founded in 1996, Smedvig has invested over £800M of internal capital. It invests £2-15M in fast growing UK based businesses.</p>
<p>Atomwise</p> 	<p>Y Combinator invested \$6 000 000 in 2015</p> <p>Y Combinator-backed Atomwise scores \$6M to use deep learning for drug discovery. Instead of relying on more traditional machine learning approaches, Atomwise employs deep learning, which involves training artificial neural networks on a large quantity of data — like billions of pictures, for example — and then giving them new data to receive inferences, or predictions, in response.</p>	<p>Y Combinator</p>  <p>Y Combinator is a startup accelerator based in Mountain View, CA. Twice a year they invest a small amount of money (\$120K) in a large number of startups. The YC partners work closely with each company to get them into the best possible shape and refine their pitch to investors.</p>







AI R&D startups investments 2010-2016

AI startups	Investment description	Investor name
<p>Benevolent AI</p> 	<p>Woodford Investment Management invested \$87 000 000 in 2015</p> <p>Benevolent AI has raised \$87M from blue-chip institutional investors and pharmaceutical companies including Woodford Investment Management, Lundbeck, Upsher Smith Laboratories, Lansdowne Partners. The company announced a major partnership with Johnson & Johnson in November 2016.</p>	<p>Woodford Investment Management</p> <p><small>woodford</small></p> <p>Woodford Investment Management LLP is authorised and regulated by the Financial Conduct Authority. The trust currently intends to conduct its affairs so that its securities can be recommended by IFAs to ordinary retail investors in accordance with the FCA's rules in relation to non-mainstream investment products and intends to continue to do so for the foreseeable future.</p>
<p>Cytox</p> 	<p>Seneca Partners invested £1 500 000 in 2014</p> <p>This money allowed Cytox to extend the clinical research programme and more rapidly access potentially valuable utility claims. The laboratory facilities and partnership would allow the company to partner with academia and industry in Europe and North America in the development of new Alzheimer's disease therapies and biomarkers.</p>	<p>Seneca Partners</p>  <p>Seneca Partners is a middle market focused investment banking and private investing firm. Their transaction and investing experience includes most industry sectors, however has strong experience in manufacturing, healthcare and business services.</p>
<p>Deep Genomics</p> 	<p>True Ventures invested \$3 700 000 in 2015</p> <p>Deep Genomics has raised \$3.7M in seed financing in a funding round led by True Ventures with participation from Bloomberg Beta and unnamed angel investors. The Toronto-based bioinformatics company plans to use the funds to grow its team of machine learning and genome biology experts and to further develop and validate its proprietary deep learning technology.</p>	<p>True Ventures</p>  <p>Founded in 2005, True Ventures is a Silicon Valley-based venture capital firm that invests in early-stage technology startups. The firm maintains a strong community that supports founders and their teams, helping True companies achieve higher levels of success and impact.</p>

AI R&D startups investments 2010-2016

AI startups	Investment description	Investor name
<p>GNS Healthcare</p> 	<p>Celgene Corporation invested \$10 000 000 in 2015</p> <p>GNS Healthcare, which has developed an analytics tool for precision medicine and population health, raised \$10 million from Celgene Corporation, Alexandria Real Estate Equities, and Gi Global Health Fund. The financing will be used to accelerate the development of new, cloud-based big data solutions at the intersection of precision medicine and population health.</p>	<p>Celgene Corporation</p>  <p>Celgene Corporation is a global integrated biopharmaceutical company primarily engaged in the discovery, development and commercialization of innovative therapies designed to treat cancer and immune-inflammatory related diseases in patients with limited treatment options.</p>
<p>NuMedii</p> 	<p>Claremont Creek Ventures invested \$3 500 000 in 2013</p> <p>NuMedii received \$3.5M in a Series A funding led by Claremont Creek Ventures and Lightspeed Venture Partners, with participation by Life Science Angels and others. NuMedii raised funding to further develop its proprietary technology and prepare its first three internal drug development programs for clinical testing.</p>	<p>Claremont Creek Ventures</p>  <p>Claremont Creek Ventures is a seed and early stage venture firm. CCV invests in companies that serve essential, broad-impact industries with innovative digital solutions that increase efficiency or create entirely new high-growth, high-margin businesses.</p>
<p>Nuritas</p> 	<p>NDRC invested €100 000 in 2015</p> <p>Nuritas Ltd is a bioinformatics technology company specialising in the discovery of peptides (chains of amino acids) with functional health or therapeutic benefits in nutrition and cosmetics. NDRC VentureLab is targeted at enabling ventures that are commercialising science, tech or intellectual property with high potential for success.</p>	<p>National Digital Research Centre</p>  <p>NDRC builds high-impact new ventures. By providing the people, time, space and investment needed at the earliest stages of dedicated commercialisation work, NDRC is creating companies worthy of commercial investment and with the ability to scale.</p>

AI R&D startups investments 2010-2016

AI startups	Investment description	Investor name
<p>Recursion Pharmaceuticals</p> 	<p>Lux Capital invested \$12 900 000 in 2016</p> <p>Recursion Pharmaceuticals raised \$12.9m to discover new drugs using artificial intelligence. The Series A round of funding was led by leading deep technology investor Lux Capital, with participation from Obvious Ventures, Epic Ventures, and more. With its funding, Recursion will develop its next-generation “Platform 2.0” – to scale its endeavor from the exploration of dozens of targets and diseases per year to thousands.</p>	<p>Lux Capital</p>  <p>Lux Capital Management is a research-driven investment firm focused on founding, seed and early stage investments in the physical and life sciences. Lux takes an active role in helping entrepreneurs build successful businesses in high growth sectors.</p>
<p>Synthace</p> 	<p>UK Innovation & Science Seed Fund invested £2 200 000 in 2015</p> <p>The firm has a growing collection of integrated technologies – including the Antha language for biology, driving an automated laboratory environment – for engineering biological systems. The new financing was used to expand automation and to further develop and disseminate its Antha language.</p>	<p>UK Innovation & Science Seed Fund</p>  <p>The UK Innovation & Science Seed Fund (formerly known as The Rainbow Seed Fund) is a £27.1m early-stage venture capital fund building and growing technology companies stemming from the UK’s research base.</p>
<p>ThoughtSpot</p> 	<p>General Catalyst Partners invested \$50 000 000 in 2016</p> <p>ThoughtSpot’s disruptive technology has garnered attention from customers and investors, including lead investor General Catalyst Partners, and Geodesic Capital. Existing investors Lightspeed Ventures and Khosla Ventures continue to support ThoughtSpot’s success through additional investments.</p>	<p>General Catalyst Partners</p>  <p>General Catalyst Partners provide the ongoing momentum that accelerates your ideas, your career, and your company toward standout success. They create the ideal conditions for growth, surround you with the right people, and offer mentorship based on deep experience.</p>

AI R&D startups investments 2010-2016

AI startups	Investment description	Investor name
<p>Transcriptic</p> 	<p>Data Collective invested \$13 400 000 in 2016</p> <p>Transcriptic will utilize the new capital to drive the company's product, team and expansion plans. The new funds will allow the company to grow its team to accommodate further growth, extend the capabilities of its innovative platform, and deliver on its vision of using its automated platform to dramatically increase research productivity.</p>	<p>Data Collective</p>  <p>Data Collective is a venture fund with a unique team of experienced venture capitalists, technology entrepreneurs and practicing engineers, investing together in seed and early stage Big Data and IT infrastructure companies.</p>
<p>twoXAR</p> 	<p>Andreessen Horowitz invested \$3 400 000 in 2015</p> <p>twoXAR will use these funds to expand its engineering and commercial teams and advance the progress of new and existing partnerships focused on drug candidates for metabolic and neurological diseases.</p>	<p>Andreessen Horowitz</p> <p>Andreessen Horowitz is a Silicon Valley-based venture capital firm with \$2.7 billion under management. They invest from seed to growth. It prefers to invest in the technology sector, biotech, and medicine companies at the intersection of computer science and life sciences.</p>
<p>Verge Genomics</p> 	<p>IA Ventures invested \$4 000 000 in 2015</p> <p>The firm was looking to change drug development for neurodegenerative diseases by using algorithms to find the gene networks contributing to those diseases and matching drugs that can affect the entire network. Verge said in a statement that it will use the proceeds to expand development on its leading algorithmic platform while advancing lead drug candidates through further preclinical proof-of-concept experiments.</p>	<p>IA Ventures</p> <p>IA Ventures is an early stage venture firm based in NYC but with investments in Los Angeles, San Francisco, Toronto and the UK. IA Ventures loves getting involved very early, often seeding companies before a dollar of revenue has been generated.</p>

Chapter XIII

**2017 - Investment Rounds,
M&A deals and Notable Events**




AI Company Name	Date	Amount	Type of Deal	Industry/Academia partner	Description
Exscientia	9 May 2017	€250M	Cooperation	Sanofi	Exscientia and Sanofi will develop bispecific small molecule drugs in the high interest area of metabolic disease, including diabetes.
Antidote	7 September 2017	£11M	Investment	Merck Global Health Innovation Fund; Octopus Ventures; Smedvig Capital	This funding will accelerate the development of new capabilities for its trial matching platform, including precision medicine and EHR-matching, as well as further global expansion.
GNS Healthcare	23 August 2017	\$6M	Investment	Amgen Ventures; Alexandria Real Estate Equities	The funds will be used to further develop the company's REFS causal machine learning and simulation platform - as well as solutions across drug discovery and development, value-based drug solutions, and care management.
AiCure	17 November 2017	\$15M	Investment	Baird Capital; Tribeca Venture Partners; Biomatics Capital Partners	The investment will accelerate commercial and engineering activities. AiCure is solving the lack of patient oversight and poor adherence to therapy, a \$500 billion problem in the US alone.

AI Company Name	Date	Amount	Type of Deal	Industry/Academia partner	Description
Insilico Medicine	2014-2017	\$10M	Investment	Deep Knowledge Ventures; Juvenescence Limited	Insilico Medicine's primary expertise is in the many flavors of generative adversarial models, one-shot learning, reinforcement learning and meta-learning used to develop a portfolio of over 1,000 promising molecules targeting cancer and age-related diseases.
ThoughtSpot	17 August 2017	\$60M	Investment	Lightspeed Venture Partners; Capital One Growth Ventures	ThoughtSpot's funding will help with the company's debut of a new artificial intelligence product, SpotIQ.
BioAge Labs	28 July 2017	\$10.9M	Investment	Andreessen Horowitz; Pear Ventures; Felicis Ventures; Elad Gil	The company intends to use the funds to build the team, refine and test its signatures of aging, and begin in vivo evaluation of drug candidates.
PathAI	3 November 2017	\$11M	Investment	General Catalyst; 8VC; DHVC (Danhua Capital); Pillar Companies	The startup will use the funds to build out its team and develop its artificial intelligence-based technology.
Berg Health	28 August 2017	N/A	Cooperation	AstraZeneca	BERG announced a research collaboration with AstraZeneca to identify and evaluate novel targets and therapeutics to treat neurological disorders such as Parkinson's disease.







AI Company Name	Date	Amount	Type of Deal	Industry/Academia partner	Description
Berkeley Lights	13 June 2017	N/A	Cooperation	GlaxoSmithKline	Berkeley Lights, Inc. announced that it will deliver to GlaxoSmithKline a Beacon™ Optofluidic platform for cell line development.
Recursion Pharmaceuticals	10 October 2017	N/A	Cooperation	Takeda Pharmaceutical Co. Ltd.	Recursion will screen 250 shelved preclinical assets from Takeda in exchange for an undisclosed upfront payment and more than \$90 million in milestones, plus royalties.
Synthace	11 August 2017	£2M	Cooperation	Oxford BioMedica	The agreement is a two-year £2 million collaboration project focused on gene and cell therapy manufacturing, co-funded by the UK's innovation agency, Innovate UK.
Nimbus Therapeutics	3 October 2017	N/A	Cooperation	Celgene	Under the terms of the agreement, Celgene will receive an option to acquire each program in the alliance up through a clinical inflection point. Nimbus will receive an upfront payment and potential downstream milestone payments for each program Celgene chooses to acquire. Nimbus will retain full control of research and development activities for each program prior to the program's option point. Financial terms will remain undisclosed until Celgene acquires a program.

AI Company Name	Date	Amount	Type of Deal	Industry/Academia partner	Description
Calico Labs	23 March 2017	N/A	Cooperation	C4 Therapeutics	C4 Therapeutics (C4T) and Calico announced a five-year collaboration to discover, develop, and commercialize therapies for treating diseases of aging, including cancer. The partnership will pursue preclinical research and Calico will be responsible for subsequent clinical development and commercialization of resulting products that may emerge from the collaboration.

AI R&D startups investments 2017

AI startups	Investment description	Investor name
<p>Exscientia</p> 	<p>Sanofi invested 250 000 000€ in 2017.</p> <p>Exscientia and Sanofi will develop bispecific small molecule drugs in the high interest area of metabolic disease, including diabetes. Exscientia will be responsible for compound design, while Sanofi will handle the chemistry synthesis, as well as further assays, preclinical experiments and subsequent trials.</p>	<p>Sanofi</p>  <p>Sanofi is a healthcare company engaged in the research, development, manufacturing, and marketing of innovative therapeutic solutions. It covers areas such as diabetes solutions, human vaccines, innovative drugs, consumer healthcare, emerging markets, animal health.</p>
<p>Antidote</p> 	<p>Merck Global Health Innovation Fund (GHI) invested £11 000 000 in 2017</p> <p>This funding will accelerate the development of new capabilities for its trial matching platform, including precision medicine and EHR-matching, as well as further global expansion.</p>	<p>Merck Global Health Innovation Fund</p>  <p>Merck GHI is evolving corporate healthcare venture capital globally by utilizing their healthcare ecosystem strategy.</p>
<p>GNS Healthcare</p> 	<p>Amgen Ventures invested \$6 000 000 in 2017</p> <p>The funds will be used to further develop the company's REFS causal machine learning and simulation platform -- as well as solutions across drug discovery and development, value-based drug solutions, and care management.</p>	<p>Amgen Ventures</p>  <p>The firm primarily invests in the biotechnology sector with a focus on discovering and developing human therapeutics with a focus on oncology, inflammation, hematology, nephrology, metabolic disorders, neuroscience, and cardiovascular therapeutics</p>

AI R&D startups investments 2017

AI startups	Investment description	Investor name
<p>AiCure</p> 	<p>Baird Capital invested \$15 000 000 in 2017</p> <p>The investment will accelerate commercial and engineering activities. AiCure is solving the lack of patient oversight and poor adherence to therapy, a \$500 billion problem in the US alone.</p>	<p>Baird</p>  <p>Baird Capital makes venture capital, growth equity, and private equity investments in strategically-targeted sectors around the world. Baird Capital is the direct private investment arm of Robert W. Baird & Co.</p>
<p>Insilico Medicine</p> 	<p>Deep Knowledge Ventures and Juvenescence Limited invested over \$10 000 000 in 2014-2017</p> <p>Insilico Medicine's primary expertise is in the many flavors of generative adversarial models, one-shot learning, reinforcement learning and meta-learning used to develop a portfolio of over 1,000 promising molecules targeting cancer and age-related diseases. Besides AI for Drug Discovery, the company is also extremely active in the niche of applying AI for drug repurposing and AI for aging biomarker discovery.</p>	<p>Deep Knowledge Ventures</p> <p>DKV lead by Dmitry Kaminskiy is an investment fund focused on early stage companies at the intersection of AI and precision medicine and Longevity.</p> <p>JUVENESCENCE Juvenescence Limited</p>  <p>Juvenescence Limited is a VC firm focused exclusively on longevity startups, led by prominent British investor Jim Mellon.</p>
<p>ThoughtSpot</p> 	<p>Lightspeed Venture Partners invested \$60 000 000 in 2017</p> <p>ThoughtSpot's funding will help with the company's debut of a new artificial intelligence product, SpotIQ. With this technology, a computer asks thousands of questions on its own, making assumptions about what the user wants to know based on the user's profile and certain search terms. The search produces dozens of analyzed data sets in seconds.</p>	<p>Lightspeed Venture Partners</p>  <p>Lightspeed Venture Partners is a venture capital firm that is engaged in the consumer, enterprise, technology, and cleantech markets. Lightspeed is an early stage venture capital firm focused on accelerating disruptive innovations and trends in the Enterprise and Consumer sectors.</p>


AI R&D startups investments 2017

AI startups	Investment description	Investor name
<p>BioAge Labs</p> 	<p>Andreessen Horowitz invested \$10 900 000 in 2017</p> <p>The company intends to use the funds to build the team, refine and test its signatures of aging, and begin in vivo evaluation of drug candidates. BioAge Labs initially targets specific diseases where aging is causal. However, its ultimate goal is to combat the suffering and disability caused by all aging-related diseases, and to restore both the quality and quantity of life in old age.</p>	<p>Andreessen Horowitz ANDREESSEN HOROWITZ</p> <p>Andreessen Horowitz LLC is a venture capital firm specializing in investing in seed, start-ups, early, mid stage, growth, and late stage. It prefers to invest in business and technology sector with a focus on software, cloud computing, enterprise software and data-storage, software related biology, biotech, and medicine companies at the intersection of computer science and life sciences with a focus on digital therapeutics, cloud technology in biology, and computational medicine.</p>
<p>PathAI</p> 	<p>General Catalyst Partners invested \$11 000 000 in 2017</p> <p>PathAI, a Cambridge, MA-based company developing A.I. software aim at helping pathologists be more efficient and accurate in diagnosing disease. The startup will use the funds to build out its team and develop its artificial intelligence-based technology.</p>	<p>General Catalyst Partners </p> <p>General Catalyst Partners is a private equity and venture capital firm. The firm seeks to invest in technology with a focus on advanced materials, clean energy solutions, cyber security and biosecurity and more.</p>

AI R&D startups cooperations 2017

AI startups	Deal description	Partner Organization
<p>Berg Health</p> 	<p>On 28th August 2017 BERG announced a research collaboration with AstraZeneca to identify and evaluate novel targets and therapeutics to treat neurological disorders such as Parkinson's disease. AstraZeneca will provide BERG with its curated library of central nervous system (CNS) optimized fragments. BERG will employ AstraZeneca's fragment library to assist in discovering drug candidates for therapeutic development. BERG's current clinical pipeline consists of therapeutics as well as companion and disease diagnostics that support clinical development in the areas of oncology, neurology and endocrinology.</p>	<p>AstraZeneca</p>  <p>AstraZeneca is a global, science-led biopharmaceutical company that focuses on the discovery, development and commercialisation of prescription medicines. Its purpose is to push the boundaries of science to deliver life-changing medicines. AstraZeneca focuses on three main therapy areas: Oncology, Cardiovascular & Metabolic Disease (CVMD) and Respiratory – and it is also selectively active in the areas of autoimmunity, neuroscience and infection.</p>
<p>Berkeley Lights</p> 	<p>On 13th June 2017 Berkeley Lights, Inc. announced that it will deliver to GlaxoSmithKline a Beacon™ Optofluidic platform for cell line development. The Beacon platform innovates various processes within drug discovery and development, reducing lead times and increasing capacity by transforming currently fragmented microfluidic workflows into automated nanofluidic workflows.</p>	<p>GSK</p>  <p>A science-led global healthcare company with a special purpose: to help people do more, feel better, live longer. GSK aims to bring differentiated, high-quality and needed healthcare products to as many people as possible, with its 3 global businesses, scientific and technical know-how and talented people.</p>
<p>Recursion Pharmaceuticals</p> 	<p>On 10th October 2017, Recursion entered a collaboration with Takeda Pharmaceutical Co. Ltd. to discover rare disease candidates for Takeda's TAK-celerator pipeline. Recursion will screen 250 shelved preclinical assets from Takeda in exchange for an undisclosed upfront payment and more than \$90 million in milestones, plus royalties.</p>	<p>Takeda</p>  <p>As a global pharmaceutical leader, Takeda focuses on solving unmet needs where it can make a real difference and on putting patients first. Its therapeutics focus is oncology, gastroenterology, and the central nervous system, as well as vaccines.</p>

AI R&D startups cooperations 2017

AI startups	Deal description	Partner Organization
<p>Synthace</p> 	<p>On 11th August 2017, Oxford BioMedica announced it has agreed, as lead partner, to enter into a collaboration agreement with a consortium of partners, including the Cell and Gene Therapy Catapult, Stratophase Ltd and Synthace Ltd. The agreement is a two-year £2 million collaboration project focused on gene and cell therapy manufacturing, co-funded by the UK's innovation agency, Innovate UK.</p>	<p>Oxford BioMedica</p>  <p>Oxford BioMedica is a leading gene and cell therapy company focused on developing life changing treatments for serious diseases. Oxford BioMedica is based across several locations in Oxfordshire, UK and employs more than 250 people.</p>
<p>Nimbus Therapeutics</p> 	<p>On 3rd October 2017, Nimbus Therapeutics announced the initiation of a long-term strategic alliance with Celgene Corporation in immunology. Under the terms of the agreement, Celgene will receive an option to acquire each program in the alliance up through a clinical inflection point. Nimbus will receive an upfront payment and potential downstream milestone payments for each program Celgene chooses to acquire. Nimbus will retain full control of research and development activities for each program prior to the program's option point. Financial terms will remain undisclosed until Celgene acquires a program.</p>	<p>Celgene</p>  <p>Celgene Corporation is an integrated global pharmaceutical company engaged primarily in the discovery, development and commercialization of innovative therapies for the treatment of cancer and inflammatory diseases through gene and protein regulation.</p>
<p>Calico Labs</p> 	<p>On 23 March 2017, C4 Therapeutics (C4T) and Calico announced a five-year collaboration to discover, develop, and commercialize therapies for treating diseases of aging, including cancer. The partnership will pursue preclinical research and Calico will be responsible for subsequent clinical development and commercialization of resulting products that may emerge from the collaboration.</p>	<p>C4 Therapeutics</p>  <p>C4 Therapeutics is pioneering a new class of drugs. C4's technology platform produces small molecule drugs that harness machinery already present in cells to selectively target disease-relevant proteins for degradation.</p>

Chapter XIV

**Q1 2018 - Investment Rounds, M&A deals
and Notable Events**

AI Company Name	Date	Amount	Type of Deal	Industry/Academia partner	Description
Atomwise	7 March 2018	\$45M	Investments	Monsanto Growth Ventures	Atomwise partnered with Monsanto in 2017 to help the agtech company find a quicker and more cost-effective way to bring new crop protection products to market.
twoXAR	19 March 2018	\$10M	Investments	SoftBank Ventures; Andreessen Horowitz Bio Fund; OS Fund	The proceeds will be used to build the company's drug pipeline through partnerships and accelerate preclinical development of existing candidates.
XtalPi Inc	January 2018	\$15M	Investments	Alphabet Inc; Tencent Holdings Ltd; Sequoia Capital China	The funding will be used to develop new computational models built on big data generated from XtalPi's high-precision computing platform and to expand its business into adjacent areas along the pharmaceutical value chain. The investment will also support the construction of a prediction-driven research lab.
Berkeley Lights	January 2018	N/A	Cooperation	Pfizer Inc.	A research collaboration and license agreement focused on optimizing BLI's proprietary Beacon™ Optofluidic platform with the goal of helping to accelerate Pfizer's monoclonal antibody (mAb) discovery and gene editing workflows.

AI Company Name	Date	Amount	Type of Deal	Industry/Academia partner	Description
Sirenas	12 February 2018	N/A	Cooperation	Bristol-Myers Squibb	A multi-target research collaboration agreement with Bristol-Myers Squibb to deploy Sirenas' drug discovery platform against certain undisclosed challenging therapeutic targets to identify potential drug candidates. Sirenas will receive an undisclosed up-front payment, funding for research activities and potential success fees from Bristol-Myers Squibb.
Nuritas	9 February 2018	N/A	Cooperation	Nestlé	As part of the collaboration, Nuritas will deploy its technology platform, which uses artificial intelligence and DNA analysis to predict, unlock and validate highly efficacious peptides, exclusively from natural food sources.

Investment round Q1 2018 / Atomwise

On **7th March 2018 Monsanto Growth Ventures**, the venture capital arm of Monsanto Co. was the lead investor in **Atomwise**, artificial intelligence startup's **\$45 million** Series A raise. Atomwise partnered with Monsanto in 2017 to help the agtech company find a quicker and more cost-effective way to bring new crop protection products to market. Terms of that partnership were not disclosed.

Monsanto Growth Ventures (MGV) led the Series A round with DCVC (Data Collective) and B Capital Group. Y Combinator, Khosla Ventures, DFJ, Baidu Ventures, Tencent and Dolby Family Ventures participated. The oversubscribed round brings Atomwise's total capital raised to more than \$51 million.

Monsanto Growth Ventures, DCVC (Data Collective), and B Capital Group led the raise in support of Atomwise's mission to become the preferred artificial intelligence partner for the world's leading pharmaceutical, biotech, and agrochemical companies.

Atomwise has struck partnerships with four of the top-ten U.S. pharma companies, multiple biotech firms, and over forty major research universities. All told, Atomwise has over fifty distinct molecular discovery programs. The Atomwise approach demonstrates a new model for a pharmaceutical industry that is facing a crisis of declining productivity, spending more on research each year, yet achieving fewer breakthroughs per dollar. Atomwise has brought the power of artificial intelligence to breakthrough research on deadly viruses, several forms of cancer, neurodegenerative diseases, metabolic diseases, life-threatening bacteria, endemic parasites, and crop-blighting fungi in agriculture. With this funding, Atomwise is ready to help hundreds of organizations discover compounds that could become tomorrow's blockbusters.

Atomwise has delivered significant research results since its seed funding in 2015. Dozens of its discovery programs have achieved success in the hands of its partners, contrasting with an industry that typically has extremely high rates of failure for comparable work.

Sources: <https://www.businesswire.com/news/home/20180307005638/en/Atomwise-Raises-45-Million-Series-Preferred-Artificial>



Investment round Q1 2018 / twoXAR

On **19th March twoXAR**, an artificial intelligence (AI)-driven biopharmaceutical company, announced that it has raised **\$10 million** in Series A financing led by **SoftBank Ventures**, a SoftBank Group early stage venture capital arm. Joining SoftBank Ventures is the Andreessen Horowitz Bio Fund and OS Fund. The proceeds will be used to build the company's drug pipeline through partnerships and accelerate preclinical development of existing candidates. With this financing, JP Lee, Managing Director at SoftBank Ventures, and Vijay Pande, PhD, General Partner at Andreessen Horowitz, have been appointed to the twoXAR Board of Directors.



The company's AI-driven discovery platform has the potential to transform the identification of new medicines and dramatically improve the success rates of preclinical development. The twoXAR team has already established a number of collaborations with global biopharmaceutical leaders and demonstrated how candidates identified by their technology translate to successful in vivo studies.

Using its proprietary AI-driven platform, twoXAR rapidly identifies drug candidates for in vivo testing in weeks rather than years and has demonstrated in vivo success rates significantly greater than those of traditional approaches across therapeutic areas including diseases such as liver cancer, rheumatoid arthritis, and type 2 diabetes. twoXAR is building a pipeline of novel, proprietary drug candidates through partnerships with biopharmaceutical companies, drug developers, and investors.

twoXAR's approach to developing their pipeline through partnerships and spin-outs enables them to apply their technology broadly across therapeutic areas, put drug development in the hands of expert drug developers, and create a portfolio of drug programs that significantly increases the probability of a twoXAR-discovered treatment benefiting patients. twoXAR previously raised \$4.3 million in seed financing from investors including Andreessen Horowitz, CLI Ventures, and the Stanford-StartX Fund.

Sources: <https://www.businesswire.com/news/home/20180319005411/en/SoftBank-Ventures-Leads-10M-Investment-AI-Driven-Drug>

Investment round Q1 2018 / XtalPi

In **January 2018** **Alphabet Inc's** Google, **Tencent Holdings Ltd** and **Sequoia Capital China** have joined a **\$15 million** B series funding round for Boston- and Shenzhen-based artificial intelligence (AI) pharmaceutical firm **XtalPi Inc.**

This funding will be used to develop new computational models built on big data generated from XtalPi's high-precision computing platform and to expand its business into adjacent areas along the pharmaceutical value chain. The investment will also support the construction of a prediction-driven research lab.

XtalPi uses AI, cloud computing and quantum physics to improve drug design processes. The deal is the first co-investment by Google and Tencent since the two companies revealed that they have signed a patent sharing agreement, paving the way for cooperation between the two firms. To give an idea of its computing focus XtalPi has built an elastic HPC (high performance computing) cloud that can deploy up to one million cores across AWS, Tencent cloud, Google Cloud and Alibaba Cloud.

The startup previously raised a \$5 million Series A round by Tencent in late 2015, prior to that, social network Renren led its seed investment. It counts ZhenFund and FreeS Fund as other investors. This new round — which takes XtalPi to \$20 million from investors to date — will go towards using big data from XtalPi's high-precision computing platform to develop new computational models. It will also help expand its footprint into new segments in the pharma industry.

XtalPi said it is working on a “prediction-driven research lab” that will combine its R&D with lab technology to get more precise and rounded results and predictions.



Source: <https://techcrunch.com/2018/01/23/xtalpi-google-tencent-sequoia-china/>

AI R&D startups cooperations Q1 2018

Berkeley Lights and Pfizer

In **January 2018 Berkeley Lights** announced that it has entered into a research collaboration and license agreement with **Pfizer Inc.** focused on optimizing BLI's proprietary Beacon™ Optofluidic platform with the goal of helping to accelerate Pfizer's monoclonal antibody (mAb) discovery and gene editing workflows.

Through the collaboration, the companies will combine BLI's platform – which utilizes a light-based, nano-fluidic method to select, characterize, culture and export single cells – with Pfizer's expertise in gene editing, sequencing, and molecular biology, as well as B-cell screening, to help advance the research aims and influence the development of the Beacon platform.

Berkeley Lights, Inc. (BLI) develops and commercializes platforms on which many bio-pharmaceutical, genomic, and cellular therapy applications will run. BLI launched its first commercial platform, the Beacon, in December 2016.

The Beacon platform is capable of screening thousands of plasma B-cells or gene edited cells in an automated fashion, speeding up a traditionally time-consuming, manual process to just a few days. Cell characterizations are performed through a variety of serial or multiplex fluorescence assays to determine antigen specific binding to membrane bound targets on live cells, relative affinity, and functional response with reporter cells. Individual cells with the desired characteristics are selected and exported for genomic profiling or further manipulation.

Through this program Berkeley Lights plans to deliver a new level of speed and precision that, the startup believes, is unattainable with other methods. This program enables a thorough evaluation of multiple areas within their development process to further optimize plasma b-cell and gene editing workflows.



Source: <https://www.prnewswire.com/news-releases/berkeley-lights-announces-research-collaboration-and-license-agreement-with-pfizer-300577279.html>

AI R&D startups cooperations Q1 2018

Sirenas and Bristol-Myers Squibb

On **12th February 2018** **Sirenas** announced that it has entered into a multi-target research collaboration agreement with **Bristol-Myers Squibb** to deploy Sirenas' drug discovery platform against certain undisclosed challenging therapeutic targets to identify potential drug candidates. Sirenas will receive an undisclosed up-front payment, funding for research activities and potential success fees from Bristol-Myers Squibb. In addition, Bristol-Myers Squibb has an option to license compounds identified from the collaborative efforts under a separate agreement that will include potential milestones and royalties paid to Sirenas.



Sirenas has built a remarkably effective platform that combines powerful computational approaches, deep natural product expertise, and state of the art synthesis to rapidly deliver new drug candidates. Due to Sirenas' expertise in the field, the company has formed research partnerships including the Bill and Melinda Gates Foundation and the California Institute for Biomedical Research to advance ATLANTIS™ and its emerging pipeline of immunomodulatory programs.

The research collaboration leverages Sirenas' expertise in applying ATLANTIS™, its data mining technology, to identify such potential drug candidates derived from Sirenas' proprietary chemical library isolated from global microbiome collections. ATLANTIS™ uses machine learning and "big data" approaches to uncover the complex relationships between natural small molecule metabolites and disease relevant biological assays. ATLANTIS™ provides rapid insights into the therapeutic potential, chemical novelty, structure activity relationships and global distribution of each metabolite. This functionality enables the uncovering of therapeutic leads from a previously hidden, rich pool of privileged chemistry that can be leveraged to help tackle the greatest unmet disease needs.

Sirenas believes science-focused biopharma companies can benefit from its innovative approaches to access breakthrough chemistry in delivering drug candidates for difficult biological targets. The collaboration with Bristol-Myers Squibb will help to identify potential new therapies to treat the world's highest unmet medical needs.

Source: <https://www.prnewswire.com/news-releases/sirenas-enters-into-multi-target-collaboration-with-bristol-myers-squibb-300596468.html>

AI R&D startups cooperations Q1 2018

Nuritas and Nestlé

On **9th February 2018 Nuritas** announced its collaboration with food giant **Nestlé** to discover bioactive peptide networks within natural food sources. As part of the collaboration, Nuritas will deploy its award-winning and novel technology platform, which uses artificial intelligence (AI) and DNA analysis to predict, unlock and validate highly efficacious peptides, exclusively from natural food sources. The Nuritas platform will help to cut the time and cost of discovering new ingredients for health promotion, disease prevention and medicines.



Nuritas is a rapidly growing, award-winning digital biotechnology and R&D company which has created remarkable interest globally for its peptide-finding platform capabilities. Nuritas has received global recognition for the impact its innovative technology will have on the future of food and health. This includes winning the overall Innovation Award at the Forbes Reinventing America Summit in 2015, the Nutrition Capital Network Venture competition in October 2016 and support from EU Horizon 2020 in 2016 for a peptide that carries the potential to prevent prediabetic patients from developing diabetes.

The Nuritas platform will help to cut the time and cost of discovering new ingredients for health promotion, disease prevention and medicines. For its part, Nestlé will use its considerable scientific know-how and applications expertise to validate the efficacy of these new discoveries within the target applications.

The results of Nuritas's research could lead to the discovery of new food components to help prevent, manage and even cure deadly diseases.

Founded in 2014, Nuritas boasts some pretty well-known funders from previous rounds, including Bono and The Edge from U2, and Salesforce CEO Marc Benioff. In December, it emerged that the company secured €16m Series A funding led by Chicago-based Cultivian Sandbox Ventures, bringing its total investment to date to approximately €25m.

Sources: <http://www.nuritas.com/nestle-and-nuritas-to-work-together-on-discovery-of-food-derived-bioactive-peptides-through-artificial-intelligence/>
<https://www.siliconrepublic.com/machines/nuritas-nestle-ai-dna-analysis-food-health>

Chapter XV

**Q2 2018 - Investment Rounds, M&A Deals
and Notable Events**

AI Company Name	Date	Amount	Type of Deal	Industry/Academia partner	Description
BenevolentAI	19 April 2018	\$115M	Investments	Woodford Investment Management	The company will use the funds to significantly scale its drug development activities, broaden the disease areas on which it focuses, and extend its AI platform capabilities. A portion of the funds will be used to extend BenevolentAI's capabilities into other science-based industries underpinning many of the world's most valuable markets such as advanced materials, agriculture, and energy storage.
BenchSci	2 May 2018	\$8M	Investments	iNovia Capital; Gradient Ventures; Golden Venture Partners, Afore Capital, Real Ventures, and Radical Ventures	The funds will be used by BenchSci to expand its team of engineers and scientists, implement new sales and marketing programs to drive new customer acquisition, and scale its AI technology used by researchers to accelerate biomedical discoveries.
GTN	May 2018	£2.1	Investments	Octopus Ventures; Pentech; Entrepreneur First	N/A

AI Company Name	Date	Amount	Type of Deal	Industry/Academia partner	Description
Celsius Therapeutics	May 2018	\$65M	Investments	Third Rock Ventures; GV; Heritage Provider Network; Casdin Capital; Alexandria Venture Investments	N/A
Datavant	April 2018	\$40.5M	Investments	Roivant Sciences; Travis May	N/A
OWKIN	May 2018	\$5M	Investments	GV	The company will use the new funding to continue the development of Socrates, strengthen strategic partnerships, and support internal growth.
ThoughtSpot	8 May 2018	\$145M	Investments	Lightspeed Venture Partners; Khosla Ventures; General Catalyst; Sapphire Ventures; Future Fund	ThoughtSpot will continue to innovate its next-generation analytics platform, accelerate global business growth, including expansion in EMEA and APAC, and grow its R&D centers in Palo Alto, Seattle, Dallas, and Bangalore.

AI Company Name	Date	Amount	Type of Deal	Industry/Academia partner	Description
Recursion Pharmaceuticals	5 June 2018	\$20.5M	Investments	Square 1 Bank	The funding will allow Recursion to expand its platform to enable target discovery and new chemical entity discovery as well as identify potential treatments in new indication areas like inflammation, immuno-oncology, infectious disease, and aging.
ReviveMed Inc	18 April 2018	\$1.5M	Investments	Rivas Capital; TechU, Team Builder Ventures, WorldQuant Ventures	The financing will allow the company to continue scaling the platform and begin building its internal drug discovery pipeline.
Insilico Medicine	11 June 2018	N/A	Investments	WuXi AppTec; Pavilion Capital; Juvenescence; Bold Capital Partners	The funding is intended to enhance Insilico Medicine's work in the innovative approaches to the generation of novel molecules using a variety of machine learning and deep learning techniques, as well as to expand a variety of the biomarker discovery initiatives.
Boehringer Ingelheim	May 2018	N/A	Cooperation	Bactevo	Boehringer Ingelheim announced a partnership with Bactevo to use its Totally Integrated Medicines Engine platform to identify novel small molecule lead compounds.

AI Company Name	Date	Amount	Type of Deal	Industry/Academia partner	Description
Cloud Pharmaceuticals	30 May 2018	N/A	Cooperation	GlaxoSmithKline	GSK announced a partnership to use AI for the design of novel small-molecule drugs with Cloud Pharmaceuticals.
Hitachi	March 2018	N/A	Cooperation	Mitsubishi Tanabe Pharma	Mitsubishi Tanabe Pharma partnered with Hitachi to optimize clinical trial planning with AI.
XtalPi	May 2018	N/A	Cooperation	Pfizer	Pfizer announced a partnership with XtalPi to combine quantum mechanics and machine learning to predict the properties of drugs.
Deep Genomics	April 2018	N/A	Cooperation	Wave Life Sciences	Wave Life Sciences and Deep Genomics announced their collaboration to discover novel therapies for genetic neuromuscular disorders. Under the collaboration, the companies will analyze and test oligonucleotides against potential therapeutic targets within multiple genes implicated in neuromuscular disorders.

Investment round Q2 2018 / BenevolentAI

On **19th April 2018 BenevolentAI** announced that it has raised **\$115 million** from new and existing investors at a pre-money valuation of \$2 billion in one of the largest funding rounds in the AI pharmaceutical sector. The majority of investors are from the United States, expanding the Company's global investor footprint. The balance of raised funds came from existing investors, including **Woodford Investment Management**. To date, the company has raised more than \$200m of funding since 2013. Credit Suisse acted as the sole placement agent.

The logo for BenevolentAI, consisting of the company name in white text on a blue rectangular background.

BenevolentAI is applying artificial intelligence to develop new medicines for hard to treat diseases. It is the first fully integrated AI company with pharmaceutical discovery and clinical development capabilities. BenevolentAI's technology aims to accelerate the journey from inventive ideas to medicines, lower costs and decrease failure rates associated with traditional drug discovery. The company's AI technology is being used to develop treatments to unmet patients' needs across a wide range of diseases, including Motor Neuron Disease, Parkinson's Disease, Glioblastoma and Sarcopenia.

BenevolentAI has already made progress in accelerating drug development, including the initiation of over 20 research and development programmes to date. The company will use the funds to significantly scale its drug development activities, broaden the disease areas on which it focuses, and extend its AI platform capabilities. A portion of the funds will be used to extend BenevolentAI's capabilities into other science-based industries underpinning many of the world's most valuable markets such as advanced materials, agriculture, and energy storage.

BenevolentAI will continue developing its core "AI brain" as well as different arms of the company that are using it specifically to break new ground in drug development and more. Other areas where the startup hopes to move into over the coming months and years include agriculture, veterinary science, and other categories that sit alongside those BenevolentAI is already tapping.

Source: <https://benevolent.ai/news/announcements/benevolentai-raises-115m-for-ai-enabled-drug-development/>

Investment round Q2 2018 / BenchSci

On **2nd May 2018 BenchSci**, an AI-powered search engine for biological products, announced that it has raised **US\$8 million** in Series A financing. The round was led by **iNovia Capital** with participation from Google's AI-focused venture fund, Gradient Ventures, and return investors Golden Venture Partners, Afore Capital, Real Ventures, and Radical Ventures. Using BenchSci, researchers can find reliable antibodies 24x faster and 75% cheaper than current methods. It now powers discoveries in 7 of the top 10 pharma companies and 910 academic institutions. The company launched out of beta in July 2017, and since that time has analyzed data on more than 4 million commercial antibodies.



As a Canadian technology startup founded by four immigrants, BenchSci prides itself on its diverse workplace and is continuing to expand its team with diverse talent. In 2017, BenchSci tripled its employee count, and plans to add 16 new team members in 2018. The funds will be used by BenchSci to expand its team of engineers and scientists, implement new sales and marketing programs to drive new customer acquisition, and scale its AI technology used by researchers to accelerate biomedical discoveries.

BenchSci's technology provides a unique value proposition for this market, enabling academic researchers to spend less time searching for antibodies and more time working on their experiments. Led by Liran Belenzon, CEO and co-founder, BenchSci accelerates biomedical discoveries via Artificial intelligence driven technology that helps researchers find reliable antibodies faster.

BenchSci has also established partnerships with many of the top scientific publishers, including Springer Nature, Wiley, Karger, the American Medical Association, FASEB, and ASPET.

Source: <https://www.benchsci.com/press/series-A/>

Investment round Q2 2018 / GTN

In **May 2018** drug discovery startup **GTN** has raised **£2.1 million** in Seed funding in a round led by Octopus Ventures and Pentech to transform the industry. Existing investor Entrepreneur First also contributed to the round, which will be used to build on GTN's drug discovery technology. GTN's technology can allegedly predict molecular properties such as binding energy and toxicity. The company is currently running collaborations with global pharmaceutical companies and also has strong partnerships with research bodies including the Francis Crick Institute.



GTN, a female-led company, has developed technology called Generative Tensorial Networks. It combines and builds upon techniques from machine learning and quantum physics to simulate, filter and discover new molecules. The company says this will help bring efficiencies to the drug development cycle, discovering much-needed medicines for patients with cancer, autoimmune and infectious diseases.

GTN uniquely combines multiple scientific disciplines, including quantum physics, biochemistry and deep learning to revolutionise medicine discovery. GTN is currently recruiting for a number of roles within the Machine Learning, Computational Chemistry and Drug Discovery fields.

Cofounder and CEO Professor Noor Shaker commented on the funding round in a statement that “interdisciplinary solutions are key to solving some of the most fundamental challenges in one of the world’s most important and commercially valuable targets for scientific R&D.”

Source: <https://www.uktech.news/news/drug-discovery-startup-gtn-lands-2-1m-seed-from-octopus-ventures-20180504>

Investment round Q2 2018 / Celsius Therapeutics

In **May 2018 Celsius Therapeutics**, a company translating single-cell genomic insights into precision therapeutics for autoimmune diseases and cancer, launched with a **\$65 million** Series A financing led by Third Rock Ventures with participation from GV (formerly Google Ventures), Heritage Provider Network, Casdin Capital, Alexandria Venture Investments and other key investors. Celsius is charting a new course of target and drug discovery by understanding the specific cells, among many others, that are key players in disease and by identifying the genes that are triggering their malfunction.



For the first time, with the approaches discovered by Aviv and Celsius' other founders, the company will combine massive datasets of unprecedented size and complexity with sophisticated machine learning algorithms. Celsius will be able to distinguish the specific cells, among many others, that play a key role in disease and identify the genes that are triggering their malfunction. This approach will allow the company to more efficiently identify specific targets for treating diseases in specific patients and ultimately develop medicines for those targets.

Celsius' fundamentally new approach aims to combine the power of single-cell genomic sequencing with computational algorithms to discover first-in-class precision therapies that have a transformative impact on the lives of patients with autoimmune diseases and cancer. To do this, the company applies a systematic approach, starting with single-cell sequencing on defined patient samples to identify and understand the individual cells and their interactions that cause disease. By analyzing single cells, Celsius' approach has the potential to understand the causes of disease at an entirely new level of resolution that overcomes limitations of traditional genomic sequencing approaches. Celsius believes this approach could be the key to bring precision medicines to autoimmune diseases for the first time.

Celsius has licensed key technologies from the Broad Institute based on the work of Drs Regev and Kuchroo, including non-exclusive licenses to single-cell technologies and an exclusive license to early stage therapeutic programs.

Source: <https://hitconsultant.net/2018/05/16/celsius-therapeutics-funding/>

Investment round Q2 2018 / Datavant

In **April 2018 Datavant**, the leader in helping healthcare organizations safely link their data to improve medical research and patient care, announced that it has acquired Universal Patient Key (UPK), the leading provider of HIPAA-compliant de-identification services for healthcare data. In addition to announcing the acquisition of UPK, Datavant announced as well the completion of a **\$40.5 million** financing round, led by Roivant Sciences and Travis May.



UPK has created a suite of software products that de-identify structured and unstructured health data through HIPAA-compliant methodologies. By using UPK's industry-leading software and services, healthcare stakeholders can securely share patient-level healthcare data while minimizing the risk of unauthorized access and patient re-identification. These services enable the shared use of longitudinal, real-world evidence to further medical research, improve health outcomes, and reduce the cost of delivering care, while at the same time protecting the anonymity of individual patients. Datavant helps data owners manage the privacy, security, compliance, and trust required to enable safe data sharing.

Datavant is a San Francisco-based company dedicated to organizing the world's healthcare data. Datavant helps data owners manage the privacy, security, compliance, and trust required to enable safe data sharing. Datavant's vision is backed by Roivant Sciences, SoftBank Vision Fund, and Founders Fund.

Datavant organizes and structures the world's healthcare data for use in clinical trial decision making. Datavant combines patient level clinical trial and real world evidence to help pharma companies improve the design and interpretation of clinical trials.

Sources: <https://www.prnewswire.com/news-releases/datavant-acquires-universal-patient-key-and-closes-40m-financing-round-300638719.html>

Investment round Q2 2018 / OWKIN

OWKIN announced in **May 2018** that it adds **\$5 million** to its Series A to build the first data-driven machine learning platform for medical research. OWKIN is a machine learning platform for medical research. The company hopes that its predictive analysis platform will enable doctors to effectively understand patient and tumor heterogeneity. After Owkin picked up \$11 million in January, this new raise brings the company's Series A funding to \$16 million and its total funding to \$18.1 million.



OWKIN Socrates is the first data-driven machine learning platform for medical research. It is designed to augment medical researchers' skills and recapture the excitement of research and exploration. Socrates will help researchers in academia, hospitals and the pharmaceutical industry. The platform is smart and will allow researchers to become machine teachers, without needing to understand the mathematics behind the scene. The platform learns while the researchers discover, improving its global, collective intelligence. The underlying machine learning technology is a unique integration of models built upon medical images, genomics and clinical data, allowing for the discovery of biomarkers and mechanisms associated with diseases and treatment outcomes.

Owkin uses artificial intelligence and machine learning to organize, validate, predict, and compare information. It then builds mathematical models and algorithms to interpret biostatistics data and patient profiles. Owkin aims to help the companies find biomarker patterns, design drugs, predict drug responses to design precision clinical trials, and help the right medication get to the target demographic.

The company will use the new funding to continue the development of Socrates, strengthen strategic partnerships, and support internal growth.

Sources:

<http://www.alleywatch.com/2018/05/owkin-adds-another-4-9m-to-its-series-a-to-build-the-first-data-driven-machine-learning-platform-for-medical-research/>
<https://www.mobihealthnews.com/content/alphabets-qv-invests-5-million-ai-startup-owkin>

Investment round Q2 2018 / ThoughtSpot

On **8th May 2018** **ThoughtSpot**, the leader in search and AI-driven analytics for the enterprise, announced it has successfully closed **\$145 million** in Series D funding. The funding was oversubscribed with strong participation from both existing as well as new investors. ThoughtSpot connects with any on-premise, cloud, big data, or desktop data source, deploying 85 percent faster than legacy technologies.



Since its founding in 2012, ThoughtSpot has raised \$306 million in total funding. With the new funding, ThoughtSpot will continue to innovate its next-generation analytics platform, accelerate global business growth, including expansion in EMEA and APAC, and grow its R&D centers in Palo Alto, Seattle, Dallas, and Bangalore. With ThoughtSpot, business leaders and frontline workers alike have made more than 3 million data informed decisions per year. With ThoughtSpot's next-generation analytics platform, business people can use Google-like search to easily analyze complex, large-scale enterprise data and get trusted insights to questions they didn't know to ask, automatically - all with a single click.

The company's record breaking year and notable market accolades, including being named a Visionary in the Gartner Magic Quadrant for Analytics & Business Intelligence, the #1 Best Big Data Company & CEO to Work for by Glassdoor, and a Top Company: Startup by LinkedIn, demonstrate global recognition for the company's solution.

In 2017, the company opened two new R&D centers, while substantially bolstering its presence in Palo Alto, where the company is headquartered. ThoughtSpot has opened an office in Bangalore, India, to innovate business intelligence in the cloud; as part of this effort, the company invested \$10M in the region. The second R&D center opened in Seattle to build artificial intelligence solutions, including the company's recently released AI-driven analytics engine, SpotIQ. The third center opened in Dallas, and will support enterprise expansion. The new funding will enable ThoughtSpot to continue to invest heavily in these engineering centers and fuel the company's ability to disrupt the analytics market.

Source: <https://www.businesswire.com/news/home/20180508006250/en/ThoughtSpot-Raises-145M-Oversubscribed-Series-Funding-Enterprise>

Investment round Q2 2018 / Recursion Pharmaceuticals

On **5th June 2018** Square 1 Bank, a division of Pacific Western Bank, announced that it has provided a **\$20.5 million** credit facility to existing client **Recursion Pharmaceuticals**, an innovative biotechnology company specializing in artificial intelligence enabled drug discovery. Recursion combines experimental biology and bioinformatics with artificial intelligence in a massively parallel system to quickly and efficiently identify treatments for any disease which can be modeled at the cellular level. Recursion is backed by several leading investors including Lux Capital, Data Collective Venture Capital, Mubadala Investment Company, and Obvious Ventures.



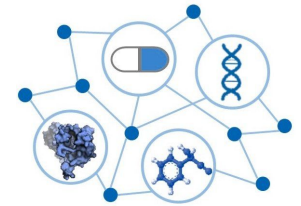
Recursion's ultimate vision is to leverage technology to build a robust and reliable map of human cellular biology, which would enable a radical shift in the pace and scale at which new treatments could benefit patients. By applying advanced machine learning algorithms to a rapidly-growing dataset of more than one petabyte of relatable biological images, the company is able to discover new chemical entities, predict mechanisms of action, reveal previously undiscovered biology, and map compounds to any disease that can be modeled in human cells.

Using a parallel approach and leveraging the speed of automation and the power of machine learning, Recursion aims to bring treatments to the clinic much faster and at a lower cost than previously possible. With Square 1's non-dilutive funding option, Recursion Pharmaceuticals is able to expand its platform to enable target discovery and new chemical entity discovery as well as identify potential treatments in new indication areas like inflammation, immuno-oncology, infectious disease, and aging. These initiatives support its ambitious goal of finding 100 new treatments by 2025.

Source: <https://www.streetinsider.com/Press+Releases/Square+1+Bank+Announces+Credit+Facility+to+Recursion+Pharmaceuticals/14273213.html>

Investment round Q2 2018 / ReviveMed

On **18th April 2018 ReviveMed Inc.** announced it has closed an oversubscribed seed round of **\$1.5 million** to advance its artificial intelligence (AI)-driven platform that unlocks the value of metabolomics data for drug discovery and development. Rivas Capital led the round, which also included participation from several institutional investors including TechU, Team Builder Ventures, and WorldQuant Ventures. ReviveMed is a pioneer in the intersection of artificial intelligence and metabolomics.



ReviveMed's platform consists of a proprietary AI algorithm which utilizes a comprehensive knowledge-based graphical database of metabolites to understand their interactions with proteins and their associations with diseases. ReviveMed can specifically discover molecular mechanisms leading to a disease from tissues and biofluid metabolites. Using this platform ReviveMed has the potential to enable the discovery of drugs, and simultaneously find the biomarkers that identify exactly which patients will benefit from the drug.

The financing will allow the company to continue scaling the platform and begin building its internal drug discovery pipeline. ReviveMed's initial internal discovery program is in metabolic diseases and focused specifically on non-alcohol fatty liver disease (NASH).

ReviveMed is a pioneer in the intersection of artificial intelligence and metabolomics. ReviveMed uniquely overcomes the difficulties of identifying a large set of metabolites for each patient, based on technology developed at The Fraenkel Lab at MIT and published in Nature Methods. It further translates metabolomic data into novel therapeutic insights for drug and drug response biomarker discovery. Currently, ReviveMed is collaborating with tier-one pharmaceutical companies to support their drug discovery programs and in pursuing internal drug discovery, initially focused on metabolic diseases.

Sources: <http://www.revive-med.com/2018/04/18/seed-fund-press-release/>

Investment round Q2 2018 / Insilico Medicine

On **11th June 2018 Insilico Medicine**, a Baltimore-based next-generation artificial intelligence company specialized in the application of deep learning for target identification, drug discovery and aging research, announced the completion of a strategic round of funding led by WuXi AppTec's Corporate Venture Fund. The strategic investment was conditional upon the successful experimental validation of Insilico Medicine's Generative Adversarial Networks (GAN) and Reinforcement Learning (RL)-based drug discovery pipeline and is intended to closely integrate Insilico Medicine's cutting-edge artificial intelligence technology with WuXi AppTec's laboratory infrastructure and expertise in drug discovery.



The round was led by WuXi AppTec's Corporate Venture Fund and includes Pavilion Capital, a subsidiary of Temasek Holdings, BOLD Capital Partners, the venture capital fund investing in exponential technologies co-founded by Peter Diamandis, and Juvenescence. The transaction has been a joint effort between WuXi AppTec's Corporate Venture Fund and WuXi AppTec's Research Services Division, which has been focused on investing in and collaborating with highly-disruptive technologies and companies globally.

The funding is intended to enhance Insilico Medicine's work in the innovative approaches to the generation of novel molecules using a variety of machine learning and deep learning techniques, as well as to expand a variety of the biomarker discovery initiatives.

Insilico Medicine is an artificial intelligence company headquartered at the Emerging Technology Centers at the Johns Hopkins University Eastern campus in Baltimore, with R&D and management resources in Belgium, Russia, UK, Taiwan and Korea sourced through hackathons and competitions. The company and its scientists is dedicated to extending human productive longevity and transforming every step of the drug discovery and drug development process through excellence in biomarker discovery, drug development, digital medicine and aging research.

Source:

<https://www.prnewswire.com/news-releases/wuxi-apptec-leads-strategic-investment-in-insilico-medicine-to-accelerate-drug-discovery-using-next-generation-artificial-intelligence-300663758.html>

M&A Deals Q2 2018

In May 2018, **Boehringer Ingelheim** announced a partnership with **Bactevo** to use its Totally Integrated Medicines Engine platform to identify novel small molecule lead compounds. Enabled by advance machine learning, Bactevo claims that its Totally Integrated Medicines Engine platform (TIME) will be able to bring about a paradigm shift in the speed, efficiency and quality of drug discovery, as well as dramatically enhanced safety profiling. In addition to working with partners to develop novel first-in-class medicines, Bactevo is also developing breakthrough medicines for the treatment of diseases that involve defects in mitochondrial function, such as MELAS and LHON. It is also targeting diseases of the central nervous system, such as Parkinson's, Alzheimer's and Amyotrophic Lateral Sclerosis (ALS). Bactevo will receive upfront payments and research funding, although that specific amount was not disclosed. The tech group could also be eligible to receive payments for certain research, development and commercialisation milestones.

On 30th May 2018, **GlaxoSmithKline** (GSK) announced a partnership to use AI for the design of novel small-molecule drugs with **Cloud Pharmaceuticals**. Cloud Pharmaceuticals will design novel small-molecule agents to GSK specified targets. Cloud Pharmaceuticals will use its proprietary AI-driven process to design the molecules. Cloud Pharmaceuticals is a leader in the computational design of new drugs and subsequent rapid, information-driven drug development. It accelerates the drug discovery and design process in a way that delivers tangible results and true value for its partners.

In March 2018, **Mitsubishi Tanabe Pharma** partnered with **Hitachi** to optimize clinical trial planning with AI. Mitsubishi Tanabe Pharma will apply Hitachi's digital technology such as artificial intelligence to make clinical trials more efficient. The partnership focuses on cutting the time spent on searching and collecting information from medical papers and ClinicalTrials.gov in the planning stage of clinical trials. A test run since the idea's inception in 2017 has confirmed that the approach can shorten the time spent on information search and collection by about 70%.

Sources: http://www.pmlive.com/blogs/digital_intelligence/archive/2018/may/boehringer_partners_with_bactevo_on_drug_discovery_1235384
<https://www.businesswire.com/news/home/20180530006184/en/Cloud-Pharmaceuticals-forms-Drug-Design-Collaboration-GSK>
<https://www.fiercebiotech.com/cro/mitsubishi-tanabe-hitachi-join-forces-ai-enabled-clinical-trials>

M&A Deals Q2 2018

In May 2018 **Pfizer** announced a partnership with **XtalPi** to combine quantum mechanics and machine learning to predict the properties of drugs. Pfizer and XtalPi are collaborating in crystal structure prediction and screening—using computer models to determine the potential molecular stability of an organic compound—and are looking to advance their work in drug design and solid-form selection. XtalPi's algorithms are supported by cloud computing, employing an elastic cluster of servers across AWS, Tencent Cloud, Google Cloud and Alibaba Cloud that can deploy up to 1 million cores in seconds.

In April 2018 **Wave Life Sciences** and **Deep Genomics** announced their collaboration to discover novel therapies for genetic neuromuscular disorders. Under the collaboration, the companies will analyze and test oligonucleotides against potential therapeutic targets within multiple genes implicated in neuromuscular disorders. The analysis will use Deep Genomics' machine learning platform to identify cause and effect relationships specific to neuromuscular-related targets that involve splicing regulation. Wave's propriety chemistry platform will be used to validate targets and elucidate the implications of target intervention across different phenotypes, with the goal of expanding Wave's pipeline of rationally designed oligonucleotides. The collaboration was built on Wave's ongoing research and development in splice correction programs, including its lead DMD program, WVE-210201, an investigational therapy targeting exon 51 currently in a global Phase 1 clinical trial. Wave's next DMD program, targeting exon 53, is expected to initiate clinical trials in Q1 2019.

Sources: <https://www.fiercebiotech.com/cro/pfizer-launches-new-collaboration-xtalpi-for-ai-drug-modeling>
<https://globenewswire.com/news-release/2018/04/10/1467697/0/en/Wave-Life-Sciences-and-Deep-Genomics-Form-Collaboration-to-Discover-Novel-Therapies-for-Genetic-Neuromuscular-Disorders.html>