AI

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

Comparative Industry Analysis and Classification Framework

1 May 2019

DEEP KNOWLEDGE ANALYTICS
PHARMA DIVISION

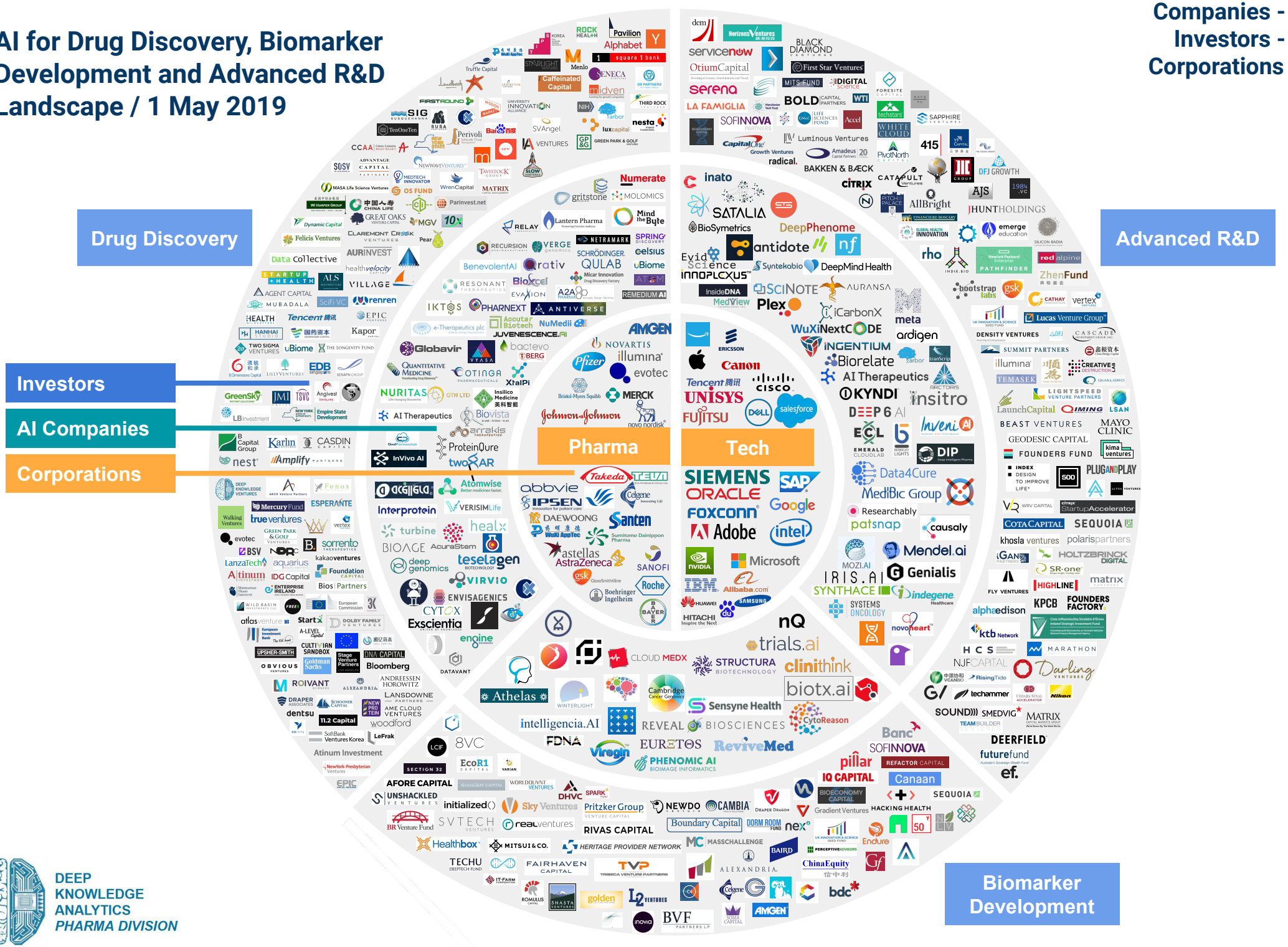
www.ai-pharma.dka.global

AI for Drug Discovery, Biomarker Development and Advanced R&D 1 May 2019

Comparative Industry Analysis & Classification Framework
Comparison of 25 Leading AI for Drug Discovery Companies

AI for Drug Discovery, Biomarker Development and Advanced R&D Landscape / 1 May 2019

Companies - 150
Investors - 350
Corporations - 50



Diversification of AI for R&D and Drug Discovery Process
1 May 2019

Companies - 150
Investors - 350

Companies

Investors

Design Preclinical Experiments

EURETOS

AFORE CAPITAL
golden
inovia
Healthbox
Boundary Capital
LCIF
IQ CAPITAL
Gradient Ventures

Preclinical Experiment Execution

novoheart
BERKELEY LIGHTS
ECL EMERALD CLOUDLAB
SYNTHACE
SOFINNOVA PARTNERS
ktb
varian
BIOECONOMY CAPITAL
Nikon
UK INNOVATION & SCIENCE SEED FUND
ROCK HEALTH
BLACK DIAMOND
HOLTZBRINCK DIGITAL
Luminous Ventures
COTA CAPITAL

Data Aggregation & Analysis

InsideDNA
SATALIA
DeepPhenome
INGENTIUM
biotx.ai
intelligencia.AI
DIP
Genialis
meta
iCarbonX
Inveni AI
Data4Cure
MedView
MOZI.AI
WuXiNextCODE
Researchably
ardigen
insitro
BioSymetrics
SCINOTE
MedBic Group
Evid Science
Accutar Biotech
patsnap
Biorelate
INNOPLEXUS
causaly
nf
KYNDI
THOUGHTSPOT
IRIS.AI
Plex
500
ef.
techammer
MITS FUND
SAPPHIRE VENTURES
KPCB
鑫根资本
ECL
MATRIX
AllBright
WHITE CLOUD
StartupAccelerator
LIFE SCIENCES FUND
PITCH PALACE
matrix
servicenow
DFJ GROWTH
DIGITAL science
FOUNDERS FUND
FORESITE CAPITAL
MAYO CLINIC
CATHAY
futurefund
DIGITAL science
Endure
NJF
OtiumCapital
rho
GEODESIC CAPITAL
BEAST VENTURES
PLUG AND PLAY
khosla ventures
BAKKEN & BÆCK
polarispartners
PivotNorth CAPITAL
CREATIVE DESTRUCTION
iGAN PARTNERS
UpHonest Capital
LIGHTSPEED VENTURE PARTNERS
kima ventures
Banc
LaunchCapital
illumina
ZhenFund
順為
CITRIX
FOUNDERS FACTORY
PATHFINDER
CapitalOne
HUNTHOLDINGS
HIGHLINE
BOLD CAPITAL PARTNERS
Darling VENTURES
IA VENTURES
DENSITY VENTURES
INDEX
DESIGN TO IMPROVE LIFE
YF CAPITAL
CATAPULT Ventures
vertex
red alpine
QIMING
TEMASEK
SUMMIT PARTNERS
MARATHON
QUALGRO
SR·one
SEQUOIA
EMERGE EDUCATION
First Star Ventures

Drug Design

Syntekabio
arrakis THERAPEUTICS
Micar Innovation
QULAB
ATOM
ANTIVERSE
RELAY THERAPEUTICS
AI Therapeutics
Insilico Medicine 英科智能
DATAVANT
VYASA
gritstone
CYTOX
SCHRÖDINGER
ProteinQure
NETRAMARK
BERG
celsius
EVAXION
A2A PHARMA
arbor
REMEDIUM AI
COTINGA PHARMACEUTICALS
IKTOS
GTN LTD
bactevo
JUVENESCENCE.AI
Globavir
PEPTICOM
Numerate
VERGE genomics
CloudPharmaceuticals
BIOAGE
BenevolentAI
engine BIOLOGICS
SPRING DISCOVERY
uBiome
NuMedii
ENVISAGENICS
RESONANT THERAPEUTICS
Mind the Byte
MOLOMICS
Atomwise
twoXAR
teselagen BIOTECHNOLOGY
VIRVIO
e-Therapeutics plc
Exscientia
XtalPi
QUANTITATIVE MEDICINE
NURITAS
deep genomics
NIH
WuXi AppTec
SUSA
true ventures
ALS
Mercury Fund
FIRSTROUND
SciFi VC
nesta
Tencent 腾讯
Pavilion
CASCADE INVESTMENT GROUP, INC.
DEEP KNOWLEDGE VENTURES
通联和承
DRAPER ASSOCIATES
Pear
MASA Life Science Ventures
Foundation CAPITAL
HANMI
Karlin
VILLAGE
WrenCapital
LB Investment
ENTERPRISE IRELAND
LILLYVENTURES
sorrento THERAPEUTICS
ARAB ANGEL
TWO SIGMA VENTURES
Pelio Collective
SLOW VENTURES
THIRD ROCK VENTURES
ridgeback
DEERFIELD
evotec
LanzaTech
CLAREMONT CREEK VENTURES
B Capital Group
ESPERANTE
Dynamic Capital
Felicis Ventures
SERAPH GROUP
Baidu 百度
W HARPER CAPITAL
MERCK
THE LONGEVITY FUND
risingtide
UPSHER-SMITH
SIG
11.2 Capital
nest
BSV
AME CLOUD VENTURES
DOLBY FAMILY VENTURES
Bloomberg
A-LEVEL Capital
Atinum Investment
atlas venture
LANSDOWNE PARTNERS
ANDREESSEN HOROWITZ
CHINA LIFE 中国人寿
ROIVANT
MGV
SoftBank Ventures Korea
CULTIVIAN SANDBOX
FRAZIER HEALTHCARE PARTNERS
edbi
woodford
SENECA
BVF
CLI
GreenSky
50
IDG Capital
renren
NEW PROTEIN
Y Combinator
Caffeinated Capital
Perivoli
Kapor
NDRC
SVAngel
MUBADALA
Stanford
10x
dentsu
AGENT CAPITAL
Goldman Sachs
STARTCAPITAL
GREAT OAKS VENTURE CAPITAL
MassDevelopment
ALTOS
GP BG
GREEN PARK & GOLF
LeFrak
CASDIN CAPITAL
NEWWAVEVENTURES
Walking Ventures
START UP HEALTH
StartX
OS FUND
Alphabet
SECTION 32
Amplify PARTNERS
DNA CAPITAL
MAVEN
aquarius
uBiome

Clinical Trial Design, Optimization, Recruitment

AURANSA
Sensyne Health
antidote BULLFROG AI
ARCTORIS
indegene Healthcare
DeepMind Health
nQ
WINTERLIGHT
Mendel.ai
REVEAL
clinithink
Athelas
DEEP 6 AI
trials.ai
inato
CLOUD MEDX
UNSHACKLED VENTURES
REFACTOR CAPITAL
realventures
BAIRD
Enzyme
CYTOX
dcm
Gi Global Health Fund LP
Amadeus Capital Partners
20
DORM ROOM FUND
nex
A2A PHARMA
ChinaEquity
bootstrap labs
NEWDO
TVP
TRIBECA VENTURE PARTNERS
SMEDVIG
NLV
L2 VENTURES
HACKING HEALTH
serena
FAIRHAVEN CAPITAL
INDIE.BIO
SEQUOIA
ALEXANDRIA
initialized
PASSION CAPITAL
AMGEN
DHVC
FLY VENTURES
Celgene VC
MITSUI&CO.
3K
CAMBIA
Pritzker Group
HERITAGE PROVIDER NETWORK
WTI
SVTECH VENTURES
KdT Ventures
bdc
pillar
FundersClub
CEDARS SINAI ACCELERATOR
DHVC
tothestars
Sky Ventures
BR Venture Fund
radical.
healthvelocity CAPITAL

Repurposing Existing Drugs

Biovista
Lantern Pharma
Pioneering Precision medicine
healx
BioXcel
RECURSION
Qrativ
AcuraStem
PHARNEXT
NYP
1 square 1 bank
ROCK HEALTH
pillar
ReviveMed
Menlo
Truffle Capital
OBVIOUS VENTURES
TECHU HEALTH WILD CATTERS
AURINVEST
EPIC VENTURES
TSVC
luxcapital
ADVANTAGE CAPITAL TNERS
MUBADALA
SPARK
SENECA
SOMA CAPITAL
Atinum Investment
Bios Partners
WILD BASIN INVESTMENTS LLC
crv
Atinum
LB Investment
KOREA
kakaoventures
GREEN PARK & GOLF VENTURES
Parinvest.net
MATRIX CAPITAL MANAGEMENT

Researching Mechanisms of Disease`

SYSTEMS ONCOLOGY
Cambridge Cancer Genomics
PHENOMIC AI BIOMAGE INFORMATICS
ReviveMed
Virogin
CytoReason
FDNA
STRUCTURA BIOTECHNOLOGY
Sensyne Health
SOFINNOVA PARTNERS
MC
BIOECONOMY CAPITAL
Endure
UK INNOVATION & SCIENCE SEED FUND
SciFi VC
NEWDO
Seedcamp
RIVAS CAPITAL
ROMULUS
WORLDQUANT VENTURES
JMI
PARINVEST
TECHU DEEPTECH FUND
MIT delta v
MC
IT-FARM
RIVA Capital S.A.
Independent Alternative Investment Advisors

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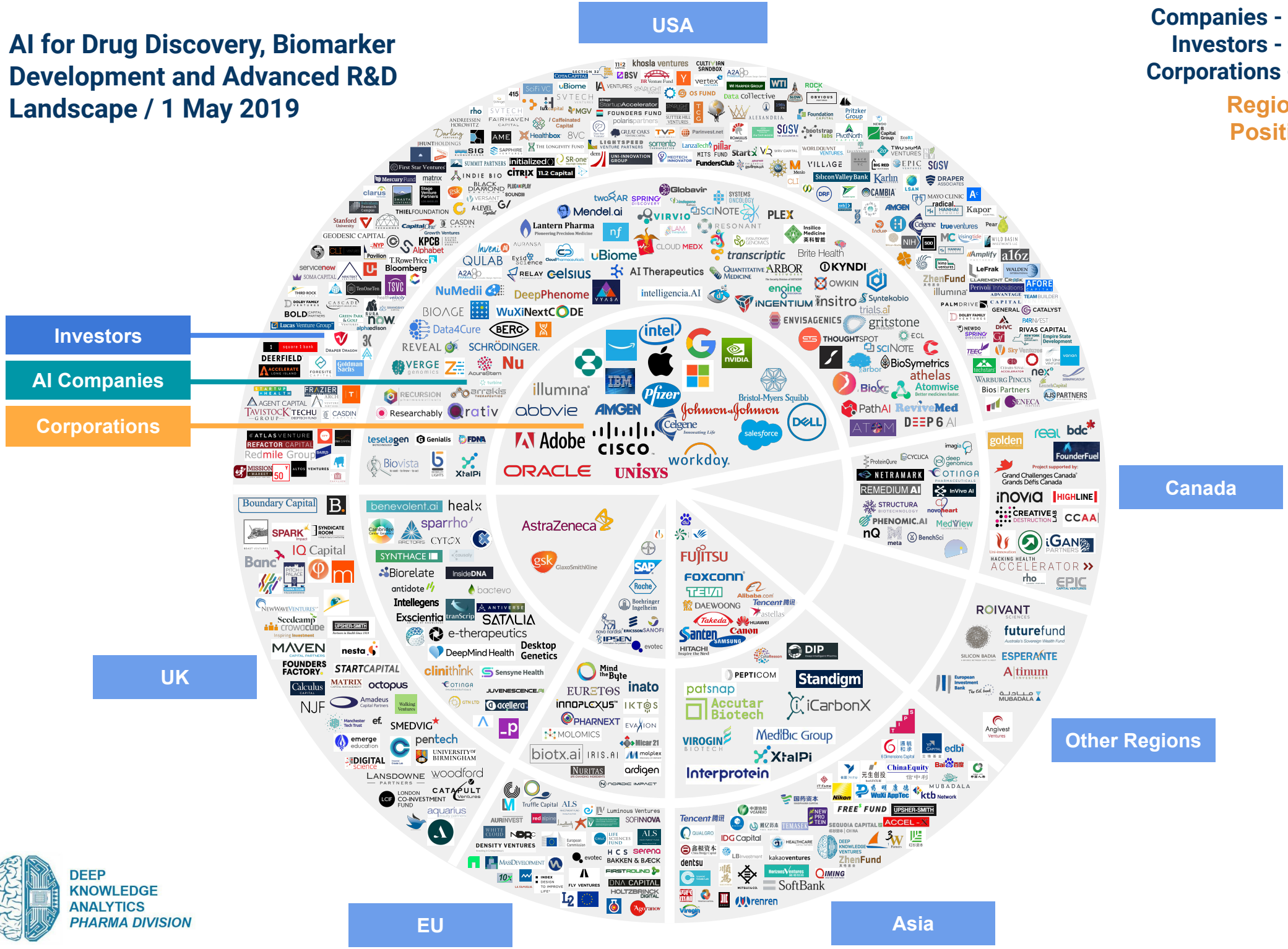
AI for Drug Discovery, Biomarker Development and Advanced R&D Landscape / 1 May 2019

Companies - 150
Investors - 350
Corporations - 50

Regional Position



DEEP KNOWLEDGE ANALYTICS
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Introduction

Comparative Industry Analysis & Classification Framework delivers a comparison of 25 leading AI for Drug Discovery companies according to their number of patents, scientific publications, ratio of AI experts to total number of employees, levels of core AI in R&D, levels of specialized AI expertise (e.g. advanced deep learning vs. basic machine learning), levels of expertise in biology and computational chemistry, partnerships with leading Pharma and Tech corporations, in conjunction with their overall levels of funding and other metrics to deliver tools for a realistic and quantitative comparison of present-day and future value of the companies, which could be used to support more effective due diligence processes.

Funding: by comparing the levels of funding that each company has acquired compared to its level of scientific validation (according to number of patents, publications and ratio of AI experts), it can deliver a sense for the ratio of efficiency of funding compared to the generated technical and scientific IP of each company.

Classification of Combined AI and Biochemistry Expertise: this section classifies each of the top 25 AI-companies according to their use of AI as a core part of their R&D operations, and their levels of expertise in biology and chemistry.

Classification of AI Expertise: this section presents a classification framework that categorizes companies according to major levels of AI asset classes, and applications of specialized Ai-techniques. This framework takes into account the total ratio of AI specialists, the number of separate AI applications, the number of visible AI applications, and whether or not they are utilizing Deep Learning as a part of their products, services or core R&D.

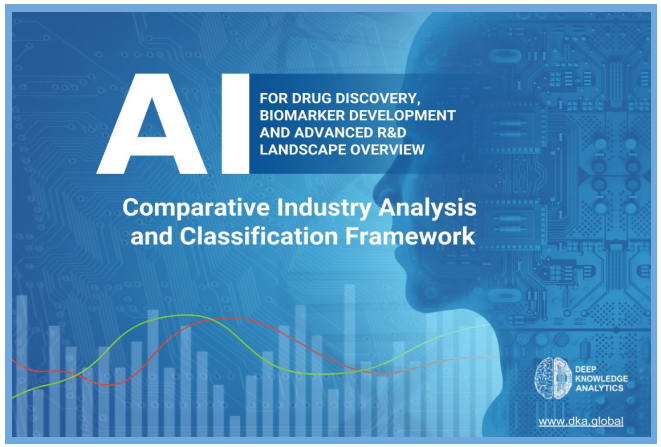
This comparative analysis is an add-on to our 110-page Q1 2019 report released in April 2019, which marked the fourth installment in a series of reports on the topic of the Artificial Intelligence in Drug Discovery Industry that Deep Knowledge Analytics has been producing for more than 2 years now.

The present comparative analysis is for internal purposes only. Its overall goal is to identify the leaders of the industry and to provide a framework for independent and reasonable assessment, and a framework for effective companies comparison. On June 15th 2019, we will release the next edition of this comparative analysis, with an additional number of parameters to extend the accuracy of the tools for evaluation of investment targets.

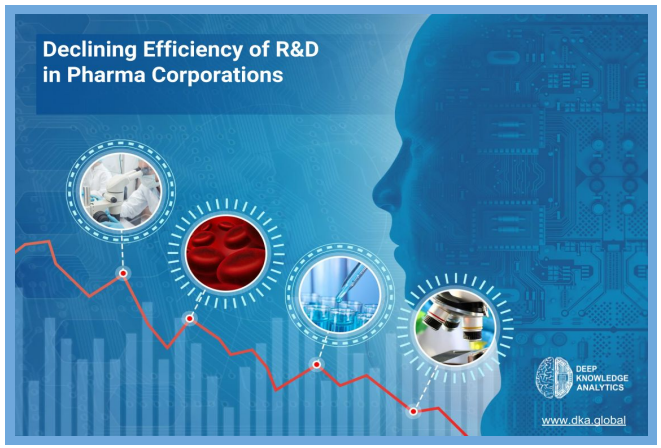
Proprietary Analytics by Deep Knowledge Analytics Pharma Division

www.ai-pharma.dka.global

Published / Q1 2019



Comparative Industry Analysis & Classification Framework



Declining Efficiency of R&D in Pharma Corporations

Upcoming / Q2 2019

Pharma AI Stock Index

Top Analysts AI in Pharma

Top-20 AI in Drug Discovery Investors

Enhanced Analysis of Most Promising AI-companies as the Best Investment Targets for AI-Pharma Index Hedge Fund

25 Leading Companies in AI for Drug Discovery Sector

1	Ardigen
2	Atomwise
3	Benevolent.AI
4	Biovista
5	C4X discovery
6	Cyclica
7	CytoReason
8	Deep Genomics
9	DeepMind Health
10	e-Therapeutics
11	Exscientia
12	GNS Healthcare
13	iCarbonX
14	Insilico Medicine
15	Insitro
16	Lantern Pharma
17	Numerate
18	Nuritas
19	PathAI
20	Recursion Pharmaceuticals
21	Schrödinger
22	twoXAR
23	Vyasa Analytics
24	WuXi NextCODE
25	XtalPi

20 Leading Investors in AI for Drug Discovery Sector

1	500 startups
2	Amadeus Capital Partners
3	AME Cloud Ventures
4	Amgen ventures
5	Andreessen Horowitz
6	Data Collective DCVC
7	Draper associates
8	Felicis ventures
9	General catalyst
10	GV
11	Khosla Ventures
12	OS Fund
13	Refactor Capital
14	Sequoia Capital
15	SOSV
16	StartX (Stanford-StartX Fund)
17	Tencent Holdings
18	WuXi AppTec
19	Y combinator
20	ZhenFund

Comparative Analysis of Top-25 AI Companies

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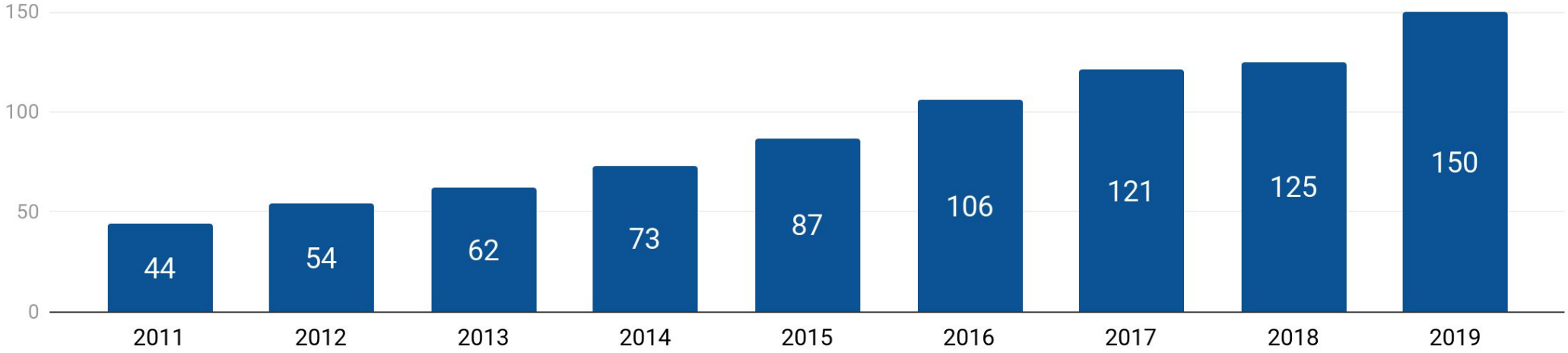
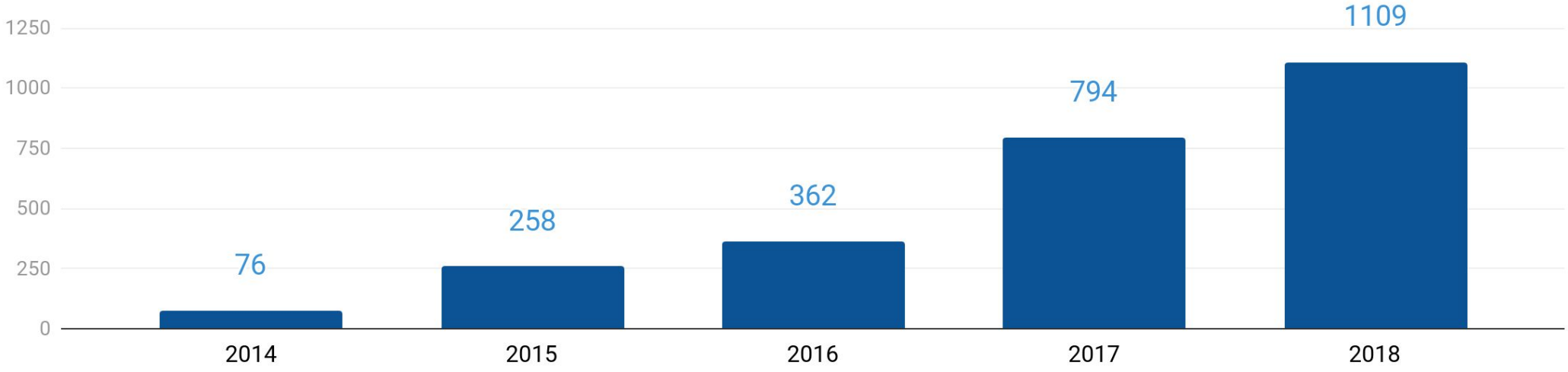
Amount of AI for Drug Discovery Companies
Amount of Investments in AI for Drug Discovery Companies

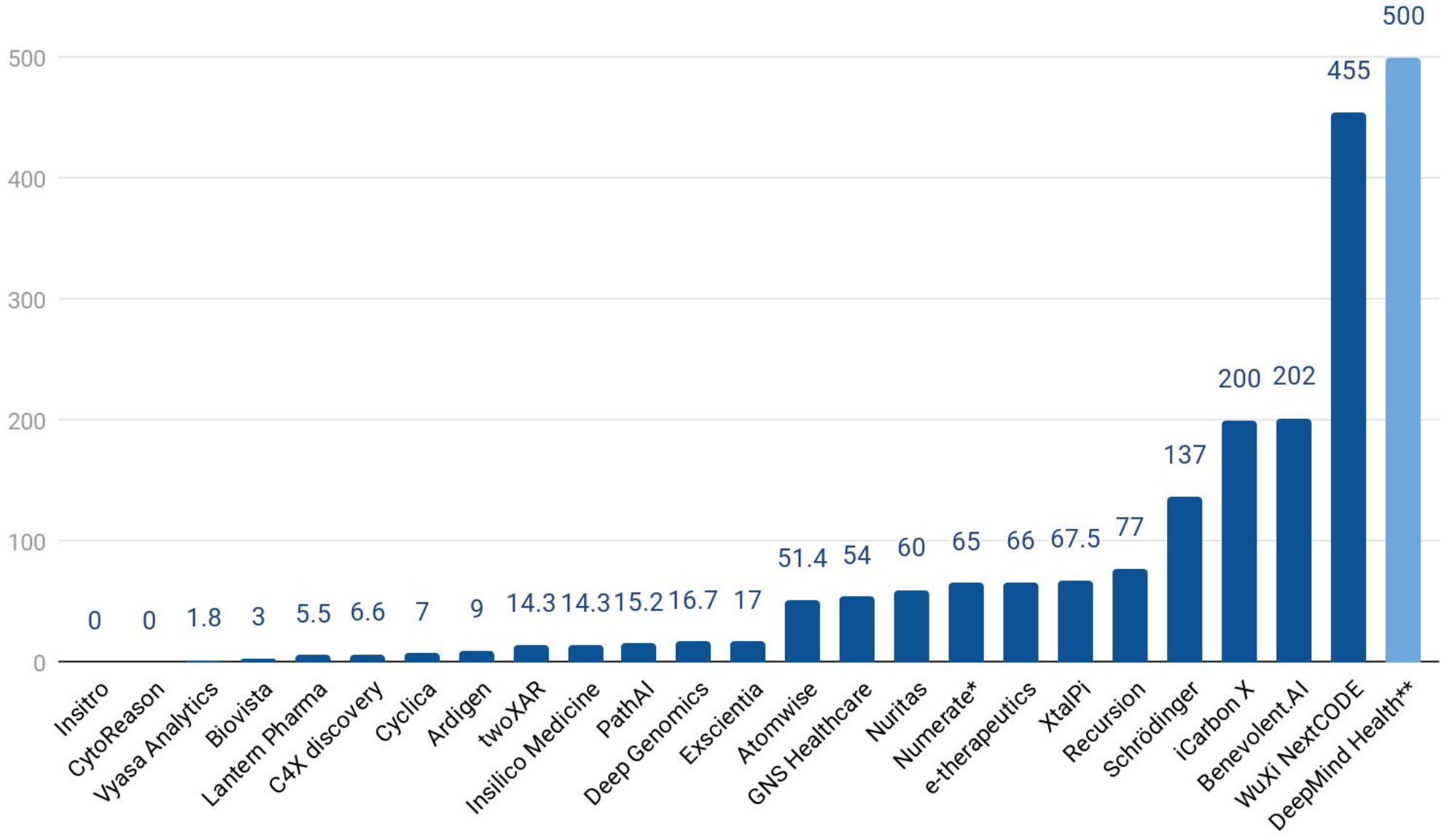
Number of AI Companies in Drug Discovery Sector



Amount of Investments in AI for Drug Discovery Companies (in millions USD) per Year

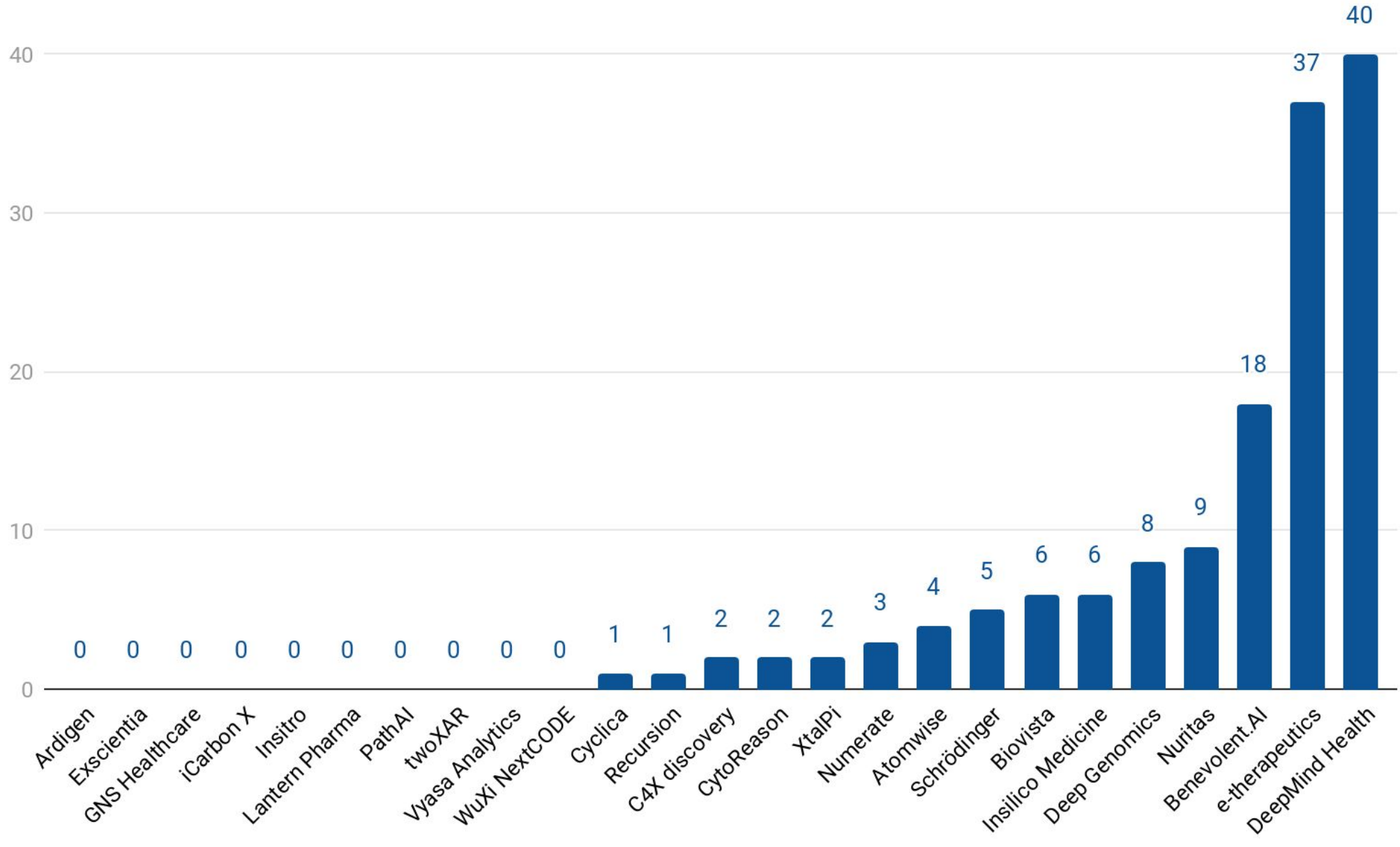


Funding, in millions USD

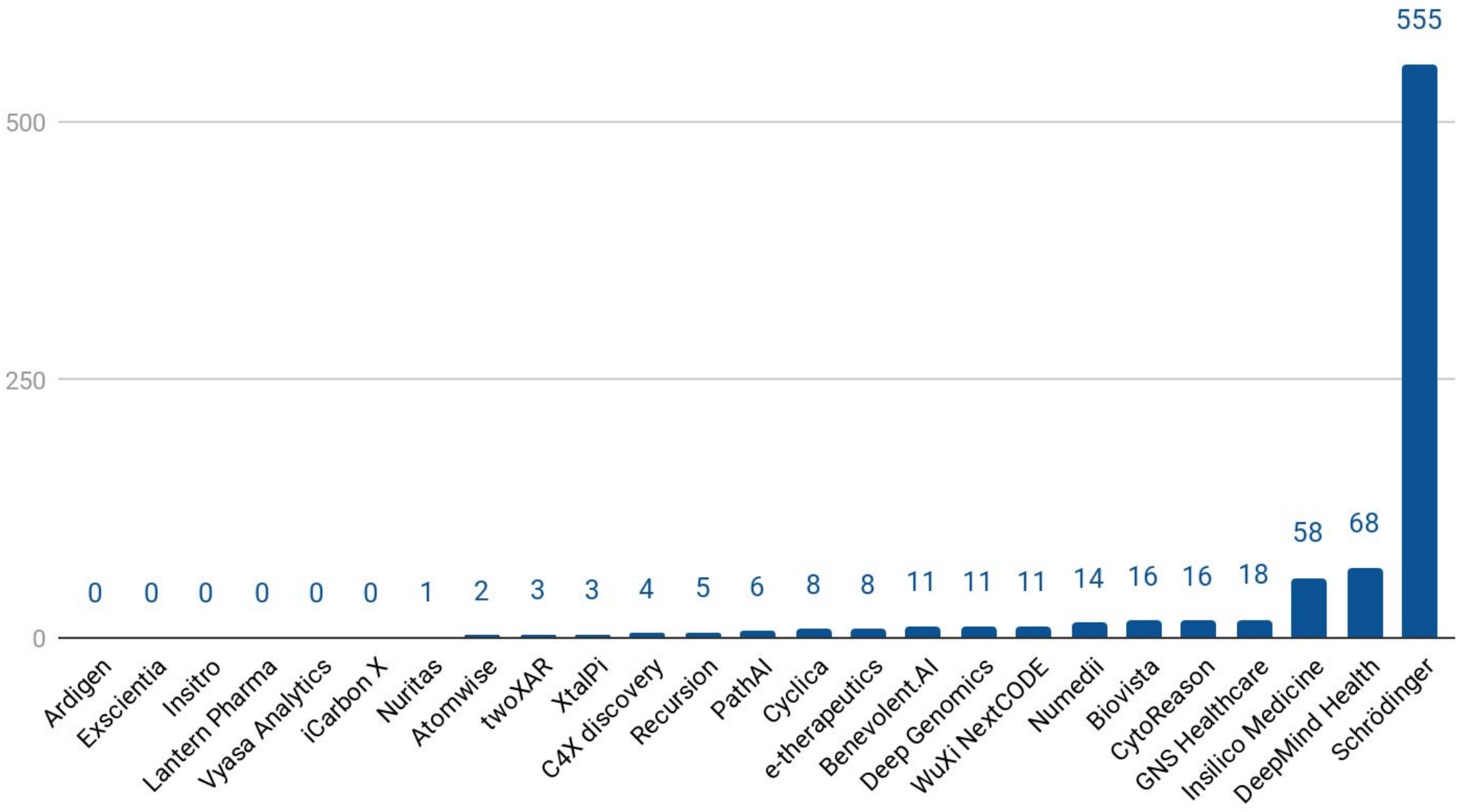


*** - approximate**
**** - DeepMind Funding Combined**

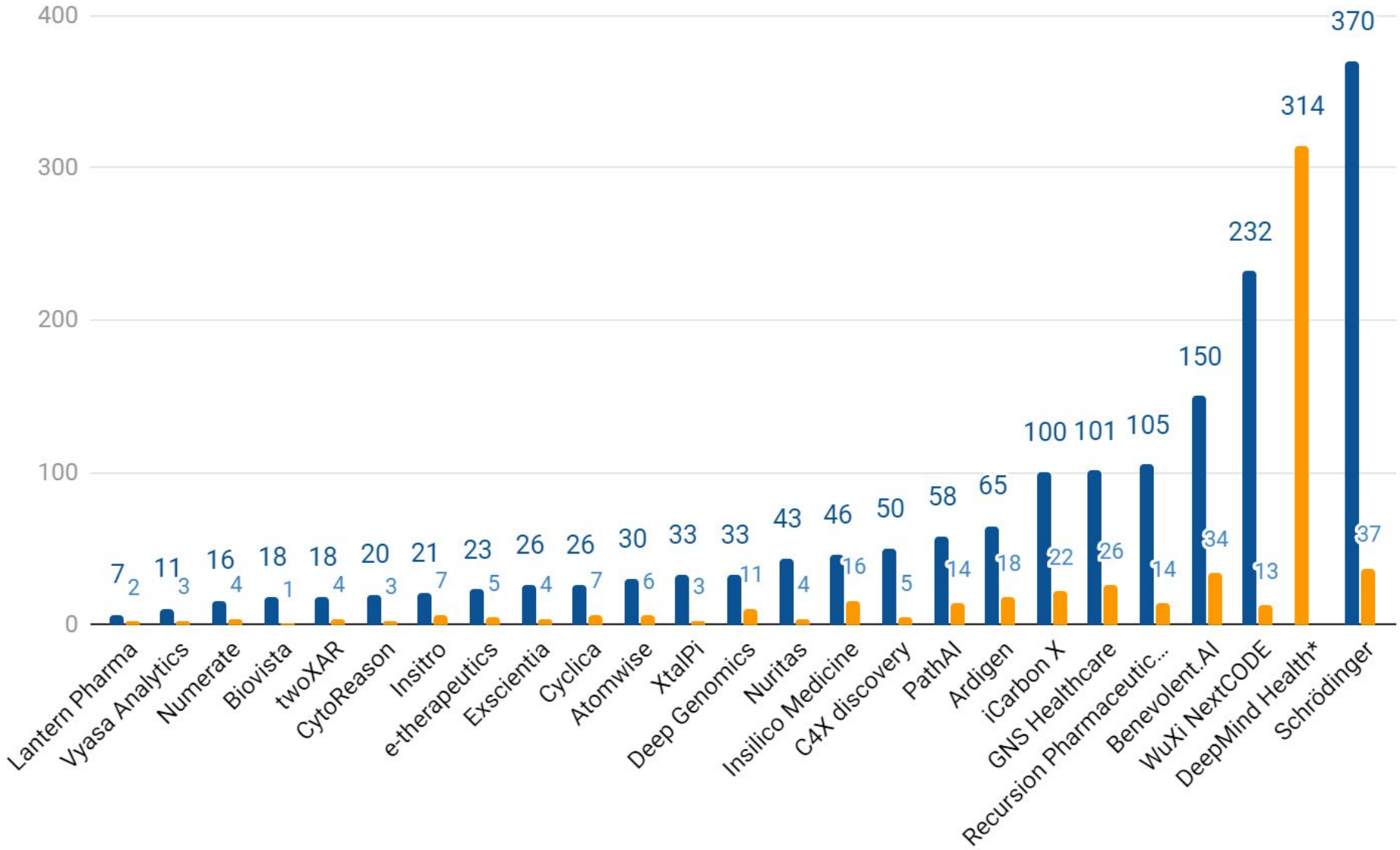
Number of Patents



Number of Scientific Publications

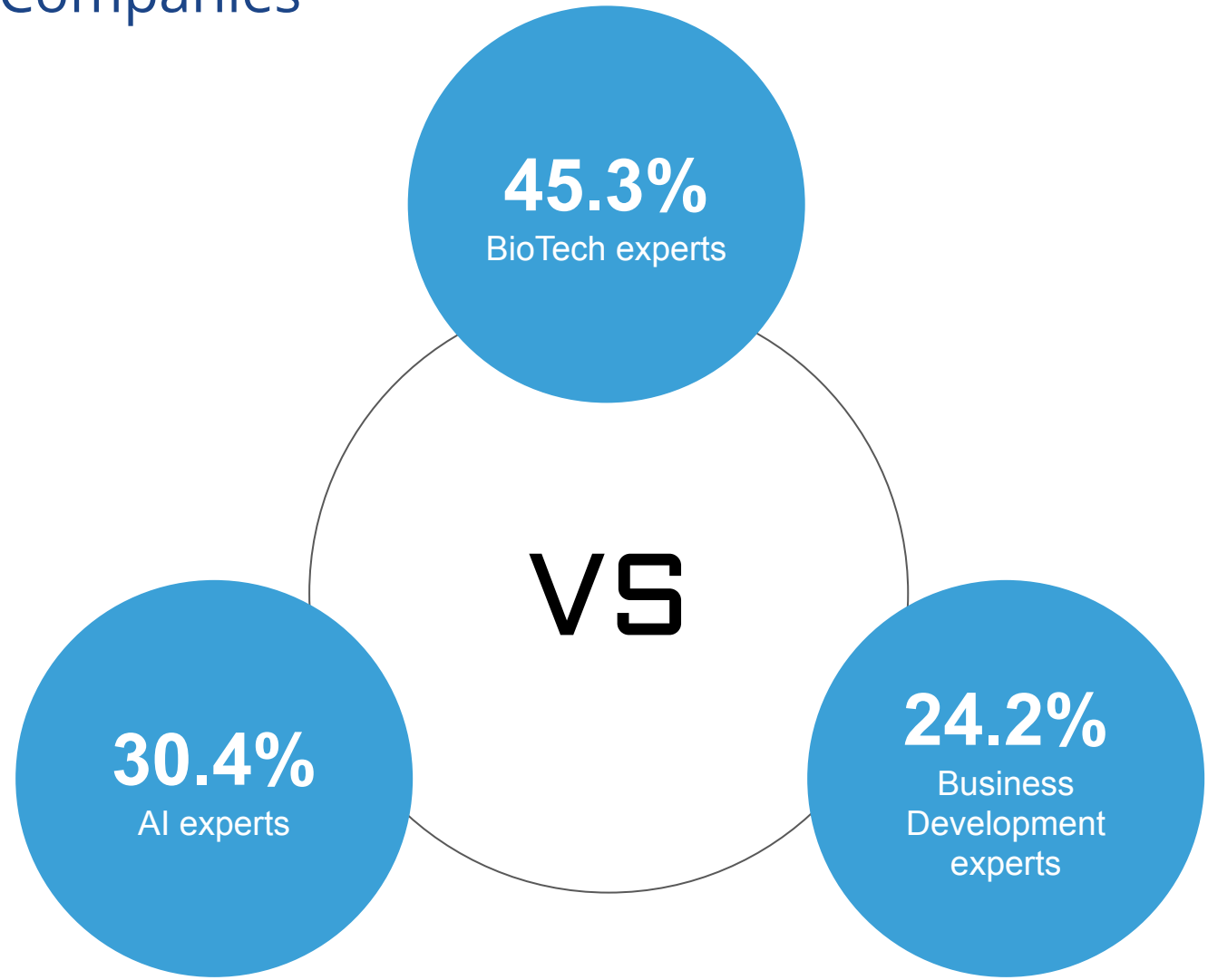


Total Number of Employees vs Number of AI experts



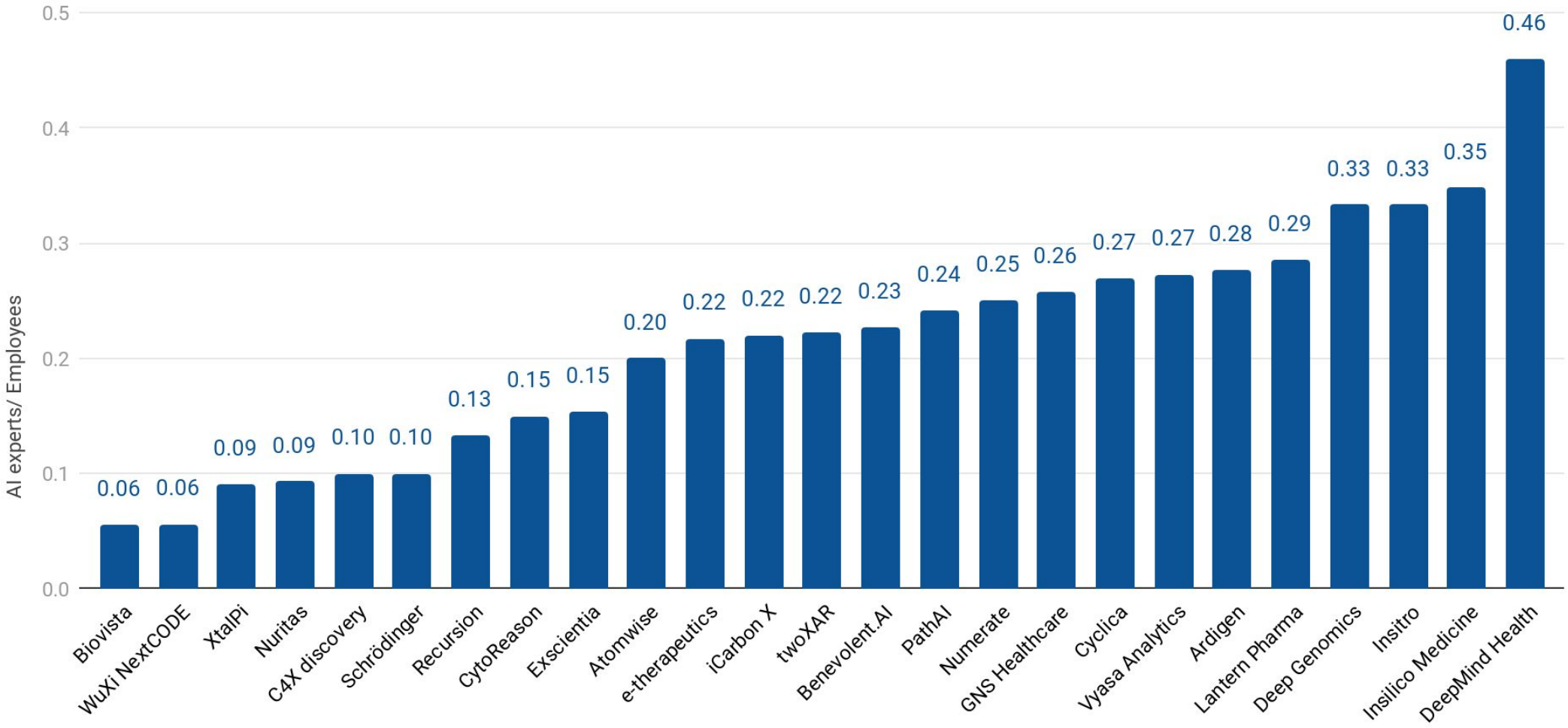
*** - information about DeepMind Health is missing**

AI experts vs BioTech experts vs Business Development experts In Top-25 AI-Companies

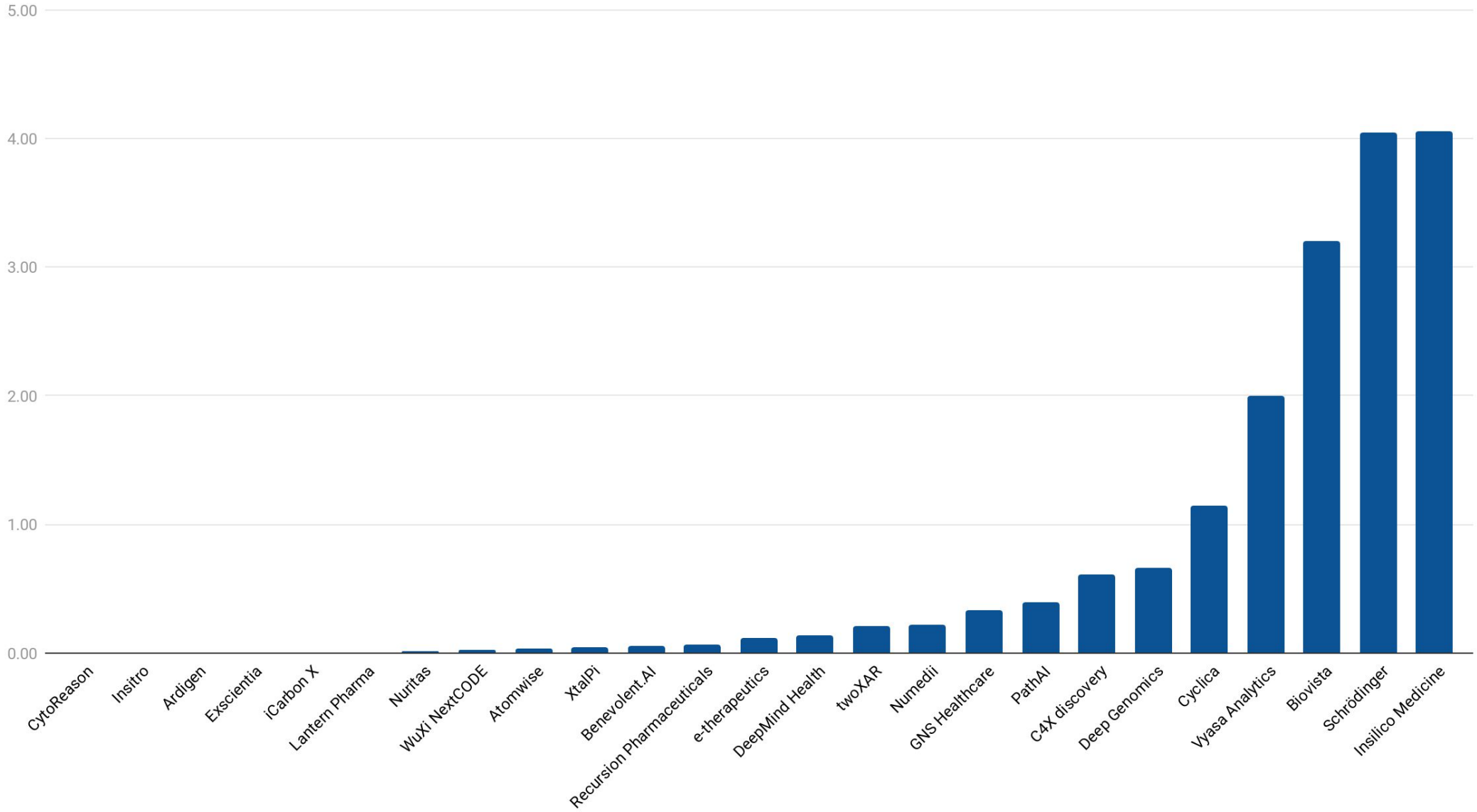


Most of the 150 AI-companies operating in the AI for Drug Discovery space on average have 15% of the stuff which can be considered as AI-experts. In the case of leading 25 AI-companies this bar raises up to 30% of the total amount of stuff. We might consider that the most balanced companies should be proportioned as 33% - AI experts, 45% Biotech experts, 24% - Business development specialists.

True AI companies The Ratio: AI experts vs Total Number of Employees



Ratio of Scientific IP vs Funding



Comparison of Top-25 AI Companies: Level of Scientific Validation

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
Ardigen	-	18/65	+	N/A
Atomwise	+	6/30	+	N/A
Benevolent.AI	+	34/150	+	N/A
Biovista	+	1/18	+	+
C4X discovery	-	5/50	+	+
Cyclica	-	7/26	+	+
CytoReason	+	3/20	+	+
Deep Genomics	+	11/33	-	N/A
DeepMind Health	+	314/683	+	N/A
e-Therapeutics	+	5/23	+	N/A
Exscientia	+	4/26	+	+
GNS Healthcare	+	26/101	-	N/A
iCarbonX	-	22/100	+	N/A

Comparison of Top-25 AI Companies: Level of Scientific Validation

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
Insilico Medicine	+	16/46	+	+
Insitro	-	7/21	+	-
Lantern Pharma	-	2/7	+	+
Numerate	-	4/16	+	+
Nuritas	-	4/43	+	+
PathAI	+	58/25	+	+
Recursion Pharmaceuticals	+	14/105	+	+
Schrödinger	+	37/370	+	-
twoXAR	+	4/18	+	+
Vyasa Analytics	-	3/11	+	-
WuXi NextCODE	+	13/232	+	+
XtalPi	-	3/33	+	-

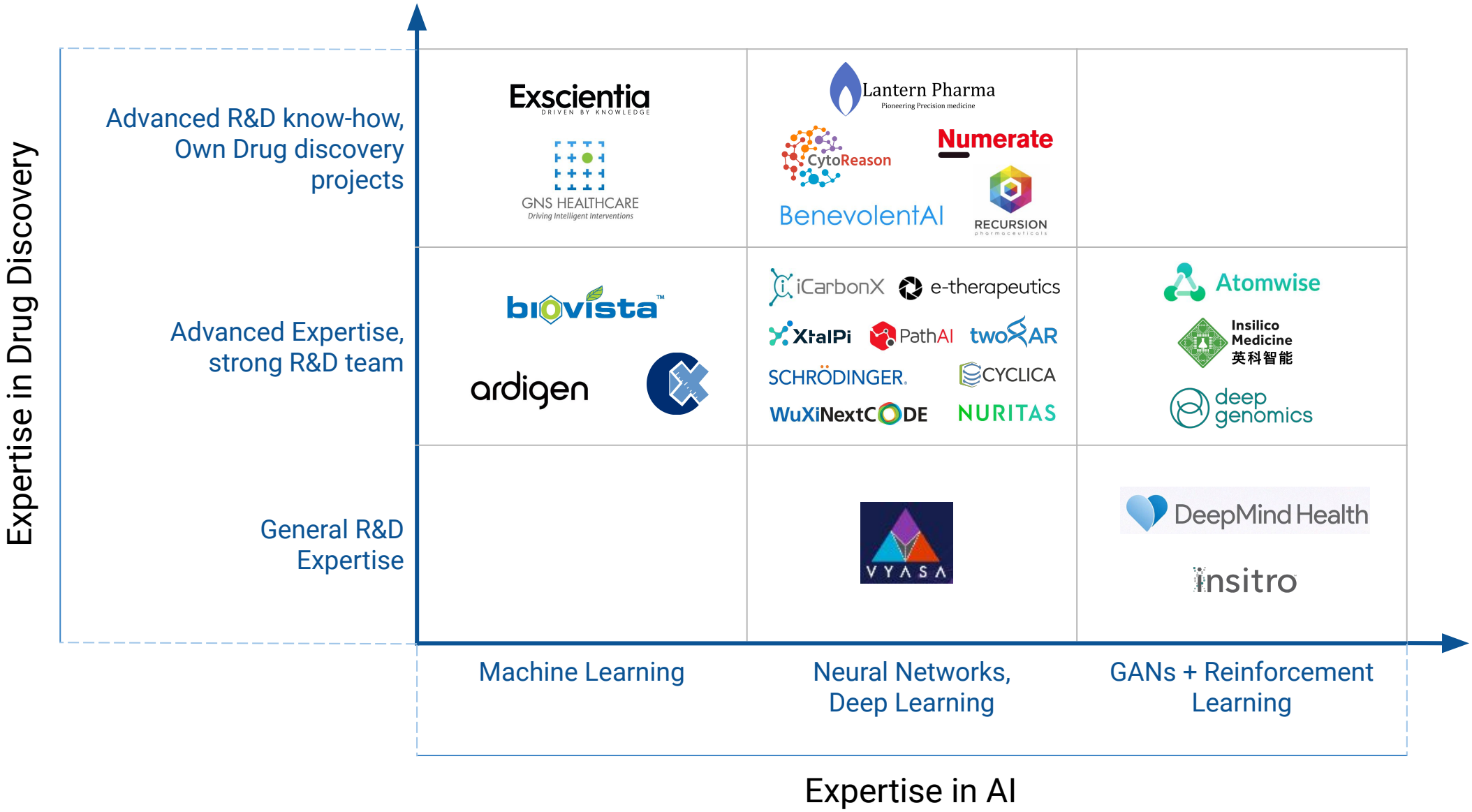
Comparison of Top-25 AI Companies by AI-Techniques

COMPANIES	COMPUTATION METHOD	DATA TYPE
Ardigen	AI	Metagenomics data, exome sequencing data, omics, immunology data
Atomwise	DL	Chemical notations, QSAR
BenevolentAI	ML, DL, symbolic AI	Text, images, EHRs, omics
Biovista	ML	Correlations between drugs, molecular targets, pathways, adverse events and diseases
C4X discovery	ML	Chemical space and novel small molecules
Cyclica	ML, DL	Chemical notations, genomic
CytoReason	Big Data	Cellular composition, images, immunology, systems biology
Deep Genomics	N/A	Chemical notations, QSAR, cellular biology data
DeepMind Health	ML	Chemical notations, structural and dynamic features of proteins
e-Therapeutics	Big Data	Chemical notations, omics
Exscientia	ML	Chemical notations, high-content screening, SAR
GNS Healthcare	ML	Clinical, omics, lab, imaging, drug, consumer, geographic, pharmacy, mobile health
iCarbonX	N/A	Genomic, metabolomic, lifestyle data

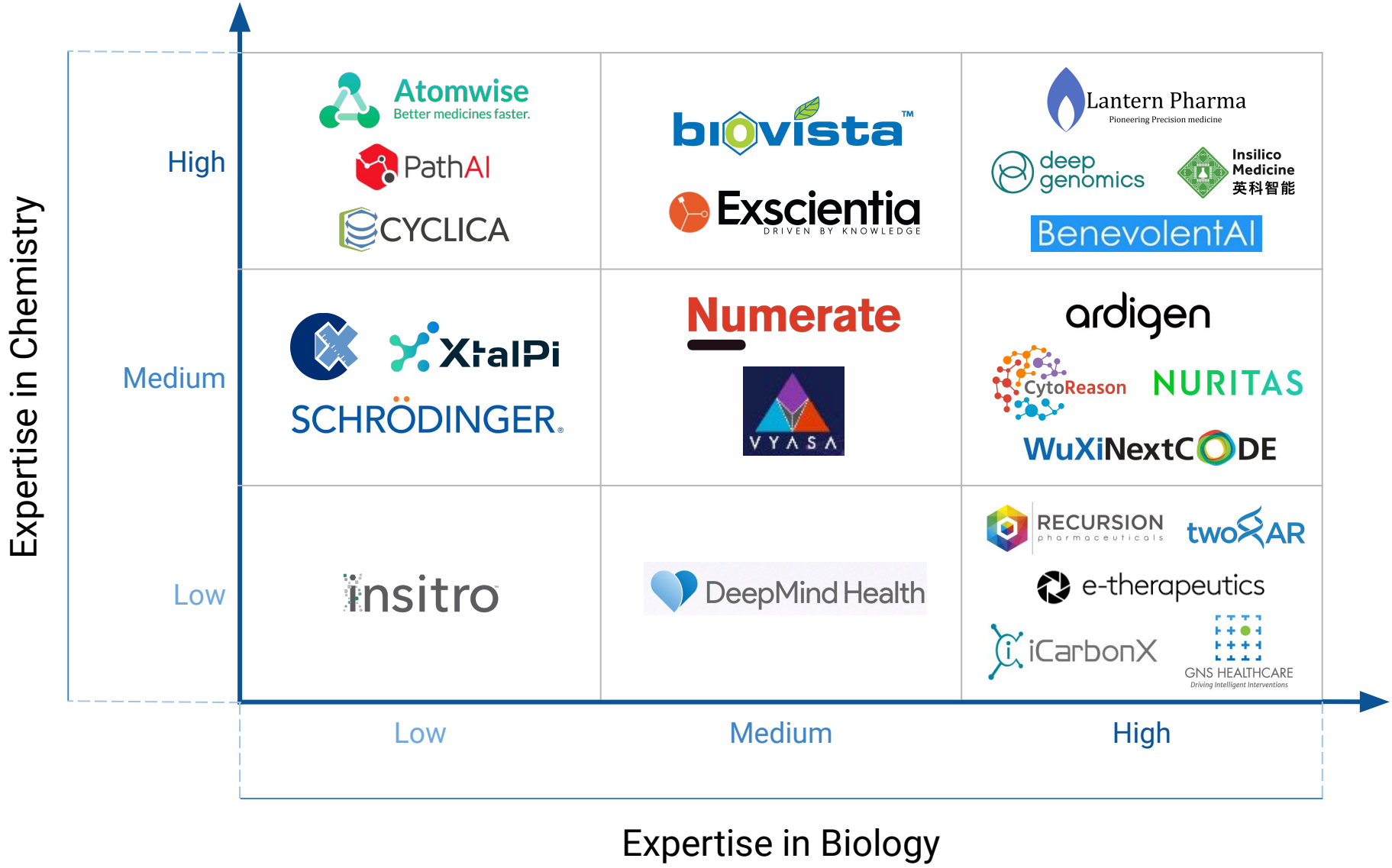
Comparison of Top-25 AI Companies by AI-Techniques

COMPANIES	COMPUTATION METHOD	DATA TYPE
Insilico Medicine	DL, GANs, GANs + RL, symbolic AI	Omics, EHR
Insitro	ML	High-quality data sets
Lantern Pharma	ML	Patient genetic profiling
Numerate	AI, cloud computing	Chemical notations, screening, high-content screening
Nuritas	Deep Learning	N/A
PathAI	ML, DL	N/A
Recursion Pharmaceuticals	N/A	Images, high content screening data
Schrödinger	ML	Chemical notations, structural information, antibody modelling features
twoXAR	N/A	Omics data, high content screening
Vyasa Analytics	DL, Big Data	Detect valuable patterns in large-scale, complex data sets
WuXi NextCODE	Domain-specific Artificial Intelligence (AI) algorithms	Multi-omic and phenotypic data
XtalPi	Quantum physics, machine learning, cloud computing	Chemical notations, quantum-mechanical molecular fingerprints

Comparison of Top-25 AI for Drug Discovery Companies
Expertise in Drug Discovery R&D / AI



Comparison of Top-25 AI for Drug Discovery Companies
Expertise in Chemistry / Biology



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

Data Mining	Biology Research	Drug Discovery			Drug Discovery	Biomarker Discovery
			Compound Generation	Compound Binding	ADME/Tox Predictions		
		Atomwise	Atomwise			
benevolent.ai		benevolent.ai		benevolent.ai	benevolent.ai	
deep genomics						deep genomics
		exscientia	exscientia	exscientia		
					GNS HEALTHCARE	
	Insilico Medicine 英科智能	Insilico Medicine 英科智能	Insilico Medicine 英科智能	Insilico Medicine 英科智能	Insilico Medicine 英科智能	Insilico Medicine 英科智能
		Numerate		Numerate		
		RECURSION				
		twoXAR				
ardigen	ardigen			ardigen	ardigen	ardigen
	NURITAS					
	e-therapeutics					

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

Data Mining	Biology Research	Drug Discovery			Drug Discovery	Biomarker Discovery
			Compound Generation	Compound Binding	ADME/Tox Predictions	
		Biovista				
CytoReason	CytoReason			CytoReason		CytoReason
DeepMind Health	DeepMind Health	DeepMind Health				DeepMind Health
			CYCLICA			
WuXiNextCODE	WuXiNextCODE	WuXiNextCODE	WuXiNextCODE	WuXiNextCODE	WuXiNextCODE	
			BioXcel			
				XtalPi		
iCarbonX	iCarbonX					
		insitro	insitro		insitro	
		Lantern Pharma	Lantern Pharma	Lantern Pharma	Lantern Pharma	
						PathAI
	SCHRÖDINGER.	SCHRÖDINGER.	SCHRÖDINGER.		SCHRÖDINGER.	
		VYASA	VYASA	VYASA	VYASA	

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

Hypothesis Knowledge Discovery	Target ID Biology	Compound Generation	Compound Binding	ADME Tox	Clinical Trials	Personalized Medicine	Real World Insights
Insilico Medicine 英科智能	Insilico Medicine 英科智能	Insilico Medicine 英科智能	Insilico Medicine 英科智能	Insilico Medicine 英科智能	BenevolentAI	Insilico Medicine 英科智能	Insilico Medicine 英科智能
BenevolentAI	twoXAR	BenevolentAI	BenevolentAI	BenevolentAI	SPARKBEYOND	freenome	BenevolentAI
SPARKBEYOND	NuMedii	inSili.com	Exscientia	Exscientia	WuXiNextCODE	iCarbonX 碳云智能	nference
nference	BIOAGE	Numerate	Atomwise	Numerate	DEEP 6	WuXiNextCODE	Qrativ
	Standigm	twoXAR	CYCLICA	twoXAR	Mendel.ai		iCarbonX 碳云智能
	deep genomics		SCHRÖDINGER	RECURSION	trials.ai		SPARKBEYOND
	RECURSION		XtalPi		OWKIN		WuXiNextCODE
	WuXiNextCODE		Numerate				
	healx		twoXAR				
	iCarbonX 碳云智能		RECURSION				

Investments into 25 AI-companies

COMPANY NAME	INVESTOR NAME	ROUND	YEAR	INVESTMENTS, MIL $
Atomwise	Monsanto Growth Ventures (MGV)	Series A	2018	45
BenevolentAI	Woodford Investment Management	Funding Round	2018	120
Cyclica	GreenSky Capital	Series A	2017	2.3
Deep Genomics	True Ventures; Khosla Ventures	Seed Round Series A	2015 2017	16.7
e-Therapeutics	Octopus Ventures	Venture Round	2009	2
Exscientia	Evotec	Venture Round	2017	15
GNS Healthcare	Amgen Ventures; Cambia Health Solutions	Venture Round Series B	2017 2014	16
Insilico Medicine	WuXi AppTec; Pavilion Capital	Series A	2018	6
Numerate	Foundation Capital; Atlas Venture; Lilly Ventures	Series B Series C	2009 2014	13.7
Nuritas	NDRC; VisVires New Protein; Cultivian Sandbox Ventures	Funding Round Seed Round Series A	2014 2015 2017	20.9
PathAI	General Catalyst	Series A	2017	11
Recursion Pharmaceuticals	Felicis Ventures; Lux Capital Data Collective DCVC	Series A Series B	2016 2017	75
twoXAR	Andreessen Horowitz; Softbank Ventures Korea	Seed Round Series A	2015 2018	14.4
WuXi NextCODE	Temasek Holdings; YF Capital; Sequoia Capital; Ireland Strategic Investment Fund	Series B Series B Series C	2017 2017 2018	440
XtalPi	FREES FUND; ZhenFund Tencent Holdings; Sequoia Capital China; China Life Healthcare Fund	Series A Series A Series B Series B	2016 2015 2018 2018	67.15

Investments into 25 AI-companies

COMPANY NAME	INVESTOR NAME	ROUND	YEAR	INVESTMENTS, MIL $
iCarbonX	China Bridge Capital; Tencent Holdings; Zhongyuan Union Cell & Gene Eng Zhongyuan Union Cell & Gene Eng	Series A	2016	200
Insitro	Third Rock Ventures; GV; Foresite Capital; Andreessen Horowitz; ARCH Venture Partners.	Series A	2018	?
Lantern Pharma	GPG Ventures; Bios Partners; Green Park & Golf Ventures; Health Wildcatters	Seed round Grant Funding round Series A	2014 2015 2015 2017	5.5
Schrödinger	Cascade Investment; Bill Gates; Scott Becker; Bill & Melinda Gates Foundation; WuXi AppTec	Series B Series C Series D Series E	2010 2012 2015 2019	137
Vyasa Analytics	MassDevelopment	Debt financing	2018	1.8
Ardigen	European Union	Grant	2014-2018	9

Investments into 25 AI-companies

COMPANY NAME	INVESTOR NAME	ROUND	YEAR	INVESTMENTS, MIL $
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Vyasa Analytics	MassDevelopment	Debt financing	2018	1.8
Ardigen	European Union	Grant	2014-2018	9

Collaborations and Research Deals with Pharma and Tech Corporations

COMPANY NAME	PARTNER NAME	DESCRIPTION	YEAR
Atomwise	Merck AbbVie	N/A	2015
BenevolentAI	Janssen	Develop new medicines for hard to treat diseases	2016
Biovista	Astellas Novartis Pfizer	Drug Repurposing	2015 2011 2010
C4X discovery	Takeda Evotec	Accelerate product development. Develop new small molecule drugs across a range of targets, therapeutic areas and stages of development	2014 2016
Cyclica	Merck Bayer WuXi AppTec	Licensing agreement for the use of Ligand Express®. Advance drug discovery programs. Drive polypharmacology in drug discovery through AI-augmented technologies	2018 2018 2018
Deep Genomics	Wave Life Sciences	Discover novel therapies for genetic neuromuscular disorders.	2018
e-Therapeutics	Novo Nordisk	Discover potentially novel biological mechanisms and therapeutic approaches for a specific area of type-2 diabetes.	2018
Exscientia	GSK Sanofi Evotec Janssen	Discover and develop first-in-class bispecific small molecule immuno-oncology therapies. A strategic research collaboration, and licence option agreement in the high-interest area of metabolic disease. Advance small molecules, and bispecific small molecules in immuno-oncology. N/A	2017 2017 2016 2013
GNS Healthcare	Genentech Celgene	N/A	2017 2016
Insilico Medicine	GSK Juvenescence Biotime Nestlé Novartis	Identification of novel biological targets and pathways of interest to GSK. Developing five commercially attractive drugs focused to treat ageing and age-related diseases. Analyzing the embryonic state of human cell samples using gene expression data.	2016

Collaborations and Research Deals with Pharma and Tech Corporations

COMPANY NAME	PARTNER NAME	DESCRIPTION	YEAR
Numerate	Servier Takeda Merck Boehringer-Ingelheim	N/A	2017 2017 2012 2011
Nuritas	Nestlé BASF	N/A	2018 2017
PathAI	Philips Bristol-Myers Squibb	Improve breast cancer diagnosis using artificial intelligence technology in big data pathology research Review pathology samples and analyze patient response to drugs in clinical trials	2017
Recursion Pharmaceuticals	Takeda Sanofi	N/A	2017 2016
twoXAR	Santen Pharmaceutical	N/A	2017
WuXi NextCODE	Google Cloud	Deliver comprehensive genomics capabilities to partners and customers worldwide.	2018

Collaborations and Research Deals with Pharma and Tech Corporations

COMPANY NAME	PARTNER NAME	DESCRIPTION	YEAR
XtalPi	Pfizer	Develop a hybrid physics- and artificial intelligence (AI)-powered software platform for accurate molecular modeling of drug-like small molecules.	2018
Ardigen	N/A	N/A	
CytoReason	Pfizer	Pfizer partners with CytoReason on immune system models for drug discovery	2019
DeepMind Health	N/A		
iCarbonX	HealthTell, Inc.	HealthTell, Inc. partners with iCarbonX to provide immune profiling in China, Singapore and Taiwan	2017
Insitro	N/A		
Lantern Pharma	Cancer Genetics Biological Mimetics	Cancer Genetics & Lantern Pharma announce strategic Collaboration for multiple lead oncology compounds	2017
Schrödinger	Amazon ChemAxon Nimbus Therapeutics Sanofi	Looking to gain an edge for its lackluster in-house R&D operations, Sanofi has signed on with Schrödinger to use computational design technology to help guide up to 10 drug discovery programs, promising to pay up to $120 million in milestones for the work.	2015
Vyasa Analytics	NVIDIA Markley Group	Vyasa Analytics joins NVIDIA inception program	2018

15 Pharma Corporations Applying AI for Drug Discovery

COMPANY NAME	BASED IN	WEBSITE
1. Amgen	United States	amgen.com
2. Astellas Pharma	Japan	astellas.com
3. Astrazeneca	United Kingdom	astrazeneca.com
4. Bayer	Germany	bayer.com
5. Boehringer Ingelheim	Germany	boehringer-ingelheim.com
6. Bristol-Myers Squibb	United States	bms.com
7. Evotec	Germany	evotec.com
8. GSK	United Kingdom	gsk.com
9. Ilumina	United States	illumina.com
10. Johnson & Johnson	United States	jnj.com
11. Merck	United States	merck.com
12. Novartis	Switzerland	novartis.com
13. Pfizer	United States	pfizer.com
14 Roche	Switzerland	roche.com
15. Sanofi	France	m-en.sanofi.com

15 Tech Corporations Applying Advanced AI-Applications in Healthcare

COMPANY NAME	BASED IN	WEBSITE
1. Alibaba	China	alibaba.com
2. Amazon	United States	amazon.com
3. Apple	United States	apple.com
4. Baidu	China	baidu.com
5. Canon	United States	usa.canon.com
6. Google	United States	google.com
7. Hitachi	Japan	hitachi.com
8. Huawei	China	huawei.com
9. IBM	United States	ibm.com
10. Intel	United States	intel.com
11. Microsoft	United States	microsoft.com
12. Nvidia	United States	nvidia.com
13. Samsung Electronics	South Korea	samsung.com
14. Siemens	Germany	siemens.com
15. Tencent	China	tencent.com

Level of AI-Strength of 150 Companies in Drug Discovery Sector

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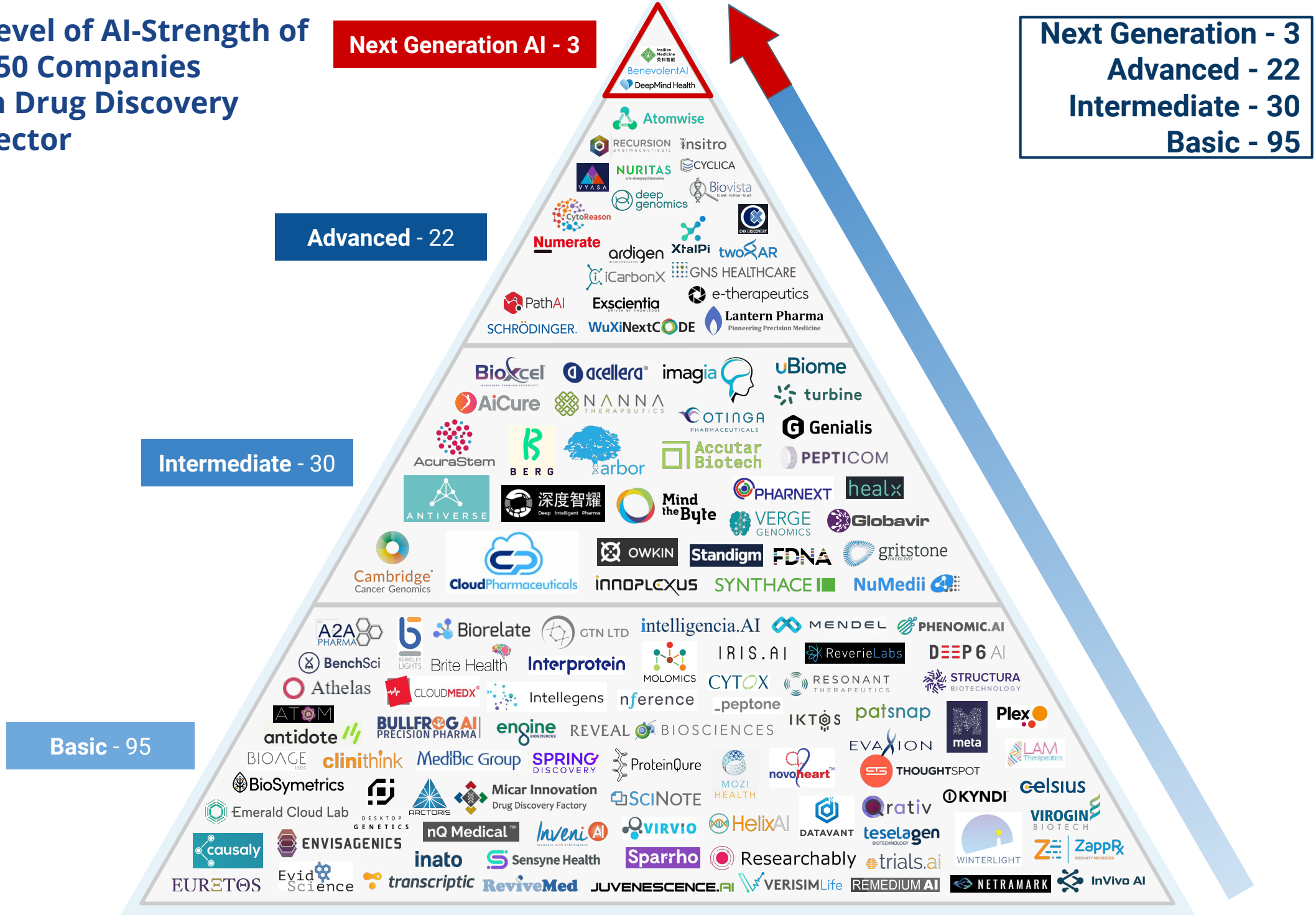
Level of AI-Strength of 150 Companies in Drug Discovery Sector

Group	Patents	Publications	AI specialists	Cooperation with Pharma or Tech Corporations	Others
Advanced level	Average/high amount of patents, related to AI, ML technologies applicable to Drug Discovery.	Significant number of publications in peer-reviewed journals.	High ratio of AI specialists on staff.	Established partnerships or collaborations with one or more Pharma and Tech Corporations	High levels of participation at Drug Discovery / AI conferences, and high visibility in media.
Intermediate level	Companies have some patents in Drug Discovery	Some publications in peer-reviewed journals.	Average ratio AI specialists on staff.	Cooperation is possible.	ex-Parma or Tech company executives and/or specialists part of staff.
Basic level	Very few patents.	Very few publications in peer-reviewed journals.	Low ratio AI specialists on staff.	No direct cooperation.	Low levels of activity in the field.

Level of AI-Strength of 150 Companies in Drug Discovery Sector



"Advanced AI" Group

The companies in this section are active in the field of Drug Discovery and basic research. The following criteria have been used to attribute companies to the list of top 25 AI companies in Drug Discovery,

1. **Significant amount of patents and peer-reviewed articles in the domain of pharmaceutical research and AI technologies:** companies in this category are demonstrating significant advances in the application of AI to drug discovery tasks, which is reflected in a high number of research publications, public presentations and press-releases, patents. They usually have strong expertise both in drug discovery and development and in theoretical and practical aspects of AI technology.

2. **High ratio of AI specialists to other employees**: companies in this category typically have a decent number of employees with background in AI/ML/DL, which allows generating unique know-how and intellectual property. Importantly, these companies have strong interdisciplinary teams uniting AI and life science experts.

3. **Direct collaborations with some of the 30 Pharma and Tech Corporations:** an important indicator for a company to be included in this category is the availability of official research collaborations with some of the top 30 Pharma and Tech corporations, where they provide advanced know-how in AI-driven drug discovery.

4. **High level of AI tech promotion:** companies in this category are typically active presenters in high profile public events, discussions and forums; they appear in news and media regularly. They contribute significantly to promoting AI-driven approach to drug discovery and basic biology, educating the public by specific use cases, and establishing best AI adoption practises.

“Intermediate AI” Group

The companies in this group still have significant know how in the AI for drug discovery domain, they were chosen based on the following criteria:

1. **Intermediate number of articles and patents:** their expertise is primarily in drug discovery or basic research, and they develop augmenting capacities in the AI-related technologies to boost core workflows.

2. **The ratio of AI specialist to other employees is average:** companies in this category typically have small-to-medium teams of AI experts collaborating with a core team of chemists/biologists.

3. **Direct collaborations with 30 Pharma and Tech Corporations:** companies in this category are supposed to have research collaborations with some of the 30 Pharma and Tech corporations, which is an indicator of a decent level of research capabilities.

4. **Average level of AI tech promotion:** companies in this list have a lower level of overall public presence and media coverage, compared to the “Advanced” Group. They participate in several top events regularly.

“Basic AI” Group

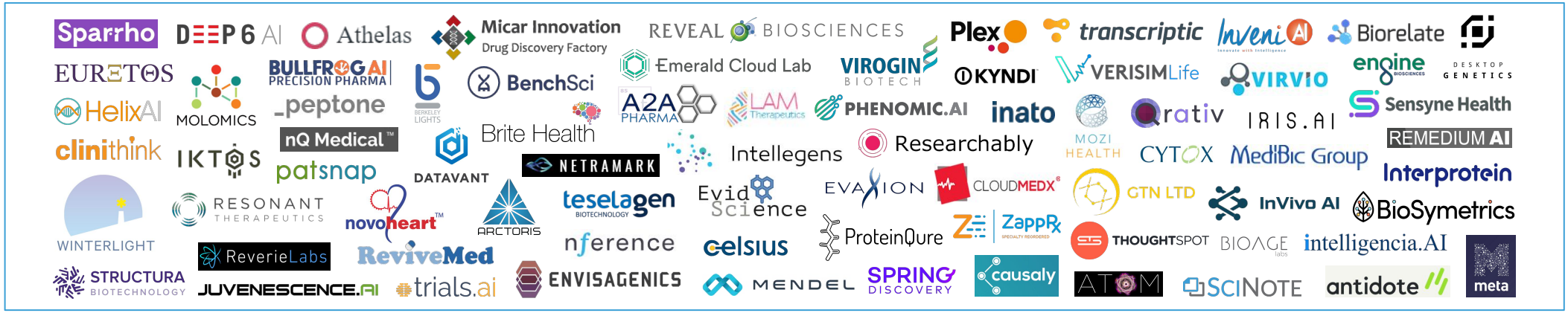
Companies in this group were chosen based on the following criteria:

1. **Low but non-zero number of research articles and patents:** these companies have a small number of research publications and/or patents covering only essential aspects of their technology. Typically, companies in this group are at the prototype or early validation stage of their technology/approach.

2. **The ratio of AI specialist to other employees is below average:** companies in “Basic” Group typically have a small number of AI-experts. They typically have early startup-like organizational structures, bootstrapping resources and human talent.

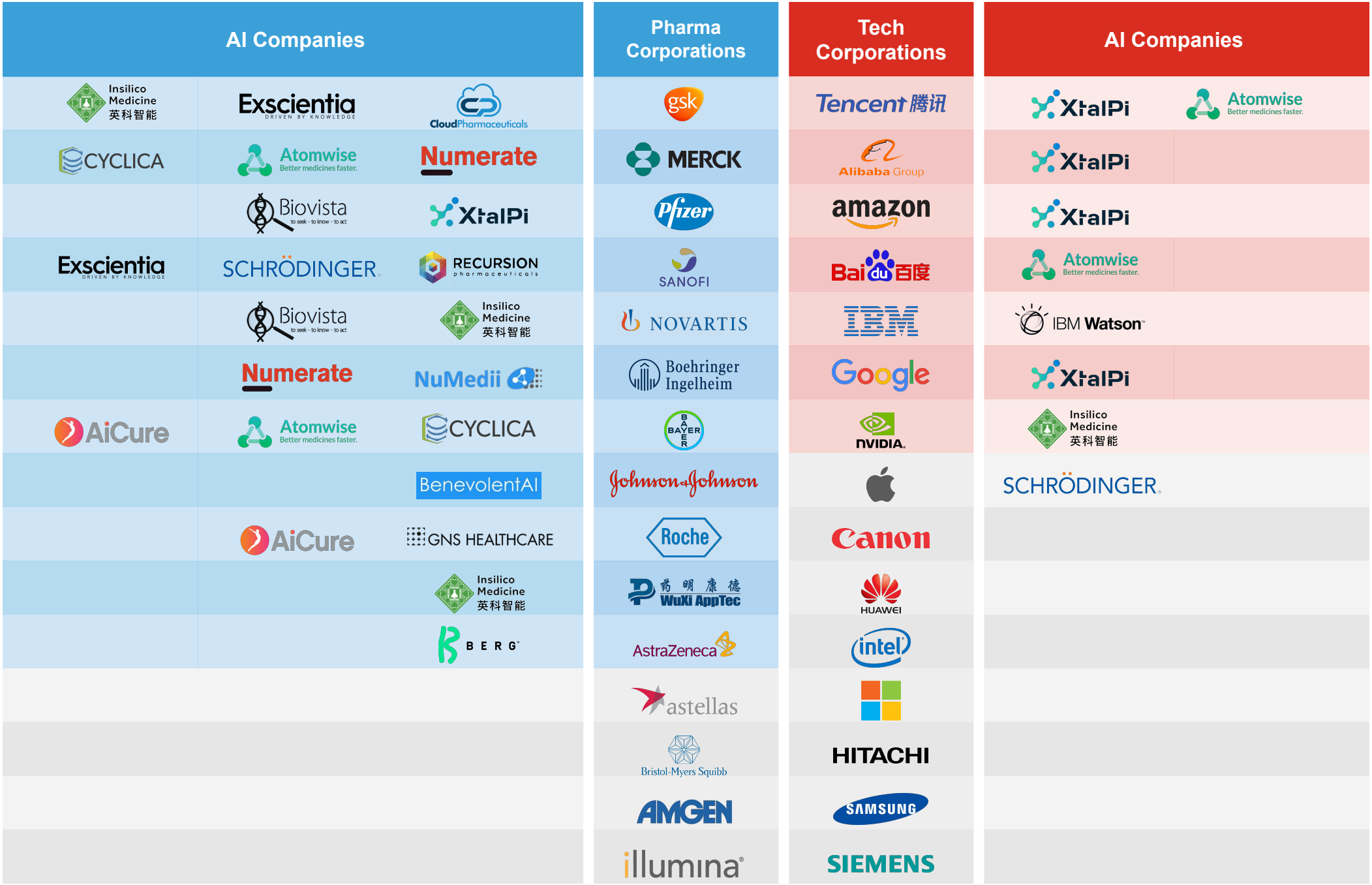
3. **Absence of officially announced collaborations with top 30 Pharma and Tech corporations:** companies in this list are typically in their early stage of development, and not yet established research ties with leading pharmaceutical or technological brands. Occasional companies in this list might just have entered in such collaborations lately, or are in the process of negotiation, though.

4. **Weak AI technology promotion:** companies in this list typically have small presence in media, public events and official forums. Their marketing teams are small, with the majority of resources allocated to developing core technological know-how.



AI for Drug Discovery Partnerships, Investments, Acquisitions

1 May 2019



Top-20 Investors Into 150 Companies in AI for Drug Discovery Sector

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Methodology

The infographic dashboard below displays geographical distribution of top-20 investors into AI-driven advanced healthcare and drug discovery companies. Top-20 Investors are mainly based in the U.S., followed by Chinese, United Kingdom and European Union companies.

The infographic on *page 47* outlines the top-20 investors in top-150 AI companies operating in the field of drug discovery and similar industries during 2012-2019. The header displayed at the top of the given infographic shows the key investors, the number of investments deals they made, and the top AI-powered biopharmaceutical and biotechnology companies that obtained funding/assistance.

Data on seed rounds, private equity, corporate rounds, venture funding, grants, as well as other types of funding rounds and non-equity assistance were collected and analysed according to various parameters set forth in Deep Knowledge Analytics evaluation criteria methodology. The top-20 leading investors in AI for drug discovery and advanced health sector have been selected based primarily upon the following criteria:

- Number of investments (from 3 to 9) made in 150-AI Companies, specializing in Drug Discovery;
- The potential for equity and non-equity financing (lead investors in seed/venture rounds);
- Investors overall background, intangible assets and philosophy.

Within the framework of the given research, data related to over 500 investment deals, concluded by 320 private and corporate investors, were collected.The share of deals concluded in 2018 constituted circa 27% of the total number of investments.

The data table on *page 49* shows the top 10 investors in top 25 biotech, biopharmaceutical research and development and advanced healthcare. The basic criteria underpinning the selection of the top 10 investors in the aforementioned industries were as follows:

- Minimum 2 investments in top 25 companies;
- The volume of funding/financing;
- Investors' intangible assets/capacities.

The trend is that investors keep investing several times in the same companies due to established partnerships and business models that gained credibility.

Top-20 AI for Drug Discovery Investors

- Sequoia Capital — Menlo Park, California, US
- Andreessen Horowitz — Menlo Park, California, US
- Felicis Ventures — Menlo Park, California, US
- Draper Associates — Menlo Park, California, US
- Khosla Ventures — Menlo Park, California, US
- Amgen Ventures — San Francisco, California, US
- Data Collective DCVC — San Francisco, California, US
- 500 Startups — Mountain View, California, US
- Y Combinator — Mountain View, California, US
- GV — Mountain View, California, US
- StartX — Palo Alto, California, US
- AME CLoud Ventures — Palo Alto, California, US
- Refactor Capital — Burlingame, California, US
- OS Fund — N/A, California, US
- General Catalyst — Cambridge, Massachusetts, US
- SOSV — Princeton, New Jersey, US

Menlo Park

San Francisco

Mountain View

Palo Alto

California

- Tencent — Shenzhen, China
- WuXi AppTec — Shanghai, China
- ZhenFund — Beijing, China
- Sequoia Capital China — Beijing, China

- Amadeus Capital Partners — Cambridge, United Kingdom

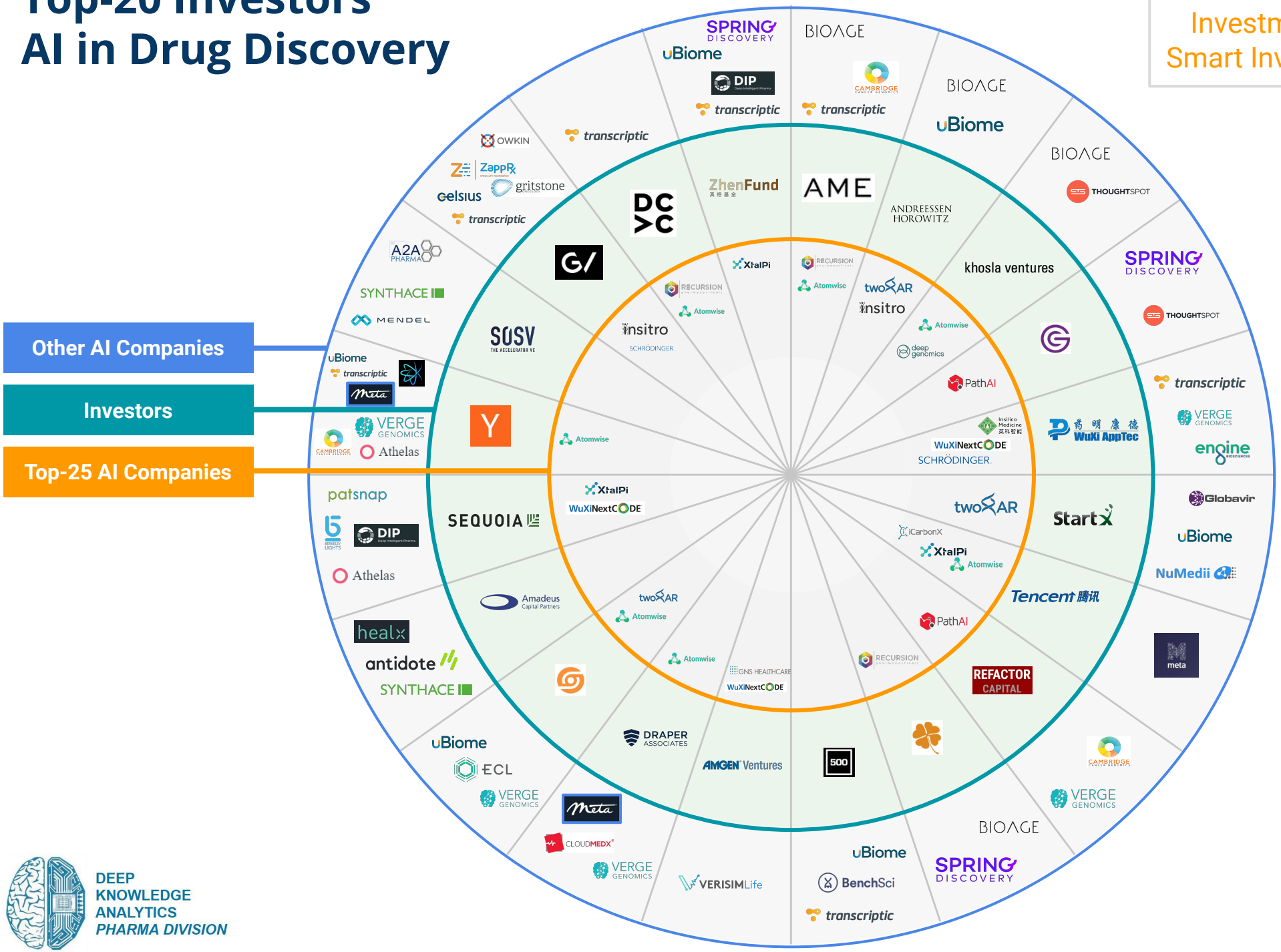
Top-20 Investors in 150 AI-Companies

1 May 2019

Top AI Companies		Investments overall	INVESTORS		Investments overall	Top AI Companies	
	Atomwise	9	Y combinator	Sequoia Capital	9	XtalPi	WuXiNextCODE
		8	SOSV	OS Fund	8	Atomwise	twoXAR
SCHRÖDINGER	insitro	8	GV	Data Collective DCVC	8	Atomwise	RECURSION
Atomwise	RECURSION	8	AME Cloud Ventures	ZhenFund	7	XtalPi	
Atomwise	deep genomics	6	Khosla Ventures	Andreessen Horowitz	6	insitro	twoXAR
		6	Amadeus Capital Partners	WuXi AppTec	5	Insilico Medicine 英科智能	WuXiNextCODE SCHRÖDINGER
	PathAI	5	General catalyst	StartX	4	twoXAR	
	PathAI	4	Refactor Capital	Tencent	4	Atomwise	XtalPi iCarbonX
		4	Felicis ventures	Draper associates	4	Atomwise	
	WuXiNextCODE GNS HEALTHCARE	3	Amgen ventures	500 startups	3		

Top-20 Investors AI in Drug Discovery

Investments vs Smart Investments



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Smart 10 Investors in Top-25 AI Companies

1 May 2019

Top AI Companies ← **INVESTORS** → Top AI Companies

Atomwise	iCarbonX	XtalPi	Tencent	WuXi AppTec	Insilico Medicine	SCHRÖDINGER	WuXiNextCODE
twoXAR	Insitro	a16z Andreessen Horowitz	GV	Insitro	SCHRÖDINGER		
WuXiNextCODE	Insitro	ARCH Venture Partners	Khosla Ventures	Atomwise	deep genomics		
RECURSION	CYCLICA	EPIC Capital	Sequoia Capital	XtalPi	WuXiNextCODE		
RECURSION	Atomwise	Data Collective DCVC	AME Cloud Ventures	RECURSION	Atomwise		

Leading AI Experts in Top-25 AI for Drug Discovery Companies

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Methodology

Nowadays it is vital to bring the healthcare standards in line with the latest advancements in the biotechnology, pharmaceutical industry, electronic medicine/healthcare and adjacent hi-tech industries. Data-driven healthcare models have to be trimmed to meet the existing demands and be focused on improving lifestyle standards. The role of the leaders who are at the forefront of the state-of-the-art sectors is essential for proper functioning of the global biotech industry.

Deep Knowledge Analytics database includes 100 leaders in the fields of drug discovery and advanced healthcare from various cutting-edge biomedical engineering and digital health companies and startups that operate using artificial intelligence, machine learning, deep learning, big data, neural networks, IoT and other breakthrough technologies.

The slide on *page 53* shows the most ingenious and entrepreneurial 18 leaders in the field of biotech and e-health realms, who work for the top 25 innovative companies that use AI-powered technologies. These top 18 vanguard leaders set the overall direction for new biomedical engineering challenges and reshape the future of the pharmaceutical industry, biotechnologies and healthcare.

These industry trendsetters were selected based on their

- Entrepreneurial flair, capacity to embark on challenging entrepreneurial activities and successfully run/manage a business along with a solid portfolio of completed projects;
- Cumulative impact on the advancement and implementation of the artificial intelligence technologies in the domain of biopharmaceutical research and development, biomedical engineering, digital healthcare solutions and services;
- Foresight and visionary approach to strategies tailored to meet the long-run expectations of the biotech industry players and stakeholders;
- Multifaceted professional and educational background and experience, interdisciplinary technical skills, business knowledge and transferable skills as well as decision-making capacities related to IT, data science, big data, artificial intelligence, machine learning, deep learning, neural networks, statistical analysis and related areas, combined with knowledge in the following areas of expertise: drug research, discovery and development, clinical trials, digital medical devices and mobile health, diagnostics, biotechnologies, bioengineering, etc.

Top 100 AI Leader in Drug Discovery and Advanced Healthcare

Atomwise

Abraham Heifets
CEO, co-founder

Izhar Wallach
CTO, co-founder

BenevolentAI

Ken Mulvany
Chairman and Founder

Jackie Hunter
CEO

Insilico Medicine

Alex Zhavoronkov
CEO, co-founder

Alex Aliper
President

Numerate

Guido Lanza
President & CEO

Brandon Allgood
co-founder and CTO

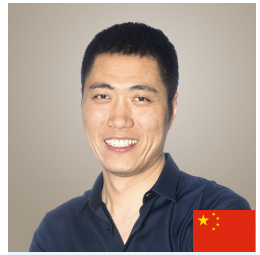
Biovista

Andreas Persidis
Co-founder and CEO

Deep Genomics

Brendan Frey
CEO

iCarbon X



Wang Jun
CEO

Daphne Koller
Founder and CEO

Insitro

Insitro

Nora Khaldi
Founder & Chief Scientific Officer

NURITAS

Nuritas

Andrew Beck
CEO, Co-founder

PathAI

PathAI

Blake Borgeson
Co-founded, Scientific Advisor

RECURSION pharmaceuticals

Recursion Pharmaceuticals

Andrew A. Radin
CEO, co-funder

twoXAR

TwoXAR

Christopher Bouton
CEO

VYASA

Vyasa

Tom Chittenden
Vice President, Statistical Sciences and Founding Director

WuXiNextCODE

WuXi NextCODE

Profile Section

Top-25 Companies / Top-20 Investors

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Top-25
AI for Drug Discovery
Company Profiles

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25 Leading Companies in AI for Drug Discovery Sector

1	Ardigen
2	Atomwise
3	BenevolentAI
4	Biovista
5	C4X discovery
6	Cyclica
7	CytoReason
8	Deep Genomics
9	DeepMind Health
10	e-Therapeutics
11	Exscientia
12	GNS Healthcare
13	iCarbonX
14	Insilico Medicine
15	Insitro
16	Lantern Pharma
17	Numerate
18	Nuritas
19	PathAI
20	Recursion Pharmaceuticals
21	Schrödinger
22	twoXAR
23	Vyasa Analytics
24	WuXi NextCODE
25	XtalPi

Ardigen

Ardigen is a Life Science computational partner in the era of Artificial Intelligence. Ardigen provides comprehensive services that leverage its domain knowledge and expertise in bioinformatics, machine learning and software engineering together with its proprietary technology. Ardigen platforms for neoepitope, biomarker, and microbiome research facilitate the improvement of the response rates in immuno-oncology. Ardigen research combines the expertise in Artificial Intelligence, Bioinformatics, Cancer Biology, Immunology and Microbiome to deliver technologies that lead to significantly increased response rates to immunotherapies.

Ardigen's in silico methods, in particular, Artificial Intelligence algorithms, minimize the laboratory effort to identify and evaluate new probiotic strains. Ardigen Neoepitope Prediction Platform can accurately predict cancer neoepitopes, assess their immunogenicity and design personalized cancer vaccines to boost the response to immunotherapy. Ardigen's holistic approach to immuno-oncology analyzes the properties of tumor and its microenvironment, including composition of immune cells, biomarkers detectable in blood and other fluids, and microbiome composition. The data is used to build a comprehensive picture of a response to immunotherapy and to select robust biomarkers to be used in the clinical trial assay and companion diagnostics development.

Atomwise

Atomwise develops artificial intelligence systems using powerful deep learning algorithms and supercomputers for drug discovery. Technology is based on convolutional neural networks – the same AI technology that recognizes faces in a crowd, enables self-driving cars, and allows you to talk to your phone. This technology uses a statistical approach that extracts the insights from millions of experimental affinity measurements and thousands of protein structures to predict the binding of small molecules to proteins. This fundamental tool makes it possible for chemists to pursue hit discovery, lead optimization and toxicity predictions with unparalleled precision and accuracy.

Atomwise delivers results 100 times faster than ultra high throughput screening. Its deep convolutional neural network, AtomNet, screens between 10 and 20 million compounds a day.

AtomNet is the first deep learning neural network for structure-based drug design and discovery. Its speed and accuracy make it the most advanced technology for small molecule binding affinity prediction.

TYPE	DESCRIPTION	YEAR	RESEARCH PARTNER / LEAD INVESTORS	AMOUNT, MLN $
Investments	Series A	2018	Monsanto Growth Ventures (MGV)	45
Collaboration & Research	N/A	2015	Merck	N/A
Collaboration & Research	N/A	2015	AbbVie	N/A
Investments	Seed Round	2015	N/A	6

BenevolentAI

BenevolentAI, founded in 2013, is an advanced technology company focused on accelerating the journey from data to medicines. It is the world's only technology company with end-to-end capability from early discovery to late-stage clinical development. The company seeks to improve patient's lives by applying technology designed to lower drug development costs, decrease failure rates and increasing the speed at which medicines are generated. BenevolentAI's approach to this is to integrate technology across the entire medicinal R&D process (rather than fragments of it) and by doing so solve fundamental innovation roadblocks such as the ability to ingest large data sets, meaningful reasoning on those data sets, validation of ideas from those data sets and the rapid experimentation of those ideas. In order to do this Benevolent AI has created a very large rich bioscience specific knowledge graph which unifies unstructured and structured data.

This is then used by the 'Benevolent Platform' - a totally unique end-to-end computational and experimental platform. The Benevolent Platform ingests data, reads, understands and contextualises data to determine the cause of a disease, proposes a drug target, makes a molecule to treat that disease and then defines the right patients to test that molecule in order to drive greater clinical success. The foundation of the platform is a comprehensive bioscience knowledge graph, capable of ingesting any relevant structured and unstructured data.

TYPE	DESCRIPTION	YEAR	RESEARCH PARTNER / LEAD INVESTORS	AMOUNT, MLN $
Investments	Funding Round	2018	Credit Suisse	120
Collaboration & Research	Develop new medicines for hard to treat diseases	2016	Janssen	N/A
Investments	Venture Round	2015	N/A	87

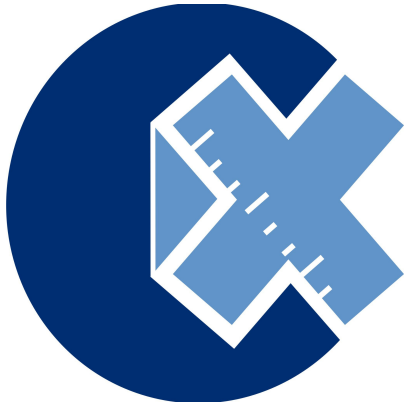
Biovista

Biovista, Inc. supplies business intelligence products and services to the life sciences industry. It offers repositioning programs that identify drugs and reposition them in isolation or in combination with other drugs to therapeutic areas, such as eye disorders, diabetes/obesity, CNS, and oncology. The company also provides pharma services, such as meta-review and gap analysis, disease cohort identification, drug repositioning, adverse event analysis, clinical hold, and clinical development plans. In addition, it offers Biovista Nutrition that helps consumers identify harmful and beneficial drug-drug and drug-nutritional supplement interactions based on their personal health profile; and Biovista Prospector, which supports sales and marketing executives deliver messages that help convert clients to customers, as well as research solutions. It serves pharmaceutical and biotechnology companies, academic institutions, and research and government organizations in the United States, EU, and Asia.

The company applies systematic discovery Artificial Intelligence platform to develop a pipeline of repositioned drug candidates in disease areas such as neurodegenerative diseases, epilepsy, oncology and orphan diseases. It also works with collaborators to proactively position and to reposition their own assets, whether new chemical entities or existing compounds. Project Prodigy combines capabilities in AI and Machine Learning, Natural Language Processing, graph databases, federated system architectures and collaborative work UIs to create solutions that support discovery and knowledge-intensive analytics in healthcare and other commercial environments.

TYPE	DESCRIPTION	YEAR	RESEARCH PARTNER / LEAD INVESTORS	AMOUNT, MLN $
Collaboration & Research	Drug Repurposing	2015	Astellas	N/A
Collaboration & Research	Drug Repurposing	2011	Novartis	N/A
Collaboration & Research	Drug Repurposing (identify up to three novel indications for each of the Pfizer candidates)	2010	Pfizer	N/A

C4X Discovery



C4X Discovery brings a new dimension to drug discovery. Using its unique NMR-based technique to determine 3D molecular structures with high accuracy, C4X Discovery is focused on optimising the design and development of medicines and partnering with the pharmaceutical sector to generate better, safer products. C4X Discovery is able to determine the bioactive 3D structures of a variety of biologically important molecules, including drugs, naturally occurring ligands and enzyme co-factors, and does this independently of traditional methods such as computational modelling and X-ray crystallography.

C4X Discovery is applying its unique technology to improve the efficiency of the drug discovery process, both in partnership with the pharmaceutical industry and across its own pipeline of high-value therapeutic targets.

TYPE	DESCRIPTION	YEAR	RESEARCH PARTNER / LEAD INVESTORS	AMOUNT, MLN $
Collaboration & Research	Develop new small molecule drugs across a range of targets, therapeutic areas and stages of development	2016	Evotec	N/A
Investments	Post-IPO Equity	2016	Calculus Capital	6.3
Collaboration & Research	Accelerate product development.	2014	Takeda	N/A
Investments	Venture Round	2009	Aquarius Equity Partners	N/A

Cyclica

Cyclica is a Toronto-based biotechnology company that leverages biophysics and artificial intelligence (AI) to make drug discovery faster, safer, and cheaper. We enable all scientists in Pharma with an integrated network of technologies, thereby driving drug discovery and revolutionizing a system troubled with attrition and costly failures.

Their cloud-based Ligand Express® platform uncovers the polypharmacological profiles of small molecules to provide insight into target identification, mechanism of drug action, lead prioritization, the elucidation of adverse effects, and drug repurposing. The company is extending the capabilities of Ligand Express® to include structural pharmacogenomics by layering annotated genetic data on top of protein structure in order to help investigate the effect of genetic variation on drug action. These capabilities have also been augmented by the addition of ADMET Prediction tool, an adaptive AI modelling methodology that outperforms traditional classifiers to generate QSAR models, thereby enabling a better understanding of the relationship between drug structure and function.

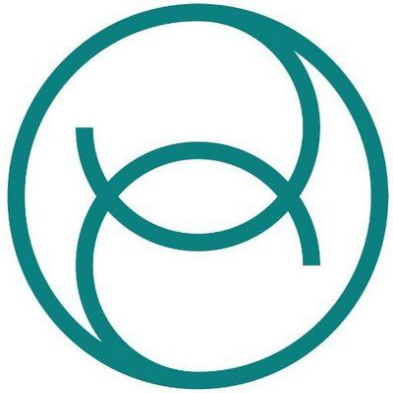
TYPE	DESCRIPTION	YEAR	RESEARCH PARTNER / LEAD INVESTORS	AMOUNT, MLN $
Investments	Series A	2017	GreenSky Capital	2.3
Investments	Series A	2016	GreenSky Capital	2.4
Investments	Venture Round	2015	GreenSky Capital	1.8
Grant	Grant	2014	N/A	0.6
Investments	Seed round	2014	StartUp Health	N/A

CytoReason

CytoReason was founded in 2016, based on more than a decade of research from Stanford and the Technion. Today they are the largest systems immunology group in the world – and growing fast! Currently they are 26 people, most of whom are PhDs with extensive pharma and biotech experience, and expect to double that over the coming year. They have been revenue generating since inception and have ongoing commercial collaborations with 3 out of the top 10 global pharma companies as well as with leading research institutions. Science is the backbone of its methodologies and applications, and must stand the test of scientific scrutiny. To date CytoReason has 16 research papers published in top quality peer-reviewed scientific journals, including four in 2018 alone – 3 of which were published in journals from the Nature group.

CytoReason's platform is based around its "Cell-Centered Models" of cellular activity per disease and per tissue. Built using vast proprietary and public data, they enable it to very rapidly and accurately compare differences with any new data set integrated into the model. CytoReason has developed the world's only machine learning model aimed at re-defining understanding of the immune system and the cells that make it tick. Computationally simulating the cellular environment to stimulate discovery.

Deep Genomics



Deep Genomics is using artificial intelligence to build a new universe of life-saving genetic therapies. Its platform allows to efficiently find drug candidates with desirable properties. Its medicines target the genetic determinants of disease at the level of RNA or DNA. These genetic diseases are mediated by altered molecular phenotypes, such as transcription, splicing, translation and protein binding. Predicting those alterations is the core competency of the company. The oligonucleotide therapeutic design space includes tens of billions of compounds, but their platform makes it possible to search this space efficiently. On-target and genome-wide off-target effect data is produced for every compound identified using our platform. That data is then fed back, closing the loop. In Project Saturn, the company is using its platform to evaluate over 69 billion molecules against 1 million targets, *in silico,* to generate a library of 1000 compounds that are experimentally verified to manipulate cell biology as intended. Think of it as a toolkit for controlling cell biology along crucial pathways, rapidly unlocking therapies with greater potential.

The platform of the company incorporates the most advanced biological knowledge, is driven by the most powerful automation technologies, and is built using proprietary as well as public datasets.

TYPE	DESCRIPTION	YEAR	RESEARCH PARTNER / LEAD INVESTORS	AMOUNT, MLN $
Investments	Series A	2017	Khosla Ventures	13
Investments	Seed Round	2015	True Ventures	3.7

DeepMind Health

DeepMind was founded in London in 2010, with the aim of building AI technologies and proving that they could have positive social impact. DeepMind Health is central to this social mission. The company has two simple goals:

First, to make a practical difference to patients, nurses and doctors and support the NHS and other healthcare systems. DeepMind Health hopes that its technologies will help to save lives, improve care and support the NHS system.

Second, to make DeepMind Health a self-sustaining initiative, through hospitals choosing to pay it for its software if they think they can have a positive impact on clinical outcomes and experience. DeepMind Health isn't looking to maximise profit, but rather to achieve sustainability so it can continue to grow its team, work with more hospitals and help more patients.

TYPE	DESCRIPTION	YEAR	RESEARCH PARTNER / LEAD INVESTORS	AMOUNT, MLN $
Acquisitions	Hark acquired by DeepMind	2016	N/A	N/A

e-Therapeutics

e-Therapeutics plc is a drug discovery and development company. It has developed proprietary computational systems to swiftly and accurately analyse and predict how medicines interact with cells in the body in hopes of optimizing the probability of identifying drug candidates with desirable efficacy and minimal side effects. By combining biological expertise and powerful computer-based platform, the company creates and analyses network models of disease to identify likely proteins that could effectively be disrupted to treat the disease. By modelling and analysing disease networks and considering the pattern of connections between proteins, and not just single pathways, it efficiently selects the very best drug-like compounds for screening and for subsequent medicinal chemistry and pre-clinical testing.

Using its NDD platform, it implements the latest mathematical and data analysis techniques to augment and interrogate the vast amount of biological information currently available in both public and private databases. The database of many millions of compounds is reviewed and looked for those that have the specific features necessary to disrupt the disease. As this process occurs '*in silico*' using advanced modelling techniques, the company can interrogate all the available data and identify the best compounds that match the optimal profile. Discovery Engine of e-Therapeutics is a combination of large-scale, proprietary databases and a suite of powerful computational tools that employ data mining, machine learning/artificial intelligence, optimization, and network analysis. The company applies these sophisticated - and in many cases, proprietary - techniques to evaluate small molecules based on their potential bioactivity in the search for better and more effective drugs to address unmet medical needs. In-silico techniques sit at the heart of how the company identifies the very best drug-like molecules for further screening. First created in 2014, it has now validated its approach in diverse areas of biology to create multiple "intervention strategies" that potentially address gaps in available treatments.

TYPE	DESCRIPTION	YEAR	RESEARCH PARTNER / LEAD INVESTORS	AMOUNT, MLN $
Investments	post-IPO	2013	N/A	64
Investments	Venture Round	2009	Octopus Ventures	2.5

Exscientia

Exscientia is applying AI and big data processing to accelerate drug discovery and development. AI driven systems actively learn best practice from vast repositories of discovery data and are further enhanced with knowledge acquired from seasoned drug hunters. With better information to hand than any researcher could acquire individually, its knowledge-driven systems design millions of novel, project-specific compounds and pre-assess each for predicted potency, selectivity, ADME and other key criteria. From this, a selection of the best, information-rich compounds are selected for synthesis and assay. With new experimental data generated, the results are integrated and the next design cycle initiated. Rapid design-make-test cycles ensure unparalleled progress towards desired project goals. Exscientia has already delivered exceptional productivity, generating candidates in roughly one-quarter of the time of traditional approaches.

Many drugs have now been shown to hit more than one target, suggesting that this *polypharmacology* is more frequent than previously anticipated. Exscientia have harnessed this knowledge to develop a system to design molecules that explicitly hit more than one target. Seeded by experimental data for individual targets, design process of the company can assess the chemical tractability of any biologically relevant pairing. Only those target pairs appearing amenable are taken forward. Bispecific designs are rapidly synthesised and tested to confirm the overall opportunity for each prioritised pairing. Those displaying the potential to encode key chemistry into a single integrated pharmacophore, are taken forward to become active drug discovery projects. To address drug discovery in areas of complex disease, where the target mechanisms are often unknown, Exscientia has extended its systems to design compounds directly against Phenotypic and High Content Screening data. Exscientia is able to drive the design process, without any requirement to consider the underlying target profile, using high-dimensional phenotypic data. This allows drug discovery to be implemented even when the target landscape is not sufficiently understood, thereby accelerating new opportunities for treatment.

Exscientia

TYPE	DESCRIPTION	YEAR	RESEARCH PARTNER / LEAD INVESTORS	AMOUNT, MLN $
Investments	Venture Round	2017	Evotec	17
Collaboration & Research	Discover novel and selective small molecules for up to 10 disease-related targets to be chosen by GSK across “multiple” therapeutic areas. Targets undisclosed.	2017	GSK	42.7
Collaboration & Research	Discover bispecific small-molecule drugs against metabolic diseases.	2017	Sanofi	283
Collaboration & Research	Discover and develop first-in-class bispecific small molecule immuno-oncology therapies. The initial focus is cancer-related adenosine targets	2016	Evotec	18
Collaboration & Research	Developed a (lead candidate) bispecific, dual-agonist compound that selectively activates two GPCR families	2015	Sumitomo Dainippon	N/A
Collaboration & Research	drug discovery and optimization of new drugs for mental illnesses	2014	Sunovion Pharmaceuticals	4.5
Collaboration & Research	N/A	2013	Janssen	N/A

GNS Healthcare

GNS Healthcare is a healthcare analytics company. It is focused on advancing and applying industrial-scale data analytics to empower key healthcare stakeholders to solve complex care, treatment and cost challenges. As a pioneer in machine learning and its application to healthcare, GNS brings an unparalleled depth and breadth of experience in leveraging AI to solve healthcare's most crucial problems. REFS (Reverse Engineering Forward Simulation) is a causal machine learning platform – an extremely powerful form of AI that learns directly from the data. Unlike other AI technologies, that rely on scanning and interpreting available data, REFS discovers new insights from the data. This is an important distinction as the results from causal machine learning are objective, unbiased and actionable.

TYPE	DESCRIPTION	YEAR	RESEARCH PARTNER / LEAD INVESTORS	AMOUNT, MLN $
Investments	Venture Round	2017	Amgen Ventures	6
Collaboration & Research	N/A	2017	Genentech	N/A
Investments	Venture Round	2016	N/A	4
Collaboration & Research	N/A	2016	Celgene	N/A
Investments	Series C	2015	N/A	10
Investments	Series B	2014	Cambia Health Solutions	10
Investments	Venture Round	2014	N/A	8.1
Investments	Series A	2013	Cambia Health Solutions	9.9
Investments	Venture Round	2012	N/A	5

iCarbonX

iCarbonX is a technology company that is changing how people monitor and understand their health status and optimize their lives. iCarbonX is building the platform and tools for digitizing, analyzing, and understanding life, and delivering intelligent products and applications—designed for every aspect and stage of life — to help everyone make smarter choices, every day.

iCarbonX is inspired by every life on this planet, and by a commitment to apply intelligence not just to data, but to the ethical use of that data. Its mission is to bring people together to improve the human condition. iCarbonX believes it must go beyond genetics to help people understand not just who they are, but how they are. iCarbonX is answering the “how” by combining biological and behavioral data with artificial intelligence in a network where people can learn from their own experience and from others like them, creating a global map of human health across cultures and continents that delivers new information and new choices, for life.

TYPE	DESCRIPTION	YEAR	RESEARCH PARTNER / LEAD INVESTORS	AMOUNT, MLN $
Investments	Series A	2016	China Bridge Capital	45
Investments	Series A	2016	Tencent Holdings, Zhongyuan Union Cell & Gene Eng	155

Insilico Medicine

Insilico Medicine, Inc. develops artificial intelligence (AI) solutions for drug discovery, biomarker development, and aging research. It develops drug discovery engines using deep learning for drug discovery, personalized healthcare, and anti-aging interventions. The company's projects include Pharma.AI, that provides advanced machine learning services to biotechnology companies, pharmaceutical companies, skin care companies, foundations, and national governments; Young.AI, a platform integrating predictors of age; Chemistry.AI, a platform for medicinal chemists to look at classes of molecules and measure the brain activity and physiological parameters; Embryonic.AI, a classifier designed to identify the embryonic score of a sample; Nutriomi, a platform for nutrition and longevity; Aging.AI 2.0, a predictor of age with deep neural network; and Mortality.AI. It provides services to academia, pharmaceutical, and cosmetic companies.

The company developed a comprehensive drug discovery engine, which utilizes millions of samples and multiple data types to discover signatures of disease and identify the most promising targets for billions of molecules that already exist or can be generated *de novo* with the desired set of parameters.

Insilico pioneered the applications of the generative adversarial networks (GANs) and reinforcement learning for generation of novel molecular structures for the diseases with a known target and with no known targets. In addition to working collaborations with the large pharmaceutical companies, the company is pursuing internal drug discovery programs in cancer, dermatological diseases, fibrosis, Parkinson's Disease, Alzheimer's Disease, ALS, diabetes, sarcopenia, and aging. Through a partnership with LifeExtension.com, the company launched a range of nutraceutical products compounded using the advanced bioinformatics techniques and deep learning approaches. In conjunction with Alan Aspuru-Guzik's group at Harvard, they have published an improved GAN architecture for molecular generation which combines GANs, reinforcement learning, and a differentiable neural computer. Insilico has also partnered with GSK, BioTime, Juvenescence and quantum computer company YMK Photonics. In 2017, NVIDIA selected Insilico Medicine as one of the Top 5 AI companies in its potential for social impact. In 2018, the company was named one of the global top 100 AI companies by CB Insights. In 2018 it received the Frost & Sullivan 2018 North American Artificial Intelligence for Aging Research and Drug Development Award accompanied with the industry brief.

Insilico Medicine

TYPE	DESCRIPTION	YEAR	RESEARCH PARTNER / LEAD INVESTORS	AMOUNT, MLN $
Investments	Series A	2018	WuXi AppTec	6
Collaboration & Research	Identification of novel biological targets and pathways of interest to GSK	2017	GSK	N/A
Collaboration & Research	Developing five commercially attractive drugs focused to treat ageing and age-related diseases	2017	Juvenescence	N/A
Investments	Series A	2017	N/A	2.8
Investments	Series A	2017	N/A	4
Collaboration & Research	Analyzing the embryonic state of human cell samples using gene expression data.	2016	Biotime	N/A
Collaboration & Research	N/A	2016	Nestlé	N/A
Collaboration & Research	N/A	2016	Novartis	N/A
Investments	Convertible Note	2014	Deep Knowledge Ventures	1.2
Investments	Seed Round	2014	Deep Knowledge Ventures	0.3

Insitro

Insitro is integrating cutting-edge machine learning techniques with the ground-breaking innovations that have occurred in life sciences that enable the creation of the large, high-quality data sets. Insitro's goal is to collect and use a range of very large data sets to train ML models to help address key problems in the drug discovery and development process.

Insitro aims to combine new technologies to develop a new approach to drug development that might help cure more people, sooner, and at a much lower cost.

Insitro is led by world-class pioneers at the intersection of data science and the life sciences, with extensive experience in applying machine learning to a range of biological problems and data sets.

TYPE	DESCRIPTION	YEAR	RESEARCH PARTNER / LEAD INVESTORS	AMOUNT, MLN $
Investments	Series A	2018	Third Rock Ventures, GV, Foresite Capital, Andreessen Horowitz, ARCH Venture Partners	N/A

Lantern Pharma

Lantern Pharma, Inc. is a clinical-stage pharmaceutical company developing new classes of precision cancer drugs with novel mechanisms of action for the treatment of unmet cancer needs. Lantern Pharma recognizes the high cost and low success trend in oncology drug development stems from the inability to appropriately stratify patient populations prior to enrollment on to clinical studies. They also recognize that levels of genetic heterogeneity in both cancers and patients make it difficult to assure a large enough response rate to validate FDA approval. As a result, many promising drugs fail and countless dollars, and lives, are lost in the process. Lantern Pharma embraced technologies such as Artificial Intelligence (AI) and Machine Learning that had been robustly tested in other industries and were able to apply these successfully to accurately stratify patient populations into responders and non-responders to de-risk clinical trials, exponentially increase successful FDA approval, and drastically reduce overall cost. Founded in 2013, Lantern developed its own proprietary AI-based platform, Response Algorithm for Drug Positioning and Rescue – RADR™. RADR™ performs genetic biomarker data analysis using advanced machine learning algorithms to stratify responders and non-responders to de-risk and maximize the success of drug rescue and repurposing in oncology.

TYPE	DESCRIPTION	YEAR	RESEARCH PARTNER / LEAD INVESTORS	AMOUNT, MLN $
Investments	Series A	2017	GPG Ventures, Bios Partners	3.7
Investments	Grant Round	2015	N/A	0.8
Investments	Funding Round	2015	Green Park & Golf Ventures	1
Investments	Seed Round	2014	Health Wildcatters	0.3

Numerate

Numerate is a computational drug design company that is transforming the discovery of new medicines that fill significant therapeutic gaps by harnessing the vast computational power of the cloud and the ever-increasing amounts of drug discovery data by applying proprietary artificial intelligence algorithms. Numerate's drug design platform combines advances in computer science and statistics with traditional medicinal chemistry approaches to overcome major challenges in small molecule drug discovery and significantly accelerate candidate selection and optimization. Using this platform, coupled with innovative funding and partnership models, Numerate is developing a therapeutic pipeline focused on producing first-in-class candidates against emerging targets addressing major unmet medical needs in cardiovascular, metabolic and neurodegenerative disease. Using a model building platform the company has developed a suite of over 6,000 mechanism-of-action based models for more than 2,500 protein targets.

TYPE	DESCRIPTION	YEAR	RESEARCH PARTNER / LEAD INVESTORS	AMOUNT, MLN $
Collaboration & Research	N/A	2017	Servier	N/A
Collaboration & Research	N/A	2017	Takeda	N/A
Investments	Series C	2014	Atlas Venture, Lilly Ventures	8.2
Collaboration & Research	N/A	2012	Merck	N/A
Collaboration & Research	N/A	2011	Boehringer Ingelheim	N/A
Investments	Series B	2009	Foundation Capital	5.5
Investments	Series A	2008	N/A	1.1
Investments	Series A	2008	N/A	2.6

Nuritas

Nuritas combines artificial intelligence and genomics to discover and unlock natural Bioactive Peptides with extraordinary health benefits. Proprietary platform of the company targets, predicts and unlocks novel bioactive peptides from food sources. These deliver highly specific, efficient and life-changing health solutions. The company's disruptive computational approach to discovery uses artificial intelligence and genomics to, for the first time ever, rapidly and efficiently predicts and then provides access to the most health-benefiting components hidden within food, called bioactive peptides. The discovery process is begun by precisely defining the health condition and targets to modulate. Then proprietary search tools are used to identify the characteristics specific to the area of focus.

Having begun the discovery process as above, the company takes advantage of multiple proprietary Artificial Intelligence algorithms, including deep learning. Using these, it is now uniquely able to predict which novel food-derived bioactive peptides deliver the predetermined effect that it is seeking. This cuts out many thousands of hours of trial and error.

TYPE	DESCRIPTION	YEAR	RESEARCH PARTNER / LEAD INVESTORS	AMOUNT, MLN $
Collaboration & Research	N/A	2018	Nestlé	N/A
Investments	Series B	2018	European Investment Bank (EIB)	30
Collaboration & Research	N/A	2017	BASF	N/A
Investments	Series A	2017	Cultivian Sandbox Ventures	16
Grant	Grant	2016	European Union	3
Investments	Seed Round	2015	VisVires New Protein	4.8
Investments	Funding Round	2014	NDRC	0.1

PathAi

PathAI's mission is to advance medicine with intelligent pathology. PathAI's platform provides end-to-end data-driven pathology analysis, resulting in fast, accurate and standardized pathologic diagnoses. PathAI's deep-learning solutions drive discovery and predictive diagnostics in drug development. PathAI's technology accelerates R&D efforts and brings standardization to all phases of the drug development pipeline. PathAI is developing clinical decision support tools to improve the clinical workflow and bring increased efficiency, standardization, and clinical insights to diagnostic pathology.

PathAI is working towards improving health around the globe, by building machine learning applications to provide pathologic diagnoses at a low cost in developing nations.

PathAI's goal is to make an enduring impact on patient care by helping hundreds of millions of people receive accurate diagnoses and effective therapies.

TYPE	DESCRIPTION	YEAR	RESEARCH PARTNER / LEAD INVESTORS	AMOUNT, MLN $
Investments	Series A	2017	General Catalyst	11
Collaboration & Research	Improve breast cancer diagnosis using artificial intelligence technology in big data pathology research	2017	Philips	N/A
Collaboration & Research	Review pathology samples and analyze patient response to drugs in clinical trials	2017	Bristol-Myers Squibb	N/A
Investments	Venture Round	2016	N/A	4.2

Recursion Pharmaceuticals

Recursion combines experimental biology, automation, and artificial intelligence in a massively parallel system to quickly and efficiently identify treatments for any disease which can be modeled at the cellular level. From its initial and continued focus on drug repurposing to treat rare diseases, Recursion has broadened its platform to probe rich data from high-throughput automated screens for a number of indications, including aging, inflammation, infectious disease, and immunology. Recursion is aggressively leveraging technology to build a robust and reliable map of human cellular biology, which will enable a radical shift in the pace and scale at which new treatments will benefit patients. The platform has resulted in the massive parallelization of drug discovery. The company has deployed this platform in pursuit of drugs for the treatment of rare genetic diseases.

Armed with experimental protocols, Recursion team generates hundreds of thousands of cellular images every week, transferring each one to the cloud in real-time. Proprietary software leverages the power of computer vision and classic machine learning alongside neural networks to analyze terabytes of this data every week.

TYPE	DESCRIPTION	YEAR	RESEARCH PARTNER / LEAD INVESTORS	AMOUNT, MLN $
Debt Financing	Debt Financing	2018	Square 1 Bank	21
Collaboration & Research	N/A	2017	Takeda	90
Investments	Series B	2017	Data Collective DCVC	60
Collaboration & Research	N/A	2016	Sanofi	N/A
Investments	Series A	2016	Felicis Ventures, Lux Capital	15
Investments	Seed Round	2014	N/A	0.3

Schrödinger

Schrödinger is a leading provider of advanced molecular simulations and enterprise software solutions and services for pharmaceutical, biotechnology, and materials science research. The predictive power of Schrödinger's software allows scientists to accelerate their research and development, reduce research costs, and make novel discoveries that might otherwise not be possible. Schrödinger also establishes deep partnerships and collaborations with companies in such fields as biotechnology, pharmaceuticals, chemicals, and electronics, and helped found the biotech company Nimbus Therapeutics. Through significant long-term investments in basic research, Schrödinger has made scientific breakthroughs across many areas of drug discovery and materials science. Hundreds of peer-reviewed scientific publications by Schrödinger scientists are frequently among the most heavily cited in their fields. Founded in 1990, Schrödinger has operations in the US, Europe, Japan, and India, with business partners in China and Korea.

TYPE	DESCRIPTION	YEAR	RESEARCH PARTNER / LEAD INVESTORS	AMOUNT, MLN $
Investments	Series E	2019	WuXi AppTec, GV, Baron Capital Management, Bill & Melinda Gates Foundation, Qiming Venture Partners	85
Investments	Series D	2015	Bill & Melinda Gates Foundation	22
Investments	Series C	2012	N/A	20
Investments	Series B	2010	Cascade Investment	10

twoXAR

twoXAR is an artificial intelligence-driven drug discovery company. The convergence of big data, cloud computing, and artificial intelligence have allowed twoXAR to build a drug discovery platform that is order of magnitudes faster, cheaper, and more accurate than traditional wet-lab based approaches.

twoXAR leverages its technology internally to build its own pipeline of therapeutic candidates across diseases as well as collaborate with biotechnology and pharmaceutical companies to jointly discover and develop novel drug candidates by: screening compound libraries for efficacy against a disease or list of diseases; identifying new drug candidates from a public library for a disease that can be developed or used as a tool compound to elucidate novel biology & create new chemical entities; identifying biologic targets from the elucidation of novel biology.

Based in Palo Alto, California, the twoXAR team includes experts in drug discovery and development, biomedical informatics, computational biology, data science and software development.

TYPE	DESCRIPTION	YEAR	RESEARCH PARTNER / LEAD INVESTORS	AMOUNT, MLN $
Collaboration & Research	Develop prodrug-based therapies for multiple therapeutic areas and indications.	2018	KemPharm	N/A
Investments	Series A	2018	Softbank Ventures Korea	10
Collaboration & Research	N/A	2017	Santen Pharmaceutical	N/A
Investments	Seed Round	2015	N/A	0.9
Investments	Seed Round	2015	Andreessen Horowitz	3.4

Vyasa Analytics

Vyasa Analytics is known for being the provider of highly-scalable deep learning software and analytics for life sciences and healthcare companies. They enable organizations to ask complex questions across large-scale data sets, and gain critical insights to make better business decisions.

Vyasa Cortex is a collaborative data analytics application powered by novel deep learning technologies. With Cortex, project teams can easily and intuitively add a wide range of data sources and then search, analyze and collaborate on those sources. Neural Concept Recognition technology, specifically built for Cortex, powers set analytics capabilities enabling end users to ask complex questions about concepts of interest in static and streaming data sources. Cortex also enables the use of Vyasa's library of deep learning analytical modules related to life sciences, healthcare, image analysis and predictive analytics.

Vyasa's goal is to help their clients gain the most from their data by implementing deep learning approaches and associated big data infrastructures that generate value through increased access to data insights.

TYPE	DESCRIPTION	YEAR	RESEARCH PARTNER / LEAD INVESTORS	AMOUNT, MLN $
Investments	Debt Financing	2018	MassDevelopment	1.8

WuXi NextCODE

WuXi NextCODE is a global biotechnology company harnessing genomic big data to propel drug discovery, clinical diagnoses, population health, and precision medicine. It is a fully integrated contract genomics organization building the global standard platform for genomic data. Its solutions include cohort sourcing, sequencing, and analysis software for genomic research. The company provides cloud-based infrastructure for digital health strategies. WuXi NextCODE has crafted a common language to harmonize all types of genomic data and unlock insights at unprecedented speed and scale. Its comprehensive platform has been used by world-class hospitals to deliver over 12K diagnoses to rare disease patients. The company serves twelve out of the world's top fifteen pharmaceutical companies. It is also the platform of choice for the world's largest population projects.

The core of WuXi NextCODE's platform is proprietary Genomically Ordered Relational database (GORdb). Proven over more than two decades, with extensive testing and input from the partners, GORdb is developed specifically to be scalable and efficient for genomics in today's big data world. GORdb can be easily used with different software and databases to provide faster and even more advanced analysis capabilities. The GORdb is fully interoperable with existing cloud and other data sources.

TYPE	DESCRIPTION	YEAR	RESEARCH PARTNER / LEAD INVESTORS	AMOUNT, MLN $
Investments	Series C	2018	Ireland Strategic Investment Fund	200
Investments	Series B	2017	Temasek Holdings, YF Capital (Yunfeng Capital)	75
Investments	Series B	2017	Sequoia Capital	165
Investments	Series A	2013	N/A	15
Acquisition	By WuXi AppTec	2010	N/A	N/A

XtalPi

XtalPi is a pharmaceutical technology company that is reinventing the industry's approach to drug research and development with its Intelligent Digital Drug Discovery and Development (ID4) platform. Through its tightly interwoven quantum mechanics, artificial intelligence, and high-performance cloud computing algorithms, the ID4 platform enables pharmaceutical companies to increase their efficiency, accuracy, and success rate at critical stages of drug R&D.

By accelerating the pace of drug discovery and development, XtalPi aims to contribute to a healthier society worldwide. The company is empowering global pharmaceutical and biotech companies to achieve faster, safer, and more cost-effective drug R&D.

XtalPi provides state-of-the-art crystal structure prediction (CSP, also known as polymorph prediction) technology that is pertinent throughout the drug development process and applicable across the biopharmaceutical industry. Combining quantum physics, artificial intelligence, and cloud HPC, XtalPi's CSP technology offers reliable, highly accurate predictions for complex molecular systems within days to weeks, and provides crucial insights on important physicochemical characteristics of the drug molecule, which makes it one of the industry's best solutions for drug solid-state screening and designing.

TYPE	DESCRIPTION	YEAR	RESEARCH PARTNER / LEAD INVESTORS	AMOUNT, MLN $
Collaboration & Research	N/A	2018	Pfizer	N/A
Investments	Series B	2018	Sequoia Capital China	15
Investments	Series B	2018	China Life Healthcare Fund	46
Investments	Series A	2016	FREES FUND, ZhenFund	1.15
Investments	Series A	2015	Tencent Holdings	5

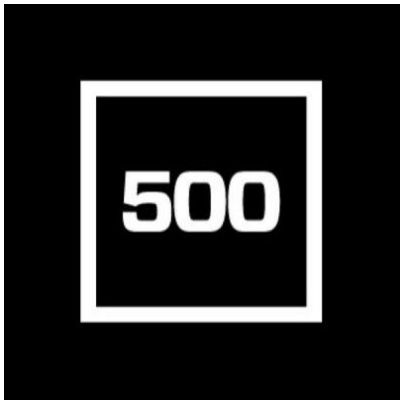
Top-20
AI for Drug Discovery
Investor Profiles

DEEP
KNOWLEDGE
ANALYTICS
PHARMA DIVISION

20 Leading Investors in AI for Drug Discovery Sector

1	500 startups
2	Amadeus Capital Partners
3	AME Cloud Ventures
4	Amgen ventures
5	Andreessen Horowitz
6	Data Collective DCVC
7	Draper associates
8	Felicis ventures
9	General Catalyst
10	GV
11	Khosla Ventures
12	OS Fund
13	Refactor Capital
14	Sequoia Capital
15	SOSV
16	StartX (Stanford-StartX Fund)
17	Tencent Holdings
18	WuXi AppTec
19	Y combinator
20	ZhenFund

500 Startups



500 Startups is a global venture capital seed fund with a network of startup programs headquartered in Silicon Valley and is the #1 most active seed fund in the world.

500's mission is to discover and back the world's most talented entrepreneurs, help them create successful companies at scale, and build thriving global ecosystems. Since its inception, 500 Startups have made it its mission to find and empower talented founders, whether they're across the world or overlooked in its own backyard.

500 Startups typically invest between $25K-$250K USD in its first check, however, they also make selective follow-on investments at Series A/B of up to $1M USD. 500 Startups is based in San Francisco, California but its companies, mentors, and advisers come from 60+ countries around the world.

COMPANY NAME	FUNDING ROUND	YEAR	AMOUNT, MLN $
BenchSci	Series A	2018	N/A
Transcriptic	Series A	2015	8.5
uBiome	Product Crowdfunding	2013	0.351

Amadeus Capital Partners

Amadeus Capital Partners is a global technology investor. Since 1997, the firm has backed more than 150 companies and raised over $1bn for investment. Amadeus Capital Partners invests in consumer services, financial technology, artificial intelligence, cybersecurity, medical technology, digital health and digital media.

Pioneering businesses they've backed include gene-sequencing innovators Solexa, massively parallel simulation platform Improbable.io, cybersecurity vendor ForeScout, Optos, producer of advanced retinal imaging, and Kreditech, provider of financial products to the 'underbanked'. Amadeus Capital Partners offers over 20 years' experience in technology investment. They invest across the world, from their bases in Bangalore, Cambridge, Cape Town, London and San Francisco. They focus on early stage, primary and secondary growth capital and emerging markets.

COMPANY NAME	FUNDING ROUND	YEAR	AMOUNT, MLN $
Antidote	Series A	2013	3.2
Antidote	Series B	2015	13.5
Antidote	Venture Round	2011	1.2
Healx	Series A	2018	10
Healx	Seed Round	2016	1.8
Synthace	Series A	2017	9.1

AME Cloud Ventures

AME Cloud Ventures is the venture fund led by Jerry Yang, co-founder of Yahoo! AME Cloud Ventures focuses on seed to later stage companies building infrastructure and value chains around data. AME Cloud Ventures loves technology-heavy companies gathering or creating unique data at every stage of the data stack — from infrastructure all the way to applications, mobile, and sensors.

AME Cloud Ventures strive to find, fund, and support true entrepreneurs. They provide a unique and genuine set of resources to their founding teams, from strong operational and business experience to networks of amazing mentors and international partners, particularly China. 'Ame', pronounced 'ah-may', means rain in Japanese - a reflection on our belief that accurate, actionable data will be a major life-blood in the future economy.

COMPANY NAME	FUNDING ROUND	YEAR	AMOUNT, MLN $
Atomwise	Seed Round	2015	6
Cambridge Cancer Genomics	Seed Round	2018	4.5
BioAge Labs	Series A	2017	10.9
Recursion Pharmaceuticals	Series A	2016	2.2
Recursion Pharmaceuticals	Series A	2016	12.9
Transcriptic	Venture Round	2016	13.4
Transcriptic	Series A	2015	8.5
Transcriptic	Seed Round - Transcriptic	2014	2.8

Amgen ventures

Amgen Ventures is a venture capital investment arm of Amgen Inc. specializing in investments in early and later-stage companies. 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. In discovery research and technology, the firm focuses on early-stage drug discovery collaborations, innovative chemical entity collections, diagnostics and biomarkers, novel antibody platforms, assay biologicals and devices, and target-focused structural biology and computational tools. It primarily invests in the North America, Europe, and the United Kingdom. The firm typically invests between $2 million and $3 million per transaction and may invest up to $10 million per company. Amgen Ventures was founded in 2004 and is based in San Francisco, California with additional offices in Seattle, Washington; Thousand Oaks, California; and Cambridge, Massachusetts.

COMPANY NAME	FUNDING ROUND	YEAR	AMOUNT, MLN $
GNS Healthcare	Venture Round	2017	6
WuXi NextCODE	Series B	2017	75

Andreessen Horowitz

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 the social media business and technology sector with a focus on software, back-end infrastructure, infrastructure of the Internet, cloud computing, enterprise software and services, consumer, business Internet, mobile-Internet, consumer Internet, cloud computing, data storage, social network browsers data-storage, consumer electronics, networking functions, 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.

COMPANY NAME	FUNDING ROUND	YEAR	AMOUNT, MLN $
BioAge Labs	Series A	2017	10.9
Insitro	Series A	2018	N/A
TwoXAR	Series A	2018	10
TwoXAR	Seed Round	2015	3.4
uBiome	Series A	2014	4.5

Data Collective DCVC

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.

Data Collective's leaders have been investing for two decades, with over 150 companies still going strong and 40 material exits to date for entrepreneurs and investors.

The firm brings to bear more than 35 experienced technology executives and experts (CTOs, CIOs, Chief Scientists, Principal Engineers, Professors at Stanford and Berkeley) with significant tenures at institutions ranging from Akamai to Zynga.

COMPANY NAME	FUNDING ROUND	YEAR	AMOUNT, MLN $
Atomwise	Seed Round	2015	6
Atomwise	Series A	2018	45
Recursion Pharmaceuticals	Series B	2017	60
Recursion Pharmaceuticals	Series A	2016	2.2
Recursion Pharmaceuticals	Series A	2016	12.9
Transcriptic	Venture Round	2016	13.4
Transcriptic	Series A	2015	8.5
Transcriptic	Seed Round	2014	2.8

Draper Associates

Draper Associates is a seed stage venture fund in Menlo Park, CA. Draper Associates invest globally, in great teams of people creating revolutionary companies in new media, gaming, SaaS, cloud, new finance, IOT, and mobile.

Draper Associates typically invest in the earliest round, in syndicate with other sophisticated investors. They are comfortable leading in dollars and terms, or participating. They are venture advisers: help where and when asked to get their companies to the next stage of growth, otherwise stay out of the entrepreneurs' way. While each investment is unique, Draper Associates often help their company's with business development, later stage capital raising, strategy, hiring, employee options, valuations, and M&A.

COMPANY NAME	FUNDING ROUND	YEAR	AMOUNT, MLN $
Atomwise	Seed Round	2015	6
CloudMedX	Venture Round	2017	5.3
Verge Genomics	Seed Round	2015	4

Felicis Ventures

Founded in 2006, Felicis Ventures is a boutique venture capital firm based in Menlo Park. They invest in iconic companies reinventing core markets (Adyen, Credit Karma, Clearslide, Rovio, Shopify), as well as those creating frontier markets (Guardant Health, Fitbit, Gingko Bioworks, Planet Labs, Vicarious).

More than 70 Felicis portfolio companies have exited, including Meraki (acquired by Cisco), Twitch (acquired by Amazon), Brightroll (acquired by Yahoo), Dropcam (acquired by Google), Ring (acquired by Amazon), Shopify (NYSE:SHOP), Fitbit (NYSE:FIT), Rovio (HEL:ROVIO), Pluralsight (NASDAQ:PS), and Adyen (AMS: ADYEN).

COMPANY NAME	FUNDING ROUND	YEAR	AMOUNT, MLN $
BioAge Labs	Series A	2017	10.9
Recursion Pharmaceuticals	Series B	2017	60
Recursion Pharmaceuticals	Series A	2016	2.2
Spring Discovery	Series A	2018	18

General Catalyst

General Catalyst is a venture capital firm that makes early-stage and transformational investments. General Catalyst backs exceptional entrepreneurs who are building innovative technology companies and market-leading businesses, including Airbnb, BigCommerce, ClassPass, Datalogix, Datto, Demandware, Gusto (fka ZenPayroll), The Honest Company, HubSpot, KAYAK, Oscar, Snap, Stripe, and Warby Parker.

The General Catalyst team leverages its broad experience to help founders build extraordinary companies. General Catalyst has offices in Cambridge, MA, Palo Alto, CA and New York City. General Catalyst has managed eight venture capital funds totaling approximately $3.75 billion in capital commitments.

COMPANY NAME	FUNDING ROUND	YEAR	AMOUNT, MLN $
PathAI	Series A	2017	11

GV

Launched as Google Ventures in 2009, GV is the venture capital arm of Alphabet, Inc. They've invested in more than 300 companies that push the edge of what's possible. In the fields of life science, healthcare, artificial intelligence, robotics, transportation, cybersecurity, and agriculture, their companies aim to improve lives and change industries.

They've built a team of world-class engineers, designers, physicians, scientists, marketers, and investors who work together to provide these startups with exceptional support on the road to success. They help their companies interface with Google, providing unique access to the world's best technology and talent.

COMPANY NAME	FUNDING ROUND	YEAR	AMOUNT, MLN $
Celsius Therapeutics	Series A	2018	65
Insitro	Series A	2018	N/A
Owkin	Series A	2018	5
Transcriptic	Seed Round	2014	2.8
Transcriptic	Seed Round	2012	1.2
ZappRx	Series B	2017	25

Khosla Ventures

Khosla Ventures is a venture capital firm that started in 2004 by Vinod Khosla, Co-Founder of Sun Microsystems. The firm focuses on environmentally friendly technologies in addition to the traditional venture areas. With over five billion dollars under management, the firm focuses on a broad range of areas including consumer, enterprise, education, advertising, financial services, semiconductors, health, big data, agriculture/food, sustainable energy and robotics. Khosla Ventures is headquartered in Menlo Park, Calif.

COMPANY NAME	FUNDING ROUND	YEAR	AMOUNT, MLN $
Atomwise	Seed Round	2015	6
Atomwise	Series A	2018	45
Deep Genomics	Series A	2017	13
ThoughtSpot	Series D	2018	145
ThoughtSpot	Series C	2016	50
ThoughtSpot	Series B	2014	30

OS Fund

OS Fund invests in entrepreneurs using applied intelligence to commercialize breakthrough discoveries in genomics, synthetic biology, diagnostics, new materials development and energy. OS Fund seeks out platform enabling technologies that accelerate discovery and commercialization. OS Fund never invests in a single molecule, model or algorithm. They do hard science investing with technology level risk. They work with their portfolio companies to develop foundational IP that solves real-world challenges and paves a path for commercialization. OS Fund has thoughtfully constructed a cross-disciplinary group of companies that are each uniquely contributing to the robust ecosystem they all need to thrive.

Four years later, OS Fund performance is in the top decile among U.S. firms. Of the 28 investments, OS Fund has 4 unicorns, 26 up valuations, and 2 acquisitions.

COMPANY NAME	FUNDING ROUND	YEAR	AMOUNT, MLN $
Atomwise	Seed Round	2015	6
Emerald Cloud Lab	Series C	2015	20.5
TwoXAR	Series A	2018	10
uBiome	Series C	2018	83
uBiome	Series A	2014	4.5
uBiome	Seed Round	2014	N/A
Verge Genomics	Series A	2018	32
Verge Genomics	Seed Round	2015	4

Refactor Capital

Refactor Capital is a $50M early-stage venture capital firm that invests in founders tackling problems in hard but not impossible areas such as applied biology, healthcare, crypto, food, wellness, transportation, aerospace, and more. Refactor Capital invests primarily in seed-stage companies, helping define go-to-market strategies and navigate the various challenges founders encounter. Refactor Capital prefers using their Series Seed docs when leading a round but remains flexible.

Refactor Capital believes that the most valuable opportunity set for startups in the next few decades will be the creative destruction of the status quo in industries that have so far resisted innovation. The way to get there might be different, but these areas are unexceptional in one important aspect: they will yield to progress like all other industries before them.

COMPANY NAME	FUNDING ROUND	YEAR	AMOUNT, MLN $
Cambridge Cancer Genomics	Seed Round	2018	4.5
PathAI	Series A	2017	11
PathAI	Venture Round	2016	4.2
Verge Genomics	Seed Round	2015	4

Sequoia Capital

From idea to IPO and beyond, the Sequoia team helps a small number of daring founders build legendary companies. Sequoia Capital spurs them to push the boundaries of what's possible. In partnering with Sequoia, companies benefit from their unmatched network and the lessons they've learned over 45 years working with Steve Jobs, Larry Ellison, John Morgridge, Jerry Yang, Elon Musk, Larry Page, Jan Koum, Brian Chesky, Drew Houston, Adi Tatarko and Jack Dorsey, among many others. In aggregate, Sequoia-backed companies account for more than 20% of NASDAQ's total value. Sequoia Capital is proud that their success also fuels great causes. The vast majority of money they invest is on behalf of non-profits and schools like the Ford Foundation, Mayo Clinic and MIT, which means that the returns generated from the incredible achievements of founders can make a massive difference.

COMPANY NAME	FUNDING ROUND	YEAR	AMOUNT, MLN $
Athelas	Seed Round	2017	3.5
Berkeley Lights	Series C	2015	56.5
Berkeley Lights	Series D	2018	95
WuXi NextCODE	Series C	2018	200
WuXi NextCODE	Series B	2017	165

SOSV

SOSV runs the world's leading accelerator programs in hardware, life sciences, cross-border internet/mobile in Asia, food, and blockchain. SOSV has >$525M in assets under management and provides seed, venture, and growth-stage funding to startups. Their market-specific accelerator programs are located in the US, Asia, and Europe. The firm has a staff of over 90 worldwide, and 620+ global mentors. SOSV is headquartered in Princeton, New Jersey with offices in San Francisco, New York, Cork, Boston, Shenzhen, Shanghai, London and Taipei. Over the past 20 years, the firm has funded well over 600 startups and currently to fund over 150 startups per year. All startups are funded initially through SOSV accelerators. SOSV invests substantial effort in social innovation and transformation in various fields, especially in education and computing, where the company and its staff have supported or founded such initiatives as Coderdojo, Open Ireland, Mathletes, Khan Academy, WeForest and more.

COMPANY NAME	FUNDING ROUND	YEAR	AMOUNT, MLN $
A2A Pharmaceuticals	Seed Round	2016	N/A
Mendel.ai	Seed Round	2017	2
Mendel.ai	Convertible Note	2016	N/A
Mendel.ai	Seed Round	2016	N/A
Synthace	Series B	2018	25.6
Synthace	Series A	2018	N/A
Synthace	Series A	2017	9.2
Synthace	Series A	2014	2.7

StartX (Stanford-StartX Fund)

StartX is a Stanford-affiliated nonprofit in Silicon Valley that runs one of the world's top startup accelerator programs. Their mission is to advance the development of the best entrepreneurs through experiential education and peer learning. Since launching in 2010, they have supported more than 450 companies and 1000 entrepreneurs, from early to the pre-IPO stage, working across a wide spectrum of industries. StartX and StartX Med, dedicated to medical and biotechnology innovation, provide founders with access to a powerful network of entrepreneurs, investors, mentors, and industry partners, along with office space and a variety of other resources. Based in Palo Alto, the accelerator also operates StartX-QB3 Labs and the Stanford-StartX Fund. They are funded by Stanford University, Stanford Health Care, Microsoft, Steelcase, Hyundai, Oriza Ventures, Nissan, Panasonic, Lightspeed Venture Partners, Analog Devices, Silicon Valley Bank, Greylock Partners, Sequoia Capital, and many others.

COMPANY NAME	FUNDING ROUND	YEAR	AMOUNT, MLN $
Globavir	Venture Round	2015	4
NuMedii	Series A	2015	2
TwoXAR	Seed Round	2015	3.4
uBiome	Series B	2016	22

Tencent Holdings

Founded in November 1998, Tencent is a leading provider of Internet value-added services in China. Since its establishment, Tencent has maintained steady growth under its user-oriented operating strategies. It is Tencent's mission to enhance the quality of human life through Internet services. Presently, Tencent provides social platforms and digital content services under the “Connection” Strategy. The development of Tencent has profoundly influenced the ways hundreds of millions of Internet users communicate with one another as well as their lifestyles. It also brings possibilities of a wider range of applications to China’s Internet industry. With its R&D staff comprising more than 60% of its employee base, Tencent has obtained patents relating to technologies in various areas such as instant messaging, e-commerce, online payment services, search engine, information security, gaming, and many more.

COMPANY NAME	FUNDING ROUND	YEAR	AMOUNT, MLN $
Atomwise	Series A	2018	45
iCarbon X	Series A	2016	155
XtalPi	Series B	2018	15

WuXi AppTec

WuXi AppTec Group is a leading pharmaceutical, biopharmaceutical, and medical device capability and technology platform company with 16,000 employees globally, including more than 13,000 dedicated scientists. Through its 28 R&D sites worldwide, and a total of 6.0 million square feet of office, laboratory and manufacturing space, WuXi Group provides comprehensive platform capabilities in small molecule R&D and manufacturing, biologics R&D and manufacturing, cell and gene therapy R&D and manufacturing, medical device testing, and molecular testing and genomics.

Today, WuXi platform is enabling more than 3,000 innovative collaborators from more than 30 countries to bring innovative healthcare products to patients.

COMPANY NAME	FUNDING ROUND	YEAR	AMOUNT, MLN $
Engine Biosciences	Seed Round	2018	10
Insilico Medicine	Series A	2018	6
Transcriptic	Venture Round	2016	13.4
Verge Genomics	Series A	2018	32

Y Combinator

Y Combinator is a startup accelerator based in Mountain View, CA. In 2005, Y Combinator developed a new model of startup funding. Twice a year they invest a small amount of money ($120K) in a large number of startups. The startups move to Silicon Valley for 3 months. The YC partners work closely with each company to get them into the best possible shape and refine their pitch to investors. Each cycle culminates in Demo Day when the startups present their business plans to a carefully selected, audience of investors. All venture investors supply some combination of money and help. In Y Combinator's case, the money is by far the smaller component. In fact, many of the startups they fund don't need the money. Y Combinator thinks of the money they invest as more like financial aid in college: it's so people who do need the money can pay their living expenses while Y Combinator is happening.

COMPANY NAME	FUNDING ROUND	YEAR	AMOUNT, MLN $
Athelas	Seed Round	2017	3.5
Atomwise	Series A	2018	45
Atomwise	Seed Round	2015	6
Cambridge Cancer Genomics	Seed Round	2018	4.5
Reverie Labs	Seed Round	2018	N/A
Transcriptic	Seed Round	2014	0.12
uBiome	Series C	2018	83
uBiome	Series A	2014	4.5
Verge Genomics	Seed Round	2015	0.12

ZhenFund

ZhenFund is a seed stage focused venture fund founded in 2011 by Bob Xu and Victor Wang, in collaboration with Sequoia Capital China. Bob and Victor previously co-founded New Oriental (NYSE: EDU), one of the world's largest education conglomerates. Three of Bob's seed investments have IPOed in NYC: Shiji Jiayuan (Nasdaq: DATE), LightInTheBox (Nasdaq: LITB) and Jumei (NYSE: JMEI). In 2016, Bob was honored on the Midas List as one of the top 100 tech investors. ZhenFund currently dominates China's early-stage venture capital scene and is rapidly expanding its U.S. practice based in Palo Alto, CA. Its portfolio has over 150 high-growth companies, including 17zuoye, OFO, VIPKID, RED, Hero Entertainment, and Urwork. ZhenFund's mission is to support, educate, and inspire the next generation of global entrepreneurs.

COMPANY NAME	FUNDING ROUND	YEAR	AMOUNT, MLN $
Deep Intelligent Pharma	Series A	2018	6.6
Deep Intelligent Pharma	Seed Round	2017	N/A
Spring Discovery	Series A	2018	18
Transcriptic	Venture Round	2016	13.4
uBiome	Series B	2016	22
XtalPi	Series A	2016	1.1

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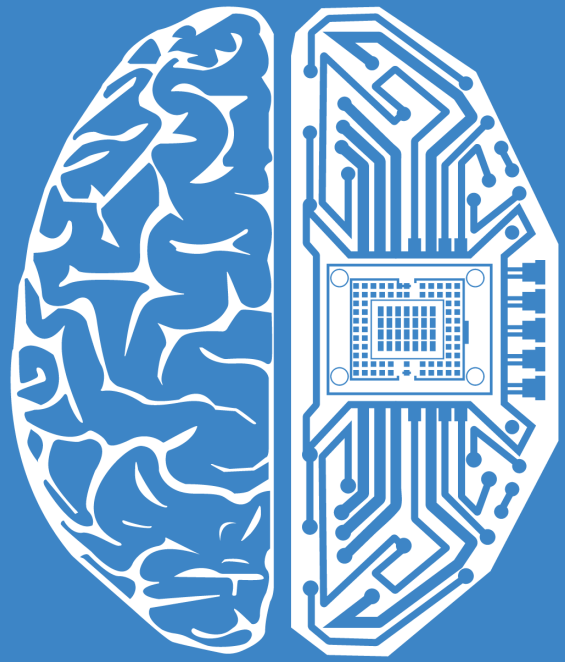

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