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twoXAR

http://www.twoxar.com

- twoXAR is an AI-driven drug discovery company founded in 2014
    - Based in Mountain View, California
- Mission: to improve health through computational medicine
- Through the convergence of big data, cloud computing, and AI, they have built a drug discovery platform that is faster, cheaper, and more accurate than traditional approaches
- The company uses its AI platform to identify promising drug candidates and decreases risks through preclinical studies
- twoXAR develop their own drug candidates using their technology as well as collaborate with biotechnology and pharmaceutical companies to jointly discover new drug candidates
- They are profit-generating business
- Co-founding team is from the Stanford School of Medicine and the MIT Sloan School of Management
- twoXAR's AI-based platform help to create portfolios of drug programs more efficiently through predictive models
    - this accelerates the drug development process, decreases risk, and substantially reduces overall costs
- Andrew A. Radin is the CEO and Co-Founder of twoXAR
    - He developed the company's unique algorithm
    - Studied biomedical informatics in Stanford University's SCPD graduate program
    - Has a Master of Science and Bachelor of Science degree in computer science
- Andrew M. Radin (same name different person) is the other co-founder
    - He operates as the Chief Marketing Officer of twoXAR
    - Holds a Master in Business Administration from MIT Sloan, a Bachelor of Science in biochemistry and cell biology from UCSD + a Bachelor of Arts in economics from UCSD
- The company's biopharmaceutical partners include:
    - Santen
    - KemPharm
    - adynxx
    - 1stBio
- They appointed Judy Lewent, Jonathan MacQuitty, and Howie Ronsen (combined they have almost 90 years of combined R&D and commercial experience in the biopharmaceutical sector) to establish a Business Advisory Board in November of 2017
- In March 2018, the company raised $10 million in Series A financing led by SoftBank Ventures (a SoftBank Group early stage venture capital arm)
    - Andreessen Horowitz Bio Fund and OS Fund also joined in on the efforts
    - Money will be used to build the company's drug pipeline through partnerships and to accelerate preclinical development of existing candidates

- twoXAR previously raised $4.3 million in seed financing from investors including Andreessen Horowitz, CLI Ventures, and Stanford-StartX Fund
- In October 2018, KemPharm Inc (a clinical-stage specialty pharmaceutical company focused on the discovery and development of proprietary prodrugs) and twoXAR announced they entered a technology collaboration to develop prodrug-based therapies for multiple therapeutic areas and indications
    - Will combined twoXAR's AI-based technology to identify and de-risk drug product candidates wit KemPharm's LAT technology (developed to create new prodrugs that are designed to address unmet patient needs)
    - This collaboration is meant to improve the profile of drug product candidates and generate long-lived composition-of-matter patents
    - KemPharm also executed a research and license agreement with Novoxar Inc. (a subsidiary of twoXAR), under which they will begin research to develop a prodrug that may form the basis of a target drug product candidate of Novoxar in a therapeutic area that has not yet been disclosed
        - This will make KemPharm eligible to receive specified license fees, payment, and royalties on commercial sales of any product developed under this agreement
- On November 15, 2018 Adynxx Inc. (a clinical stage biotechnology company focused on pain and inflammation) and twoXAR announced an agreement to develop an oral, non-hormonal drug therapy with the potential to address the underlying mechanisms of endometriosis and improve upon the standard of care
    - twoXAR will use its AI technology to identify a set of drug candidates with the potential to treat or prevent the recurrence of endometriosis and associated symptoms
    - Adynxx will select candidates from this set to test for efficacy using *in vivo* models of endometriosis based on predetermined criteria
    - Following identification of one or more candidates, Adynxx will conduct preclinical characterization work, IND-enabling work, and clinical development
- At the end of November, 2018 twoXAR received a $225K Phase 1 Small Business Innovation Research award from the National Cancer Institute of Health
    - This one-year award will fund a program for twoXAR to use its AI-driven platform to identify and validate new, first0in-class drug candidates for pancreatic ductal adenocarcinoma (PDAC) that could improve patient survival outcomes
    - twoXAR will use its platform to identify drug candidates predicted to be efficacious for PDAC and then these compounds will be evaluated using *in vitro* and *in vivo* preclinical assays
- At the beginning of 2019, twoXAR announced an agreement with 1st Biotherapeutics Inc. (a preclinical-stage biotechnology company focused on neurodegenerative diseases, immune-oncology, and orphan diseases) to jointly discover and develop novel, efficacious treatments to address unmet medical needs in glioblastoma multiforme
    - twoXAR will use its AI technology to identify a set of drug candidates with the potential to slow, stop, or reverse the progression of glioblastoma
    - The two companies will then select candidates from this set to test in preclinical efficacy models of glioblastoma

    - Once one or more candidate have been identified, 1st Biotherapeutics will use its expertise in drug development to optimize candidates and finalize the creation of novel, efficacious treatments

- LinkedIn page of Andrew A. Radin (CEO and Co-founder) - https://ca.linkedin.com/in/andrewradin?trk=org-employees_mini-profile_title
- LinkedIn page of Brian Moriarty (CFO) - https://ca.linkedin.com/in/brianmoriarty?trk=org-employees_mini-profile_title

https://www.crunchbase.com/organization/twoxar-incorporated#section-interest-signals-by-bombora

- Competetors:
    - Recursion Pharmaceuticals - https://www.recursionpharma.com
    - Cyclica - https://cyclicarx.com
    - BenevolentAI - https://benevolent.ai
- Number of employees: 11-50
- Conducted 2 rounds of funding and raised $14.3M in total
- 5 investors:
    - Andreessen Horowitz
    - StartX
    - Softbank Ventures
    - OS Funch
    - CLI Ventures

https://www.fiercebiotech.com/biotech/ai-player-twoxar-teams-up-1st-biotherapeutics-team-glioblastoma

- twoXAR uses AI to speed up drug discovery and identify drugs that have the highest probability to move forward into clinical trials and benefit patients
    - Does this by crunching data to make predictions
    - Hey incorporate every possible bit of data they can get for that disease to come up with statistical prediction on which drug candidates will be efficient in treating it
- Radin the CMO states that the quickest way to get programs up and running is through partnerships
- Since their focus is discovery, their plan is to first build up many partnerships and many candidates

https://www.openpr.com/news/1590042/Incredible-possibilities-of-Artificial-Intelligence-In-Life-Sciences-Market-2019-With-huge-Growth-by-Focusing-on-Players-as-IBM-Corporation-AiCure-LLC-NuMedii-twoXAR-Atomwise-Lifegraph-Limited-Cyrcadia-Health-Zebra-Medical-Vision-APIXIO-Enlitic.html

- twoXAR was listed as a key player in the AI in life sciences market in the Research Insights report

https://medium.com/future-literacy/moving-drug-discovery-into-the-fast-lane-os-fund-invests-in-twoxars-ai-driven-approach-67c907fc68f7

- twoXAR can rapidly move from input data to drug candidates that can be tested *in vivo* – reducing the time and cost associated with drug development
- Jeff Klunzinger (Founder and GP at OS Fund) believes twoXAR's platform will lead to a portfolio of drug programs unprecedented in scale and scope
- twoXAR's platform has produced real results in animal studies → with 30% of their drug candidates showing efficacy across four different diseases
    - Traditional discovery methods yield a ~2% success rate and this stage of drug development
- twoXAR's validation studies have led to multiple collaboration
    - Including one with Santen to discover new treatments for glaucoma
- twoXAR has proven industry expertise in computational discovery as well as pharmaceutical development
- Their AI-driven approach allows twoXAR to build a portfolio at a massive scale with a capacity to identify promising drug candidates for hundreds to thousands of disease
    - They have already tackled hepatocellular carcinoma (liver cancer), rheumatoid arthritis, type 2 diabetes, and many more diseases
- The scalability and efficiency of twoXAR's platform allows them to extract high-value drugs from existing compound libraries before other companies using existing high-throughout screening methods
    - Can screen compound libraries to identify drug candidates more efficiently → resulting in lead candidates in a matter of weeks
- twoXAR is less likely to produce false-positive drug candidates because it uses multiple computational methods to corroborate results.
    - The degree of confidence is much higher with twoXAR's predictions because they use multiple unbiased, statistically-independent, and optimized methods—applying multiple lenses to the same data for better results.
- They are also more likely to identify promising drugs others might miss
    - twoXAR looks for patterns across diverse and independent data sources of biological, chemical, and clinical data to identify drug-diseases assoications
- most other AI-driven drug discovery companies use fewer data points sources which narrows their perspective

https://www.forbes.com/sites/intelai/2019/02/11/how-ai-is-revolutionizing-drug-discovery/#5e40776eab4a

- Getting from an initial idea to the start of the animal-testing phase typically takes 4-6 years
    - Using AI has allowed twoAXR to reduce that time to about 3 months

https://medcitynews.com/2017/03/twoxar-artificial-intelligence-drug-discovery/

- AI takes away human bias
- twoXAR's platform can sift through both small and large molecule libraries
- The company's aim is to use AI to make predictions that can drive rational decision making in drug discovery
- In February 2017, twoXAR announced a partnership with Osaka, Japan-based Santen Pharmaceutical

    - twoXAR will use its AI platform to discover, screen, and prioritize novel drug candidates that are most likely to treat ocular indications, specifically glaucoma
- Previous to this the platform was applied to hepatocellular carcinoma (HCC or liver cancer) to screen a library of more than 25000 potential drug candidates
    - They then identified the 10 top candidates for HCC
    - Proof-of-concept studies were then performed by the Asian Liver Center at Stanford University
    - They then fond that its candidate, TXR-311 showed positive results in cell-based assays
    - https://www.businesswire.com/news/home/20170314005606/en/twoXAR-Announces-Preclinical-Proof-of-Concept-Data-Liver-Cancer

https://www.businesswire.com/news/home/20170619006292/en/twoXAR-Announces-Preclinical-Proof-of-Concept-Data-Type-2
June 19, 2017

- twoXAR announced that its candidate, TXR-411 ha shown promising results in the db/db mouse model of type 2 diabetes
    - TXR-411 is a molecule that twoXAR identified as having a high probability of being effective in treating T2DM
    - Proof-of-concept studies in the db/db mouse model were performed by Melior Discovery (a leading research provider of preclinical services)
    - The aim of these studies was to demonstrate proof of concept of twoXAR's AT platform as a discovery engine capable of uncovering new therapies across a diverse set of diseases
- Initial examination of TXR-411 data showed an approx. 50% decrease in glucose levels without the weight gain associated with rosiglitazone
- twoXAR was able to select this disease, identify and shortlist candidates, and generate efficacious preclinical results in less than 3 months
- In the last 12 months, twoXAR publicly announced positive preclinical proof-of-concept data in rheumatoid arthritis, liver cancer, and now type 2 diabetes
    - Across these studies, 30% of the novel candidates they tested in preclinical studies showed statistically significant efficacy signals in the *in vivo* models' respective endpoints

http://www.pharmexec.com/emerging-pharma-leaders-andrew-radin-and-andrew-m-radin

- Their approach places the cloud in the service of investigatory biology with a customized software – trademarked DUMA
    - This software can roman unbiased through billions of data points associated with a specific disease indication to tease out trends and abnormalities and render likely drug candidates and predictive assessments
    - It does this at a rate 175000 times faster than conventional screening methods
- It adds more certainty to early-stage markers, which helps de-risk the odds for failures in later stages of development