

**[Asan Nanum Foundation & DLG Special AI Lecture]  
The Integrated Entrepreneur - Combining Technical  
Excellence, Human Wisdom, and Market Mastery**

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**Founder & Leader of Silicon Valley Privacy-Preserving AI Forum**

**Advisor to KASPA of AI Semiconductor @ KASPA**

**Global Leadership Initiative Fellow @ Salzburg Global Seminar**

**Visiting & Advisory Professor @ Sogang University & DGIST**

## About Speaker

- *Co-Founder & CTO @ Erudio Bio, Inc., San Jose & Novato, CA, USA* 2023 ~
- *Co-Founder & CEO @ Erudio Bio Korea, Inc., Korea* 2025 ~
- *Leader of Silicon Valley Privacy-Preserving AI Forum (K-PAI), CA, USA* 2024 ~
- *Advisor to Korean American Semiconductor Professional Alliance (KASPA)* 2026 ~
- *CGO / Global Managing Partner @ LULUMEDIC, Seoul, Korea* 2025 ~
- *KFAS-Salzburg Global Leadership Fellow @ Salzburg Global Seminar, Austria* 2024 ~
- *Adjunct Professor, EE Department @ Sogang University, Seoul, Korea* 2020 ~
- *Advisory Professor, EECS Department @ DGIST, Korea* 2020 ~
- *AI-Korean Medicine Integration Initiative Task Force Member @ The Association of Korean Medicine, Seoul, Korea* 2025 ~
- *Director of AI Semiconductor @ K-BioX, CA, USA* 2025 ~
- *Global Advisory Board Member @ Innovative Future Brain-Inspired Intelligence System Semiconductor of Sogang University, Korea* 2020 ~
- *Technology Consultant @ Gerson Lehrman Group (GLG), NY, USA* 2022 ~
- *Advisor @ CryptoLab, Inc., Seoul, Korea* 2025 ~

- Co-Founder & CTO / Head of Global R&D / Chief Applied Scientist / Senior Fellow @ Gauss Labs, Inc., Palo Alto, CA, USA 2020 ~ 2023
- Senior Applied Scientist @ Amazon.com, Inc., Vancouver, BC, Canada 2017 ~ 2020
- Principal Engineer @ Software R&D Center, Samsung Electronics 2016 ~ 2017
- Principal Engineer @ Strategic Marketing & Sales, Memory Business 2015 ~ 2016
- Principal Engineer @ DT Team, DRAM Development, Samsung 2012 ~ 2015
- Senior Engineer @ CAE Team, Memory Business, Samsung, Korea 2005 ~ 2012
- PhD - Electrical Engineering @ Stanford University, CA, USA 2001 ~ 2004
- Development Engineer @ Voyan, Santa Clara, CA, USA 2000 ~ 2001
- MS - Electrical Engineering @ Stanford University, CA, USA 1998 ~ 1999
- BS - Electrical & Computer Engineering @ Seoul National University 1994 ~ 1998

## Highlight of Career Journey

- BS in Electrical Engineering (EE) @ Seoul National University
- MS & PhD in Electronics Engineering (EE) @ Stanford University
  - *Convex Optimization - Theory, Algorithms & Software*
  - advisor - *Prof. Stephen P. Boyd*
- Principal Engineer @ Samsung Semiconductor, Inc.
  - *AI & Convex Optimization*
  - collaboration with *DRAM/NAND Design/Manufacturing/Test Teams*
- Senior Applied Scientist @ Amazon.com, Inc.
  - *e-Commerce AIs* - anomaly detection, deep RL, and recommender system
  - *Jeff Bezos's project* - drove \$200M in sales via Amazon Mobile Shopping App
- *Co-Founder & CTO / Global R&D Head & Chief Applied Scientist* @ Gauss Labs, Inc.
- *Co-Founder & CTO* @ Erudio Bio, Inc.
- *Co-Founder & CEO* @ Erudio Bio Korea, Inc.

# Unpacking AI for Leadership, Technology, and Legal Systems

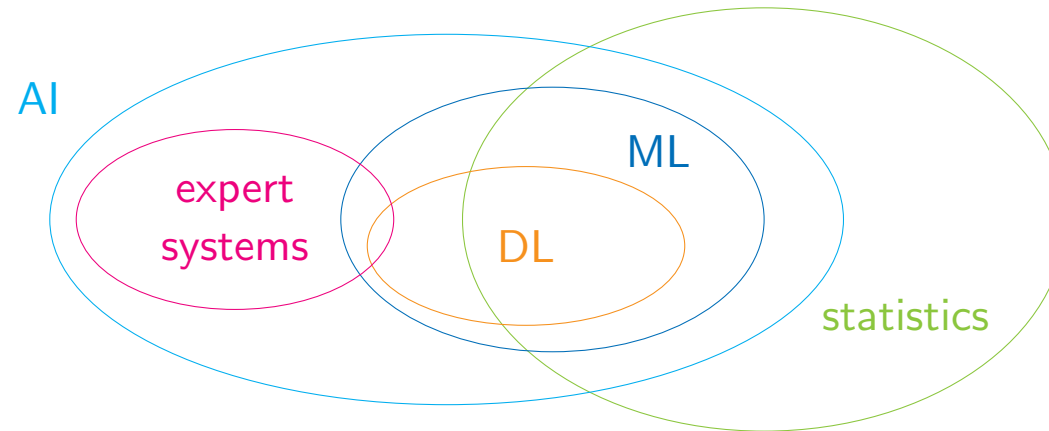
- Artificial Intelligence - 5
  - AI history & recent significant achievements, market indicators
- AI Agents - 30
  - LLM as highly effective knowledge-transfer representation learner
- Silicon Valley's Cultural Engine - 38
  - innovation ecosystem of Silicon Valley, founding and scaling startups
- Appendices
  - AI and Biotech - 47
    - AI in biology & AlphaFold 3 / Emerging Trends in Biotech
  - Erudio Bio / Erudio Bio Korea - 66
    - Versatile Smart Assay (VSA) platform with Gates Foundation's support
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# **Artificial Intelligence**

## **Definition and History**

## Definition & relation to other technologies

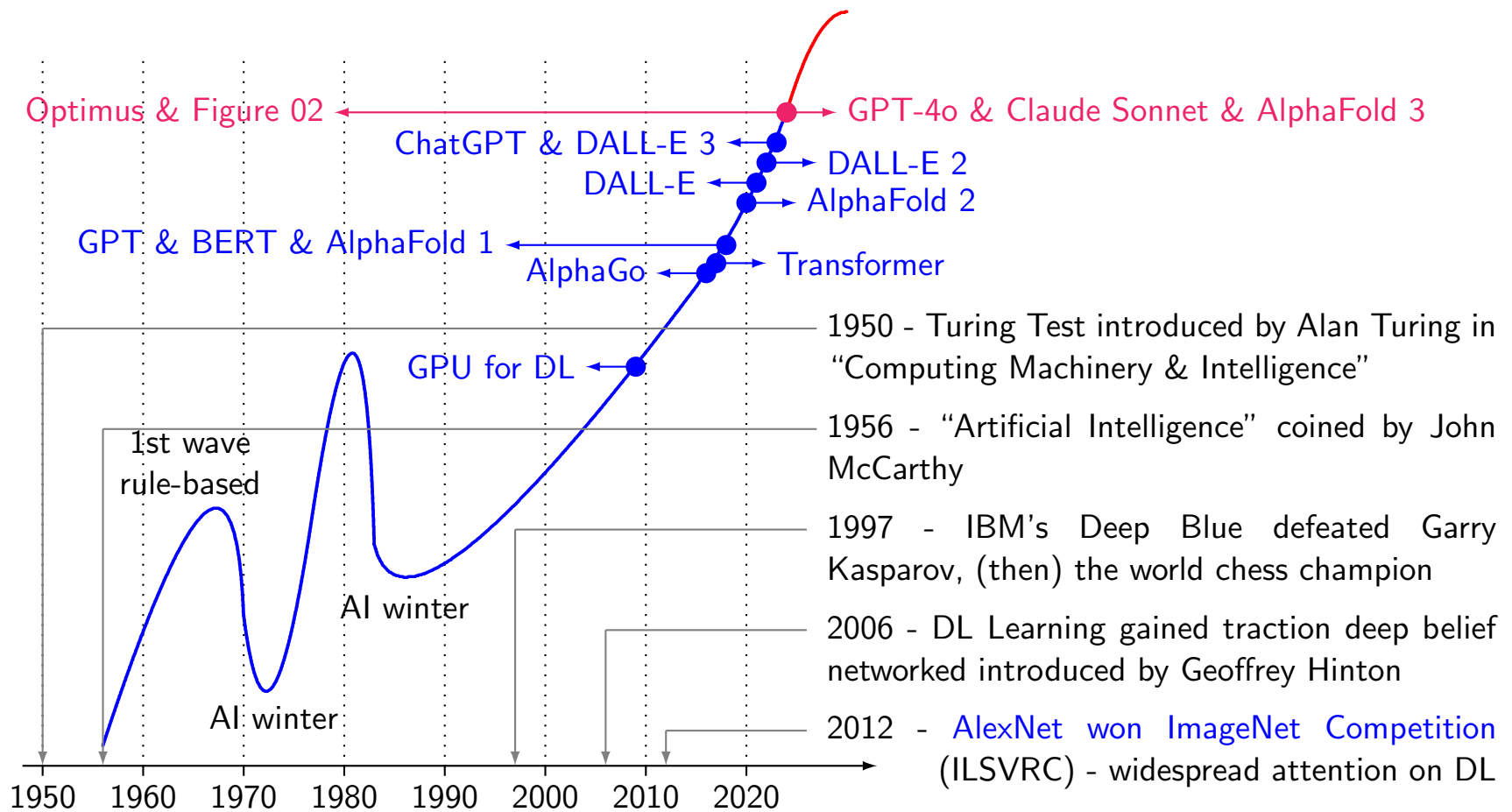
- AI
  - is technology doing tasks requiring human intelligence, such as learning, problem-solving, decision-making & language understanding
  - encompasses *range of technologies, methodologies, applications & products*
- AI, ML, DL, statistics & expert system<sup>1</sup> [HGH<sup>+</sup>22]



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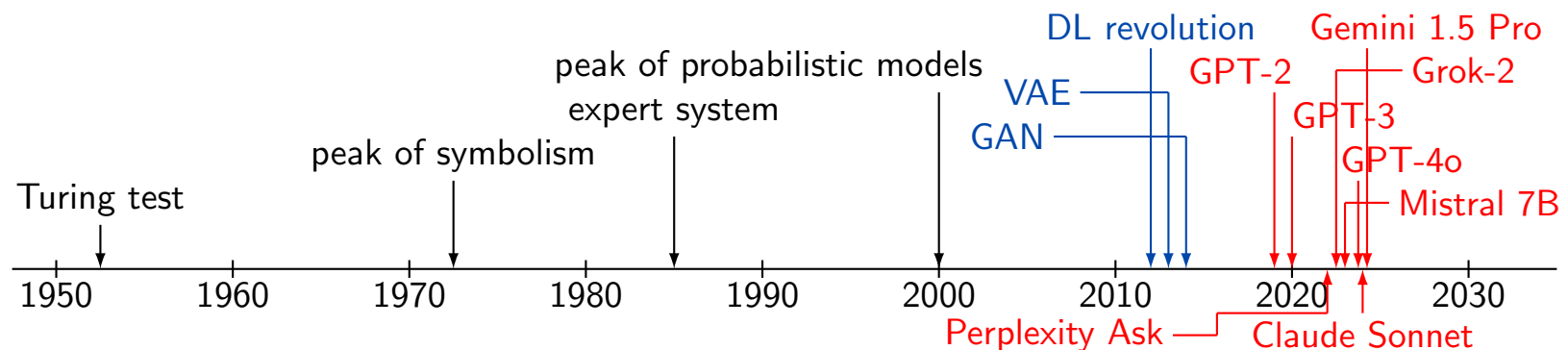
<sup>1</sup>ML: machine learning & DL: deep learning

# History



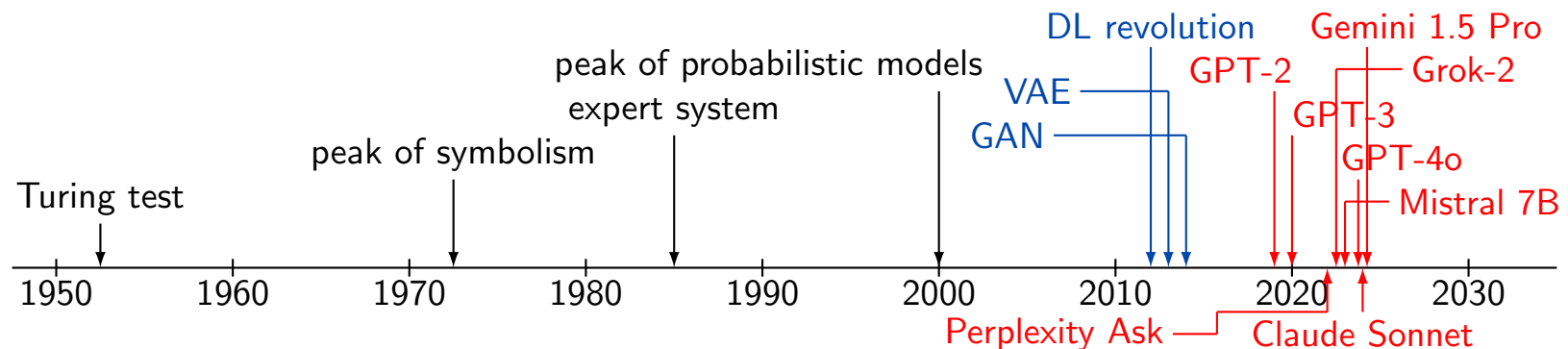
## Birth of AI - early foundations & precursor technologies

- 1950s ~ 1970s
  - Alan Turing - concept of *“thinking machine”* & *Turing test* to evaluate machine intelligence (1950s)
  - *symbolists* (as opposed to connectionists) - early AI focused on symbolic reasoning, logic & problem-solving - Dartmouth Conference in 1956 by *John McCarthy, Marvin Minsky, Allen Newell & Herbert A. Simon*
  - precursor technologies - genetic algorithms (GAs), Markov chains & *hidden Markov models (HMMs)* - laying foundation for generative processes (1970s ~)



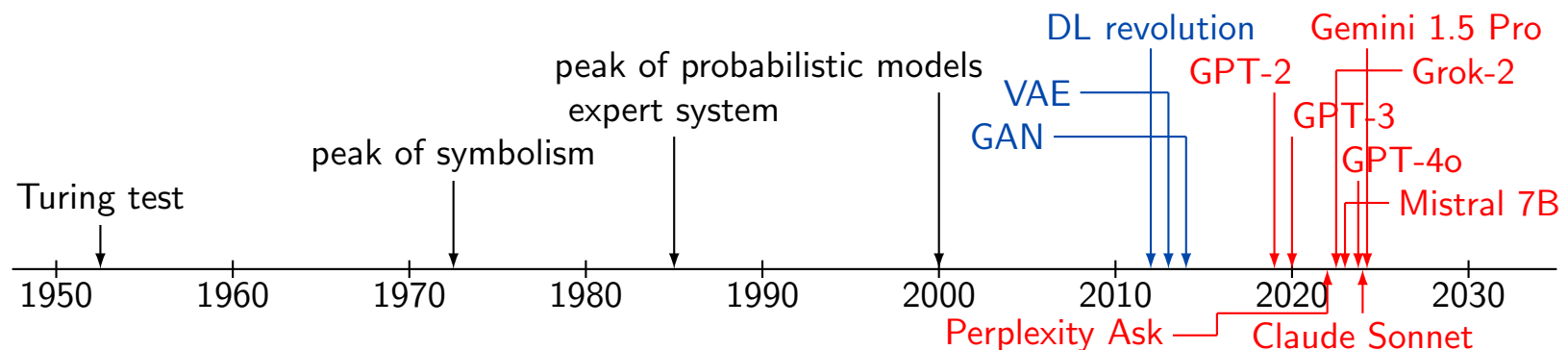
## Rule-based systems & probabilistic models

- 1980s ~ early 2000s
  - *expert systems* (1980s) - AI systems designed to mimic human decision-making in specific domains
  - development of neural networks (NN) w/ backpropagation *training multi-layered networks* - setting stage for way more complex generative models
  - *probabilistic models* (including network models, *i.e.*, Bayesian networks) & Markov models - laying groundwork for data generation & pattern prediction



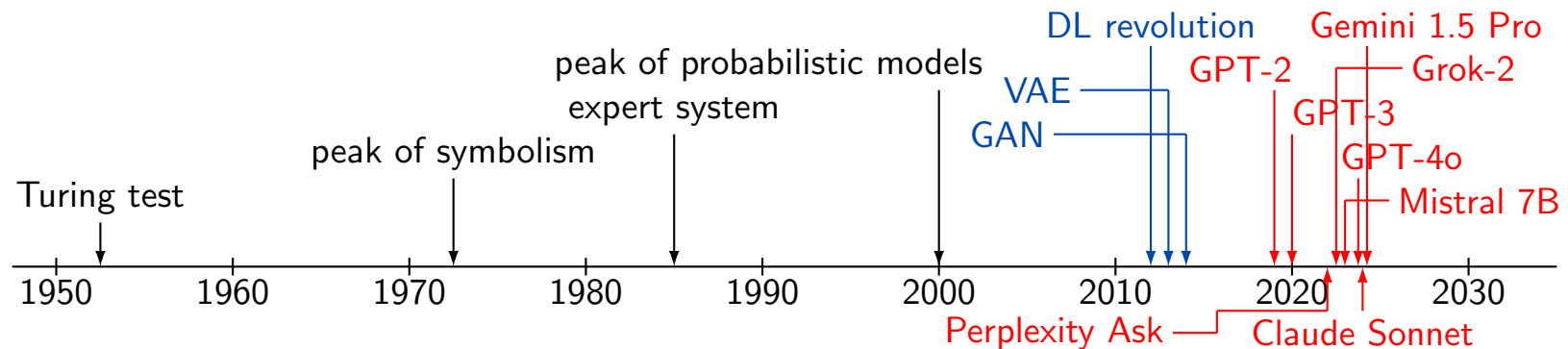
## Rise of deep learning & generative models

- 2010s - breakthrough in genAI
  - *deep learning (DL) revolution* - advances in GPU computing and data availability led to the rapid development of deep neural networks.
  - *variational autoencoder (VAE)* (2013) - by Kingma and Welling - learns mappings between input and latent spaces
  - *generative adversarial network (GAN)* (2014) - by Ian Goodfellow - game-changer in generative modeling where two NNs compete each other to create realistic data
    - widely used in image generation & creative tasks



## Transformer models & multimodal AI

- late 2010s ~ Present
  - Transformer architecture (2017) - by Vaswani et al.
    - *revolutionized NLP*, e.g., LLM & various genAI models
  - GPT series - generative pre-trained transformer
    - GPT-2 (2019) - generating human-like texts - *marking leap in language models*
    - GPT-3 (2020) - 175B params - set *new standards for LLM*
  - multimodal systems - DALL-E & CLIP (2021) - *linking text and visual data*
  - emergence of diffusion models (2020s) - new approach for generating high-quality images - progressively “denoising” random noise (DALL-E 2 & Stable Diffusion)



## **Significant AI Achievements - 2014 – 2025**

## Deep learning revolution

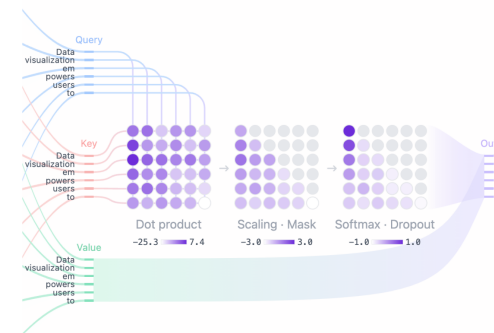
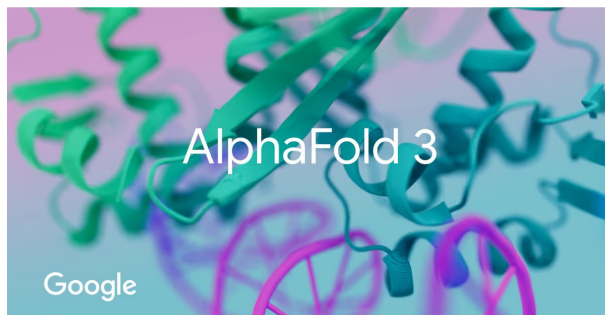
- 2012 – 2015 - DL revolution<sup>2</sup>
  - CNNs demonstrated exceptional performance in image recognition, *e.g.*, [AlexNet's victory in ImageNet competition](#)
  - widespread adoption of DL learning in CV transforming industries
- 2016 - AlphaGo defeats human Go champion
  - DeepMind's AlphaGo defeated world champion in Go, extremely complex game [believed to be beyond AI's reach](#)
  - significant milestone in RL - AI's potential in solving complex & strategic problems



<sup>2</sup>CV: computer vision, NN: neural network, CNN: convolutional NN, RL: reinforcement learning

## Transformer changes everything

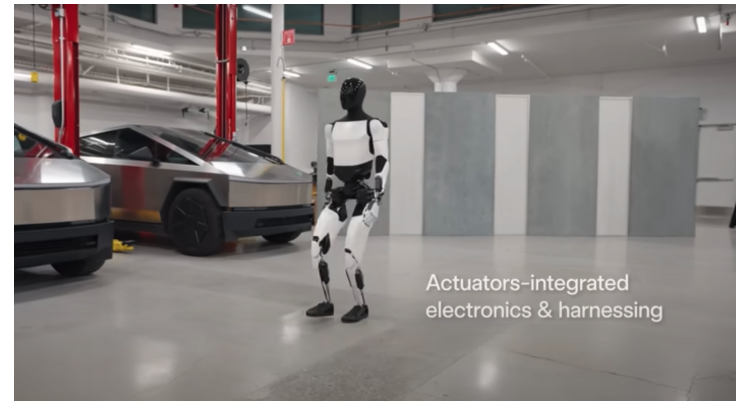
- 2017 – 2018 - Transformers & NLP breakthroughs<sup>3</sup>
  - *Transformer (e.g., BERT & GPT) revolutionized NLP*
  - major advancements in, e.g., machine translation & chatbots
- 2020 - AI in healthcare – AlphaFold & beyond
  - DeepMind's *AlphaFold solves 50-year-old protein folding problem* predicting 3D protein structures with remarkable accuracy
  - accelerates drug discovery and personalized medicine - offering new insights into diseases and potential treatments



<sup>3</sup>NLP: natural language processing, GPT: generative pre-trained transformer

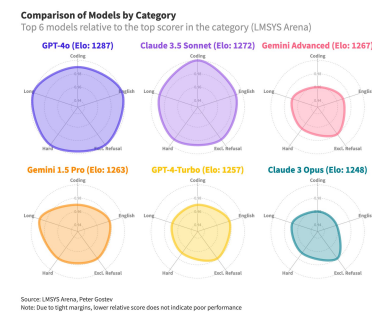
## Lots of breakthroughs in AI technology and applications in 2024

- proliferation of advanced AI models
  - GPT-4o, Claude Sonnet, Claude 3 series, Llama 3, Sora, Gemini
  - *transforming industries* such as content creation, customer service, education, *etc.*
- breakthroughs in specialized AI applications
  - Figure 02, Optimus, AlphaFold 3
  - driving unprecedented advancements in automation, drug discovery, scientific understanding - *profoundly affecting healthcare, manufacturing, scientific research*



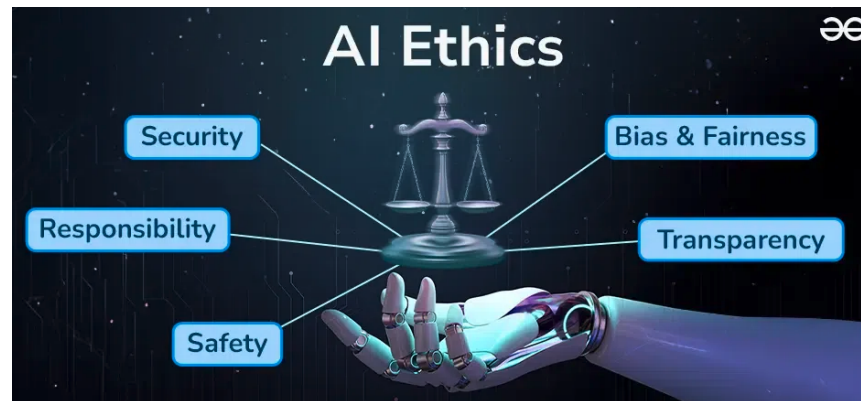
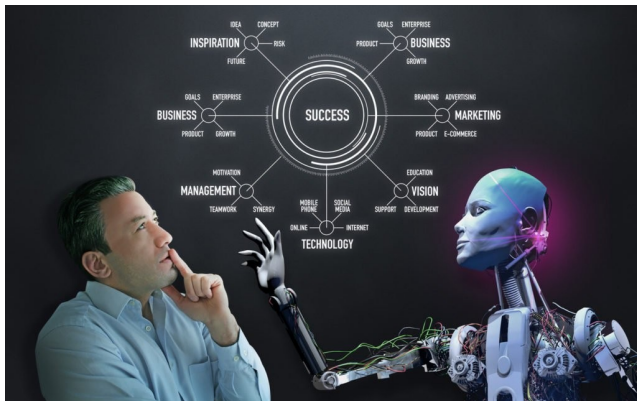
## Major AI Breakthroughs in 2025

- next-generation foundation models
  - GPT-5 and Claude 4 demonstrate emergent reasoning abilities
  - open-source models achieving parity with leading commercial systems from 2024
- hardware innovations
  - NVIDIA's Blackwell successor architecture delivering 3-4x performance improvement
  - AMD's MI350 accelerators challenging NVIDIA's market dominance
- AI-human collaboration systems
  - seamless multimodal interfaces enabling natural human-AI collaboration
  - AI systems effectively explaining reasoning and recommendations
  - augmented reality interfaces providing real-time AI assistance in professional contexts



## Transformative impact of AI - reshaping industries, work & society

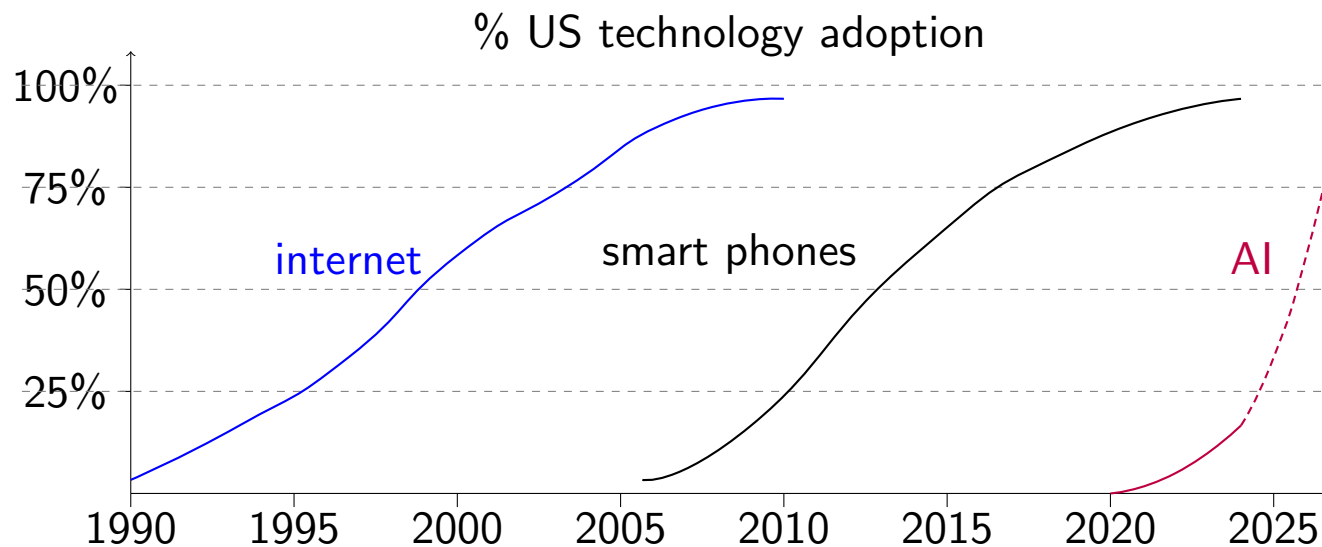
- accelerating human-AI collaboration
  - not only reshaping industries but *altering how humans interact with technology*
  - AI's role as collaborator and augmentor redefines productivity, creativity, the way we address global challenges, *e.g.*, *sustainability & healthcare*
- AI-driven automation *transforms workforce dynamics* - creating new opportunities while challenging traditional job roles
- *ethical AI considerations* becoming central not only to business strategy, but to society as a whole - *influencing regulations, corporate responsibility & public trust*



# Measuring AI's Ascent

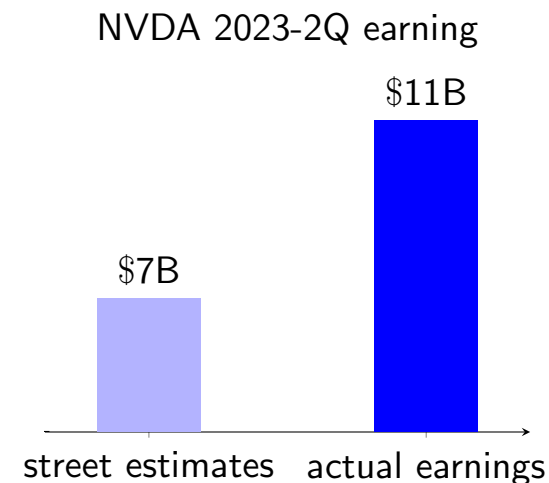
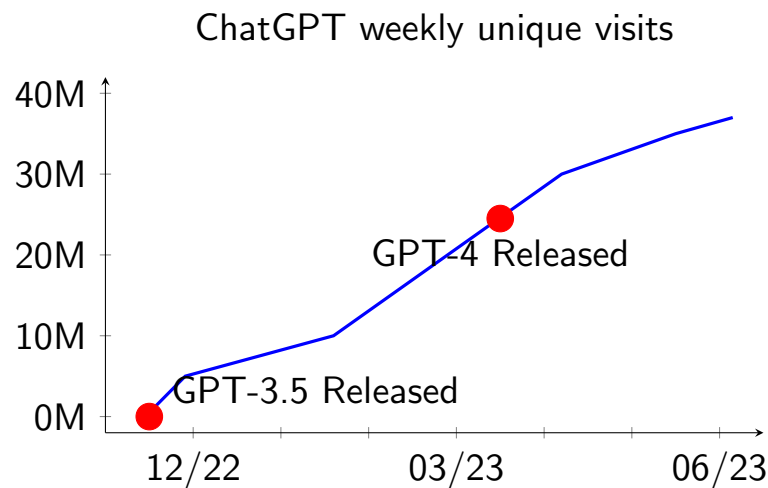
## Where are we in AI today?

- sunrise phase - currently experiencing dawn of AI era with significant advancements and increasing adoption across various industries
- early adoption - in early stages of AI lifecycle with widespread adoption and innovation across sectors marking significant shift in technology's role in society



## Explosion of AI ecosystems - ChatGPT & NVIDIA

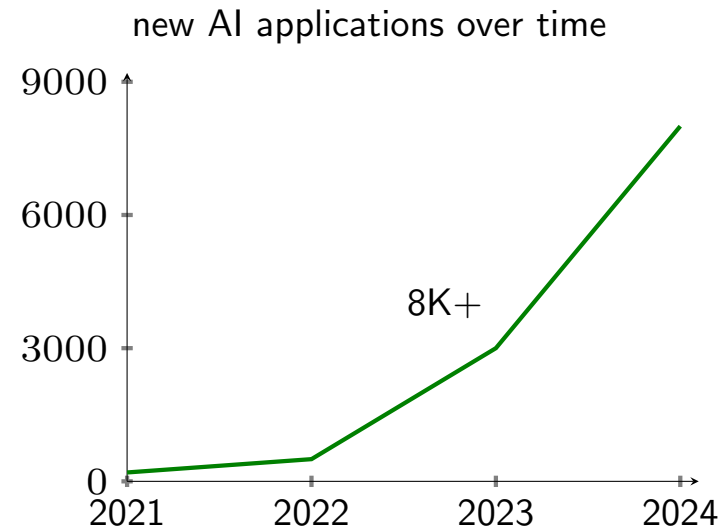
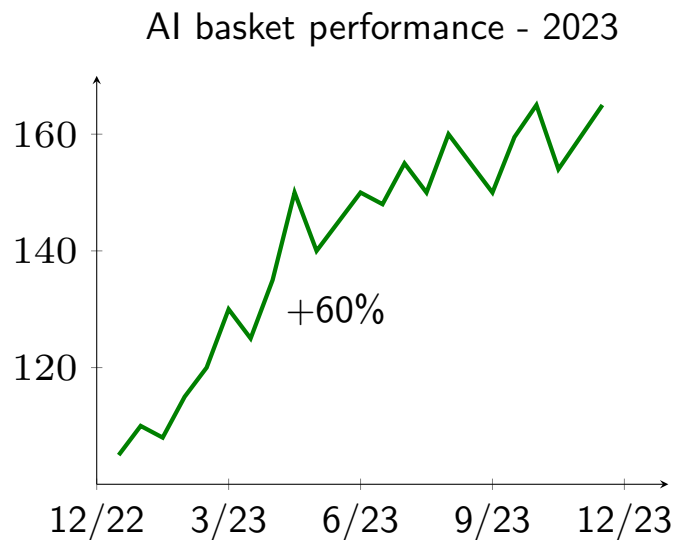
- took only *5 months for ChatGPT users to reach 35M*
- NVIDIA 2023 Q2 earning exceeds market expectation by big margin - \$7B vs \$13.5B
  - surprisingly, *101% year-to-year growth*
  - even more surprisingly *gross margin was 71.2%* - up from 43.5% in previous year<sup>4</sup>



<sup>4</sup>source - Bloomberg

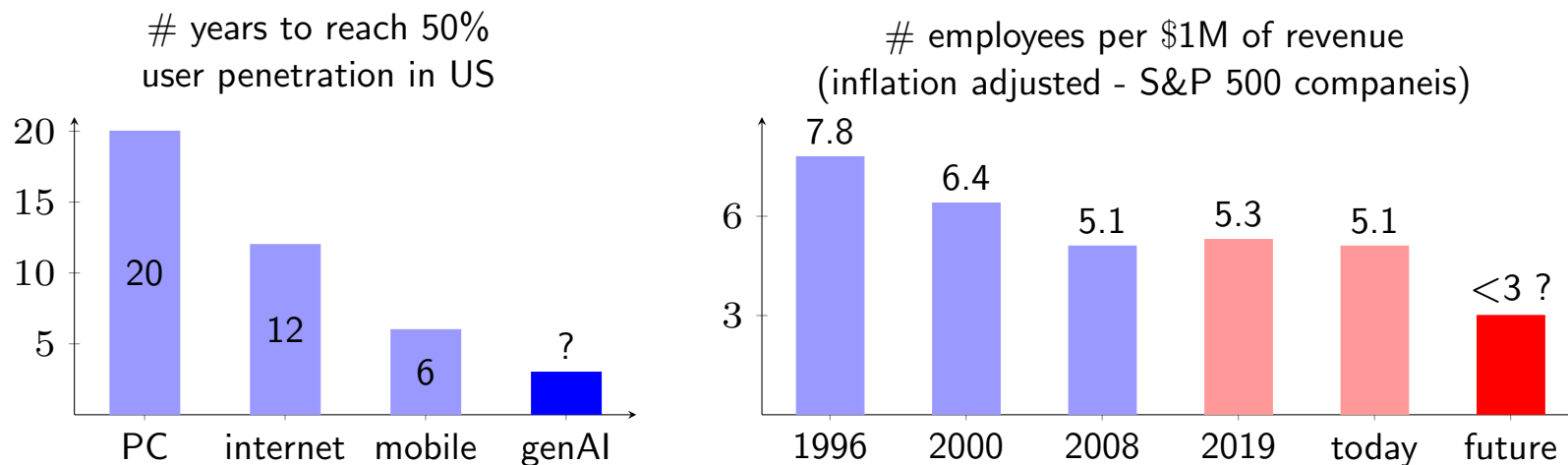
## Explosion of AI ecosystems - AI stock market

- *AI investment surge in 2023 - portfolio performance soars by 60%*
  - AI-focused stocks significantly outpaced traditional market indices
- *over 8,000 new AI applications* developed in last 3 years
  - applications span from healthcare and finance to manufacturing and entertainment



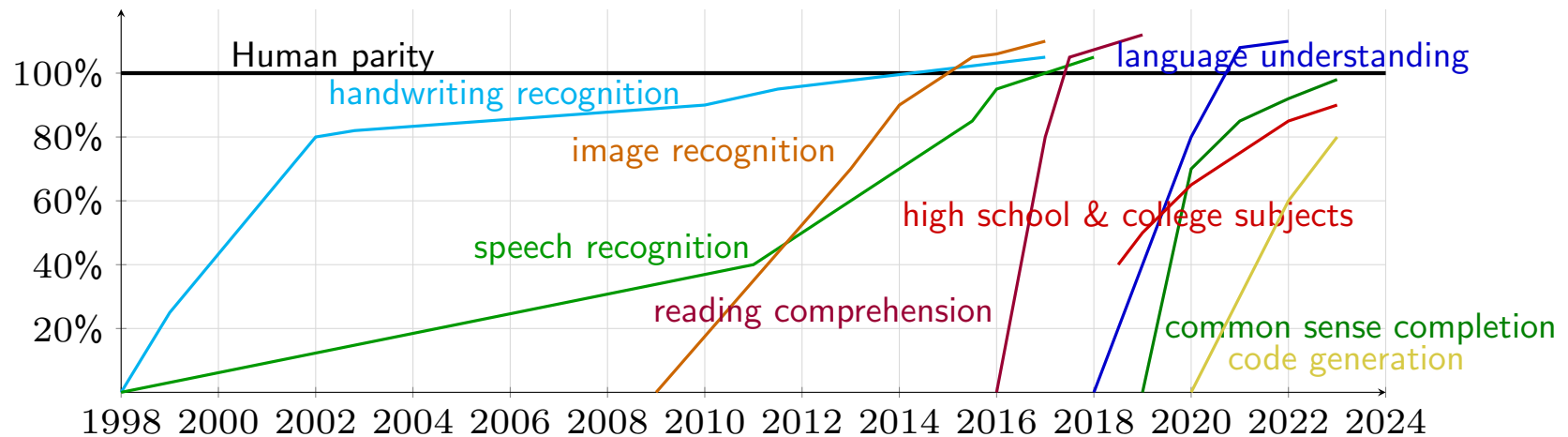
## AI's transformative impact - adoption speed & economic potential

- adoption - has been twice as fast with platform shifts suggesting
  - increasing demand and readiness for new technology improved user experience & accessibility
- AI's potential to drive economy for years to come
  - 35% improvement in productivity driven by introduction of PCs and internet
  - greater gains expected with AI proliferation



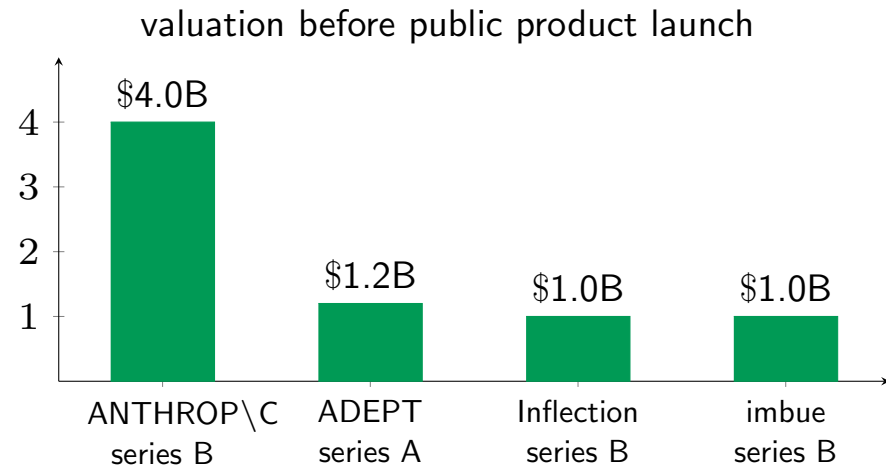
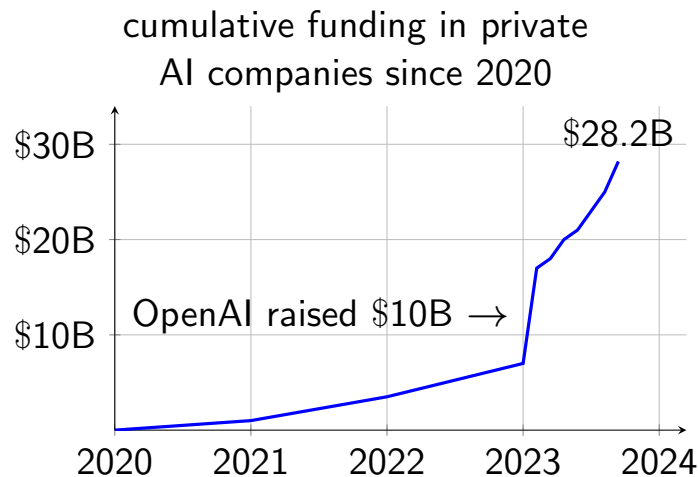
## AI getting more & more faster

- steep upward slopes of AI capabilities highlight accelerating pace of AI development
  - period of exponential growth with AI potentially mastering new skills and surpassing human capabilities at ever-increasing rate
- closing gap to human parity - some capabilities approaching or arguably reached human parity, while others having still way to go
  - achieving truly human-like capabilities in broad range remains a challenge



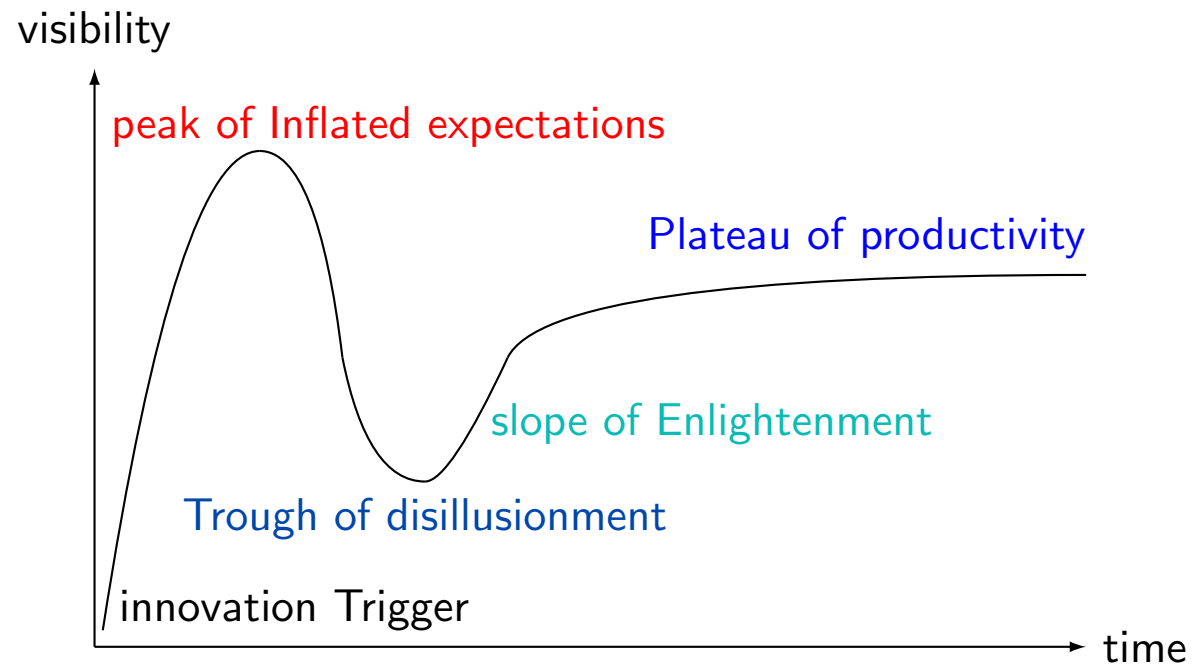
## Massive investment in AI

- *explosive growth* - cumulative funding skyrocketed reaching staggering \$28.2B
- OpenAI - significant fundraising (= \$10B) fueled rapid growth
- *valuation surge* - substantial valuations even before public products for stellar companies
- *fierce competition for capital* among AI startups driving innovation & accelerating development
- massive investment indicates *strong belief in & optimistic outlook for potential of AI* to revolutionize industries & drive economic growth



**Is AI hype?**

## Technology hype cycle



- innovation trigger - technology breakthrough kicks things off
- peak of inflated expectations - early publicity induces many successes followed by even more
- trough of disillusionment - expectations wane as technology producers shake out or fail
- slope of enlightenment - benefit enterprise, technology better understood, more enterprises fund pilots

## Fiber vs cloud infrastructure

- fiber infrastructure - 1990s
  - Telco Co's raised \$1.6T of equity & \$600B of debt
  - bandwidth costs decreased 90% within 4 years
  - companies - Covage, NothStart, Telligent, Electric Lightwave, 360 networks, Nextlink, Broadwind, UUNET, NFS Communications, Global Crossing, Level 3 Communications
  - became *public good*
- cloud infrastructure - 2010s
  - entirely new computing paradigm
  - mostly public companies with data centers
  - *big 4 hyperscalers generate* \$150B + annual revenue



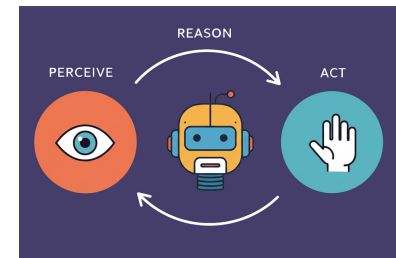
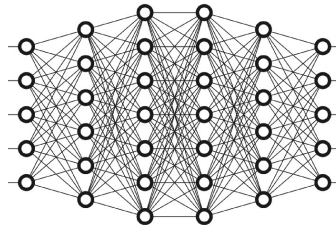
## Yes & No

characteristics of hype cycles	speaker's views
value accrual misaligned with investment	<ul style="list-style-type: none"><li>● OpenAI still operating at a loss; business model <i>still</i> not clear</li><li>● gradual value creation across broad range of industries and technologies (<i>e.g.</i>, CV, LLMs, RL) unlike fiber optic bubble in 1990s</li></ul>
overestimating timeline & capabilities of technology	<ul style="list-style-type: none"><li>● self-driving cars delayed for over 15 years, with limited hope for achieving level 5 autonomy</li><li>● AI, however, has proven useful within a shorter 5-year span, with enterprises eagerly adopting</li></ul>
lack of widespread utility due to technology maturity	<ul style="list-style-type: none"><li>● AI already providing significant utility across various domains</li><li>● vs quantum computing remains promising in theory but lacks widespread practical utility</li></ul>

# AI Agents

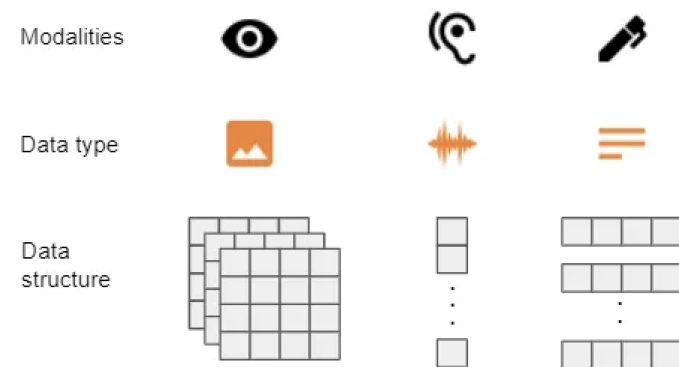
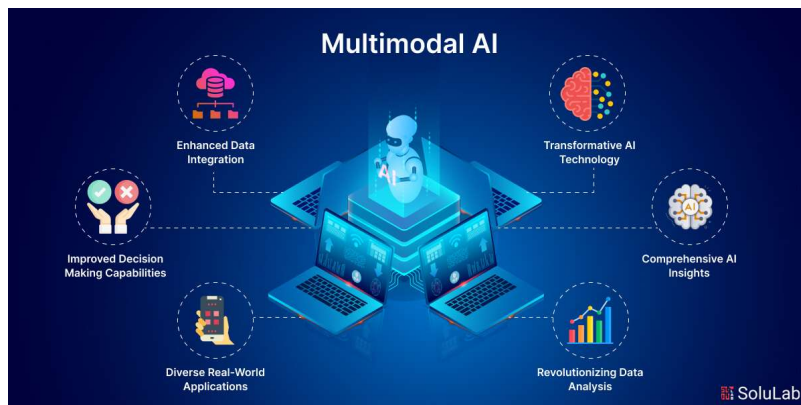
## AI progress in 21st century in keywords

- 2010 ~ Big Data
- 2012 ~ Deep Learning
- 2017 ~ Transformer - Attention is All you need!
- 2022 ~ LLM & genAI
- 2024 ~ AI Agent (Agentic AI)



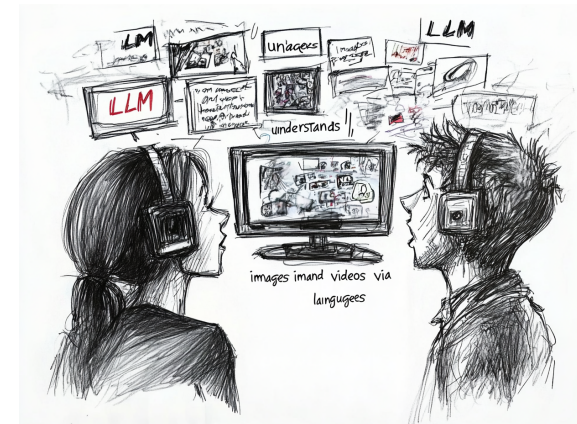
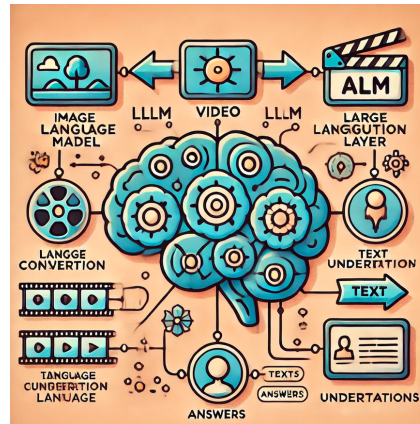
## Multimodal learning

- understand information from multiple modalities, *e.g.*, text, images, audio, video
- representation learning methods
  - combine multiple representations or learn multimodal representations simultaneously
- applications
  - images from text prompt, videos with narration, musics with lyrics
- collaboration among different modalities
  - understand image world (open system) using language (closed system)



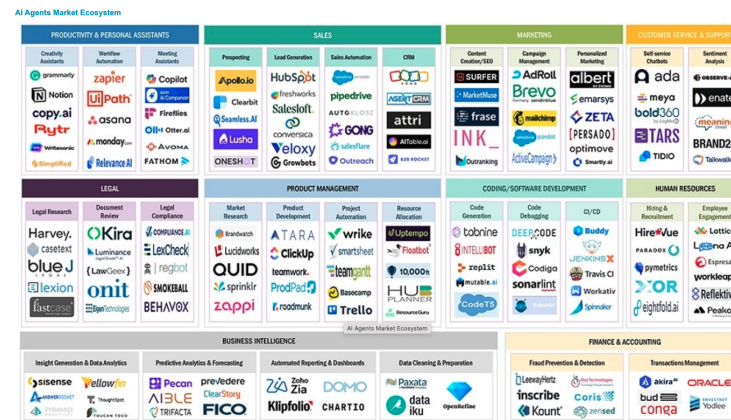
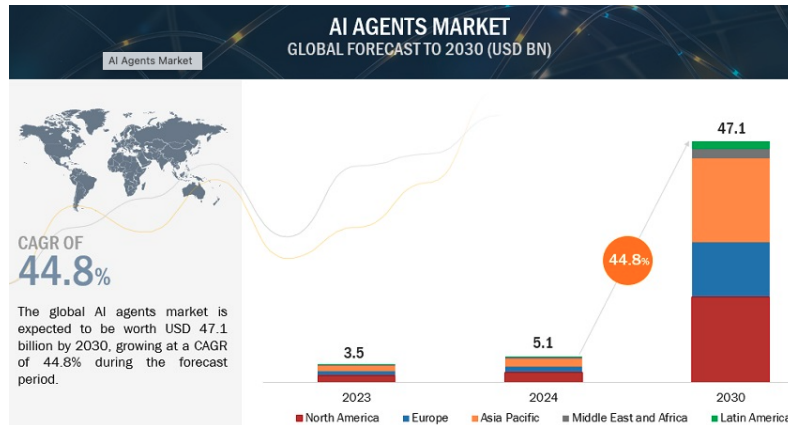
## Implications of success of LLMs

- many researchers change gears towards LLM
  - from computer vision (CV), speech, music, video, even reinforcement learning
- *LLM is not only about NLP . . .* humans have . . .
  - evolved to optimize natural language structures for eons
  - handed down knowledge using *this natural languages* for thousands of years
  - internal structure (or equivalently, representation) of natural languages optimized via *thousands of generation by evolution*
- LLM *connects non-linguistic world (open system) via natural languages (closed system)*



# Multimodal AI (mmAI)

- mmAI - systems processing & integrating data from multiple sources & modalities, to generate unified response / decision
- 1990s – 2000s - early systems - initial research combining basic text & image data
- 2010s - CNNs & RNNs enabling more sophisticated handling of multimodality
- 2020s - modern multimodal models - Transformer-based architectures handling complex multi-source data at highly advanced level
- mmAI *mimics human cognitive ability* to interpret and integrate information from various sources, leading to holistic decision-making

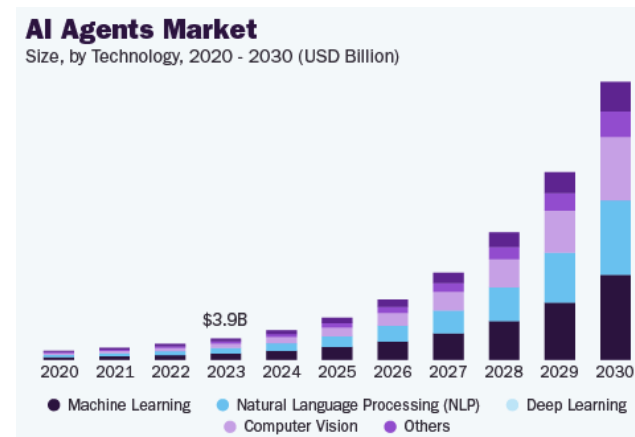
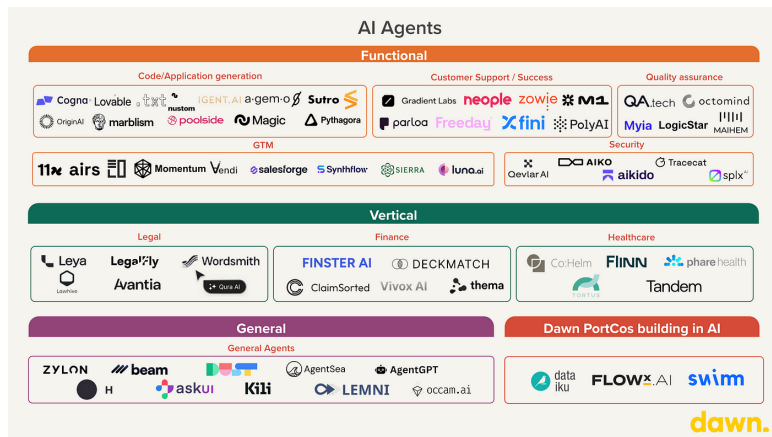


## mmAI Technology

- core components
  - data preprocessing - images, text, audio & video
  - architectures - unified Transformer-based (*e.g.*, ViT) & cross-attention mechanisms / hybrid architectures (*e.g.*, CNNs + LLMs)
  - integration layers - fusion methods for combining data representations from different modalities
- technical challenges
  - data alignment - accurate alignment of multimodal data
  - computational demand - high-resource requirements for training and inferencing
  - diverse data quality - manage variations in data quality across modalities
- advancements
  - multimodal embeddings - shared feature spaces interaction between modalities
  - self-supervised learning - leverage unlabeled data to learn representations across modalities

# AI agents powered by multimodal LLMs

- foundation
  - integrate multimodal AI capabilities for enhanced interaction & decision-making
- components
  - perceive environment through multiple modalities (visual, audio, text), process using LLM technology, generate contextual responses & take actions
- capabilities
  - understand complex environments, reason across modalities, engage in natural interactions, adapt behavior based on context & feedback



## AI agents - Present & Future

- emerging applications
  - scientific research - agents analyzing & running experiments & generating hypotheses
  - creative collaboration - AI partners in design & art combining multiple mediums
  - environmental monitoring - processing satellite sensor data for climate analysis
  - healthcare - enhanced diagnostic combining imaging, *e.g.*, MRI, with patient history
  - customer experience - virtual assistants understanding spoken language & visual cues
  - autonomous vehicles - integration of visual, radar & audio data
- future
  - ubiquitous AI agents - seamless integration into everyday devices
  - highly tailored personalized experience - in education, entertainment & healthcare



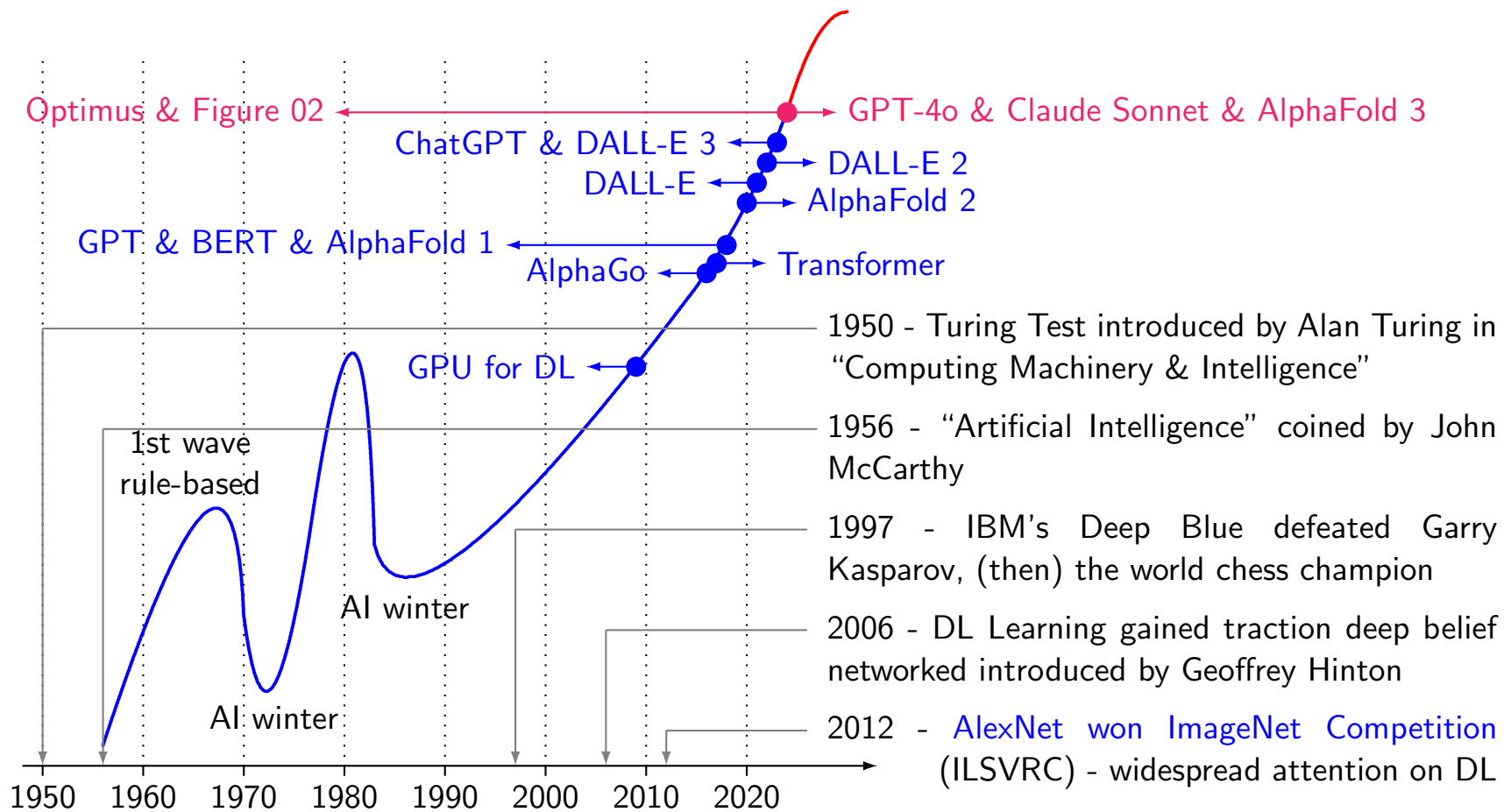
# **Silicon Valley's Cultural Engine of Innovation and Disruption**

## My journey from Samsung & Amazon to Gauss Labs & Erudio Bio

- Samsung Semiconductor, Inc.
  - inception into industry from academia, the world's best memory chip maker!
- Amazon.com, Inc.
  - experience so-called Silicon Valley big tech culture and technology
  - set tone for my future career trajectory!
- Gauss Labs, Inc.
  - found & operate AI startup, shaping corporate culture & spearheading R&D as CTO
  - inherent challenges of Korean conglomerate spin-off startup - cultural constraints, over-capitalization, and leadership limitations
- Erudio Bio, Inc.
  - concrete & tangible bio-technology in addition to AI
  - great decisions regarding business development; business models, market fit, go-to-market (GTM) strategies based on lessons learned *in a hard way* 😊

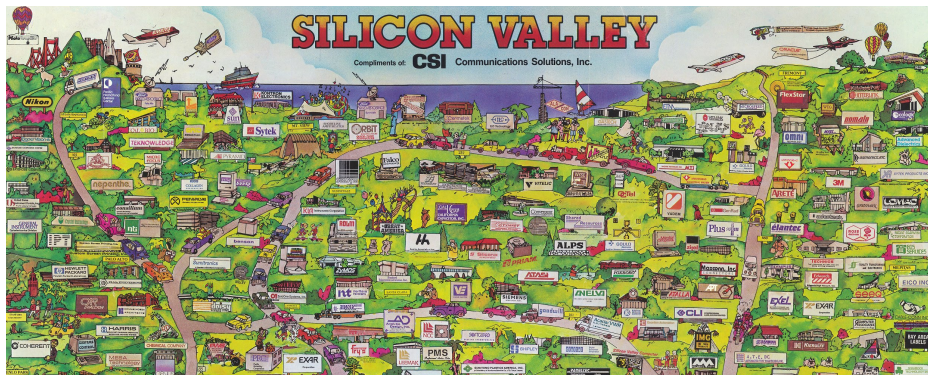


# Joining Amazon.com, Inc. at the inflection point of AI



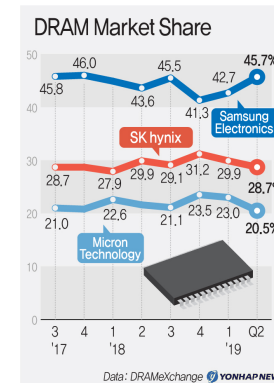
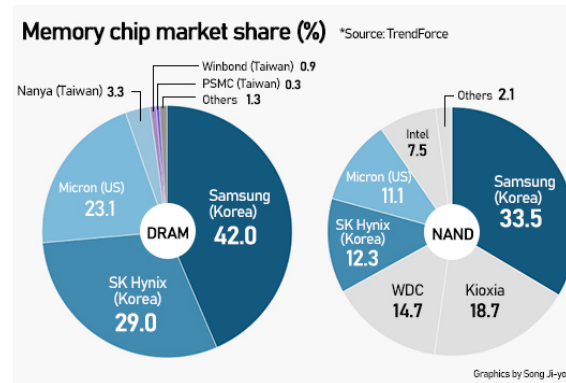
## Innovation ecosystem of Silicon Valley

- key characteristics
  - risk-taking culture, *trust* in technology → *genuine* respect for engineers and scientists
  - easy access to huge capital - VCs, angel investors alike
  - talent density - engineers, researchers, scientists, entrepreneurs, PMs, TPMs, . . .
  - diversity, “collision density” of ideas
  - ecosystem of collaboration and competition - startups, academia, industry leaders
- what they mean for global big tech
  - set trends in AI, software & hardware (and or hence) product & industry innovation
  - act as testing ground for disruptive ideas



## Case study: Amazon - amazing differentiators of big techs

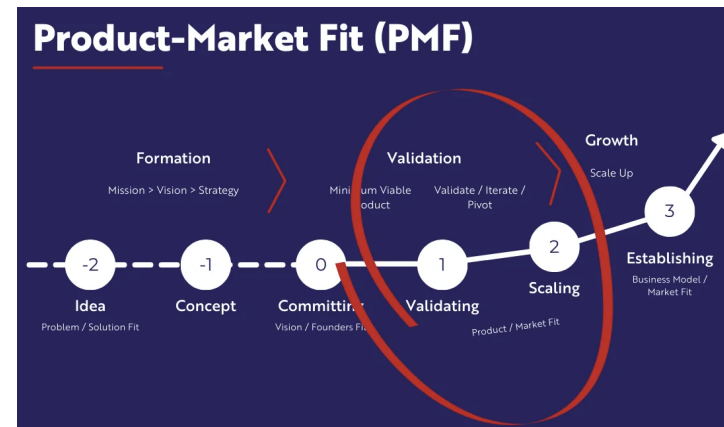
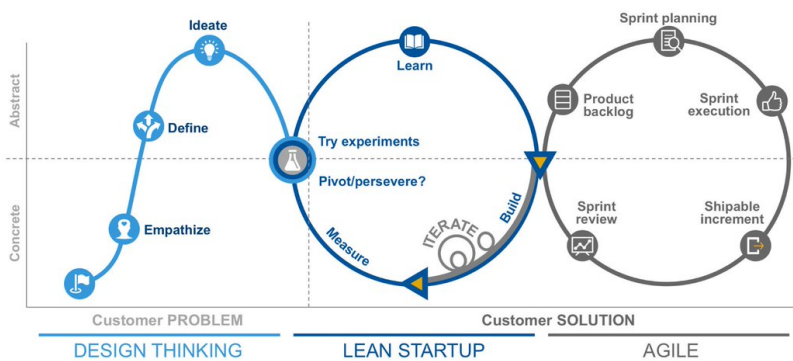
- Amazon's culture & leadership principles
  - customer obsession as driver of innovation
  - high standards & ownership culture, disagree & commit
  - bias for action and long-term thinking - sounds contradictory?
  - mechanisms like “two-pizza teams” & “Day One” for (or rather despite) scalability
- lessons for Korean corporations
  - applying customer-centric innovation in hardware & AI, *e.g.*, on-device AI
  - balancing agility with long-term R&D
  - *build / adapt / apply on the core strength of Samsung that no other company has!*



## Founding and scaling startups

- challenges
  - competence of and chemistry among co-founders crucial
  - technology & great team are *necessary*, but *not sufficient (at all!)* for success
  - business models, market fit, timing, agility, flexibility for pivoting / perseverance
- insight
  - importance of domain expertise in addition to AI
  - balancing innovation with good business decisions

### Combine Design Thinking, Lean Startup and Agile



## Bridging Silicon Valley & Korea

- cultural differences
  - risk appetite & failure tolerance
  - decision-making speed vs hierarchy
  - innovation vs execution focus
- opportunities for collaboration
  - leveraging Korea's manufacturing expertise with Silicon Valley's software/AI strengths
  - building global teams with diverse perspectives



## To be successful . . .

- embrace customer/market-centric mindset in innovation and for business decisions
- balance agility with long-term vision
- foster cross-cultural collaboration for global impact
- ((very) strategically and carefully) leverage AI to solve real-world industrial challenges

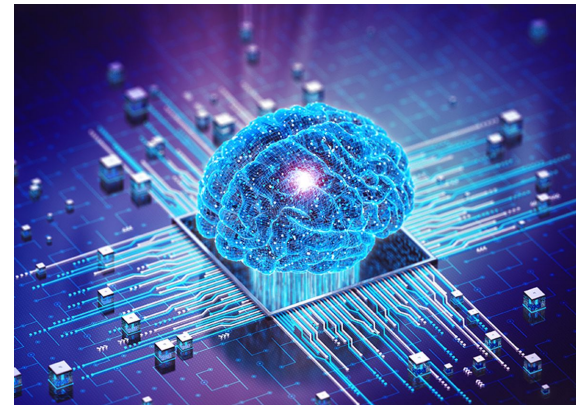


# Appendices

# **AI & Biotech**

## AI in biology

- AI has been used in biological sciences, and science in general
- AI's ability to process large amounts of raw, unstructured data (*e.g.*, DNA sequence data)
  - reduces time and cost to conduct experiments in biology
  - enables others types of experiments that previously were unattainable
  - contributes to broader field of engineering biology or biotechnology
- AI increases human ability to make direct changes at cellular level and create novel genetic material (*e.g.*, DNA and RNA) to obtain specific functions



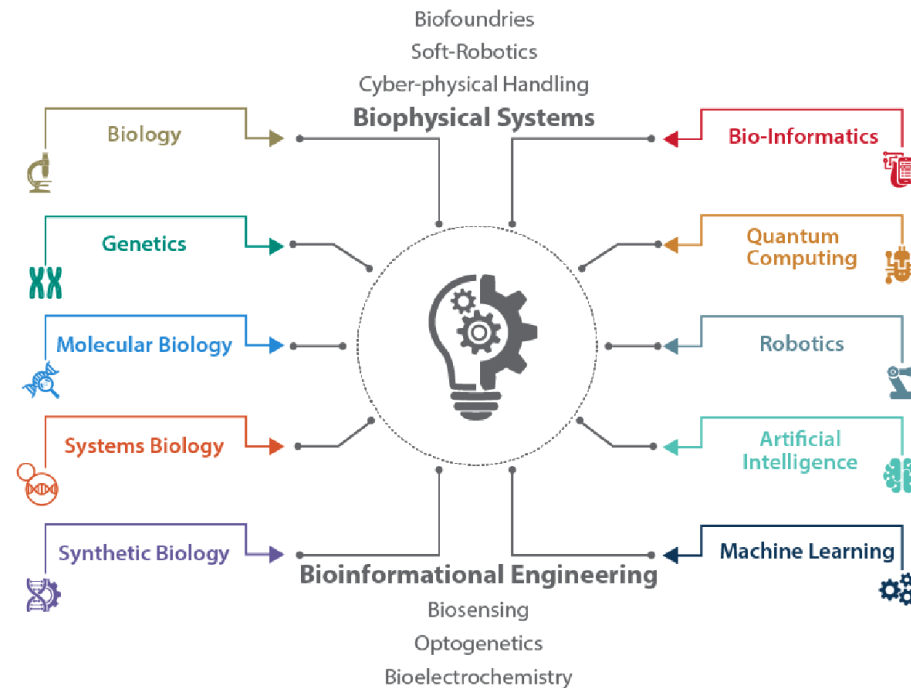
**Biotech**

## Biotech

- biotechnology
  - is multidisciplinary field leveraging broad set of sciences and technologies
  - relies on and builds upon advances in other fields such as nanotechnology & robotics, and, increasingly, AI
  - enables researchers to read and write DNA
    - sequencing technologies “read” DNA while gene synthesis technologies take sequence data and “write” DNA turning data into physical material
- 2018 National Defense Strategy & Senior US Defense and Intelligence Officials identified emerging technologies that could have disruptive impact on US national security [[Say21](#)]
  - *AI*, lethal autonomous weapons, hypersonic weapons, directed energy weapons, *biotechnology*, quantum technology
- other names for biotechnology are engineering biology, synthetic biology, biological science (when discussed in context of AI)

## Biotech - multidisciplinary field

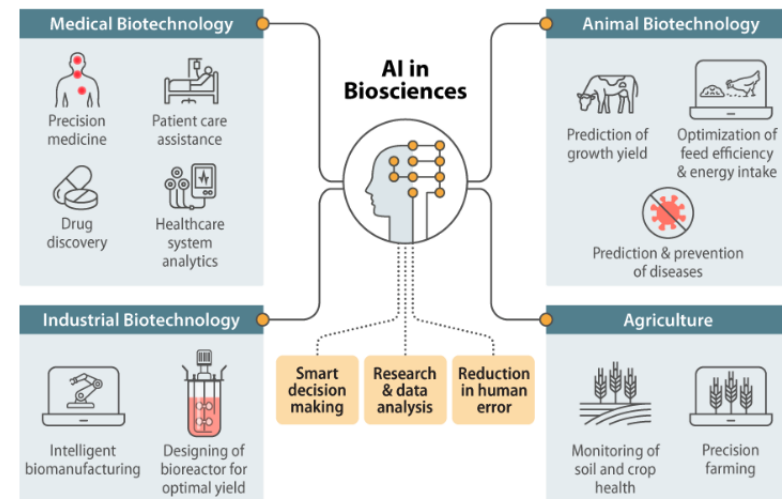
- sciences and technologies enabling biotechnology include (but not limited to)
  - (molecular) biology, genetics, systems biology, synthetic biology, bio-informatics, quantum computing, robotics [DFJ22]



## Convergence of AI and biological design

- AI & biological sciences converging [BKP22]
  - each building upon the other's capabilities for new research and development across multiple areas
- Demis Hassabis, CEO & cofounder of DeepMind, said of biology [Toe23]
 

“. . . biology can be thought of as information processing system, albeit extraordinarily complex and dynamic one . . . just as mathematics turned out to be the right description language for physics, biology may turn out to be *the perfect type of regime for the application of AI!*”
- both AI & biotech rely on and build upon advances in other scientific disciplines and technology fields, such as nanotechnology, robotics, and increasingly big data (*e.g.*, genetic sequence data)
  - each of these fields itself convergence of multiple sciences and technologies
- so *their impacts can combine to create new capabilities*



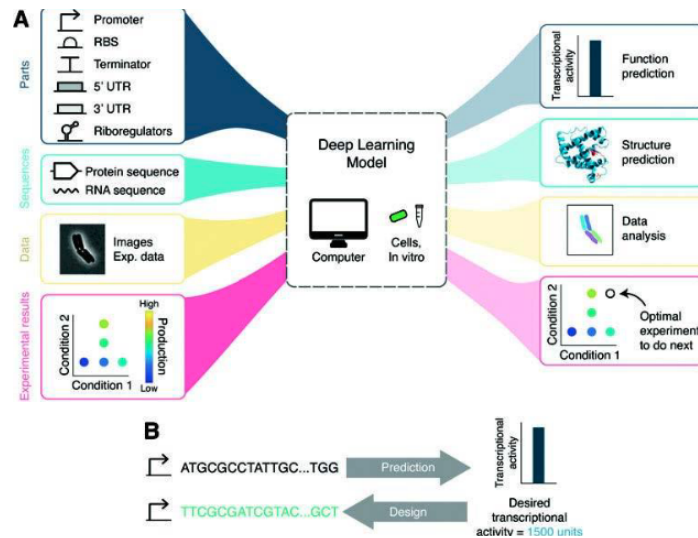
## Multi-source genetic sequence data

- AI, essential to analyzing exponential growth of genetic sequence data

“AI will be essential to fully understanding how genetic code interacts with biological processes” - US National Security Commission on Artificial Intelligence (NSCAI)

- process huge amounts of biological data, *e.g.*, genetic sequence data, coming from different biological sources for understanding complex biological systems
  - sequence data, molecular structure data, image data, time-series, omics data

- *e.g.*, analyze genomic data sets to determine the genetic basis of particular trait and potentially uncover genetic markers linked with that trait



## Quality & quantity of biological data

- limiting factor, however, is *quality and quantity* of biological data, *e.g.*, DNA sequences, that AI is trained on
  - *e.g.*, accurate identification of particular species based on DNA requires reference sequences of *sufficient quality* to exist and be available
- databases have varying standards - access, type, and quality of information
- design, management, quality standards, and data protocols for reference databases can affect utility of particular DNA sequence



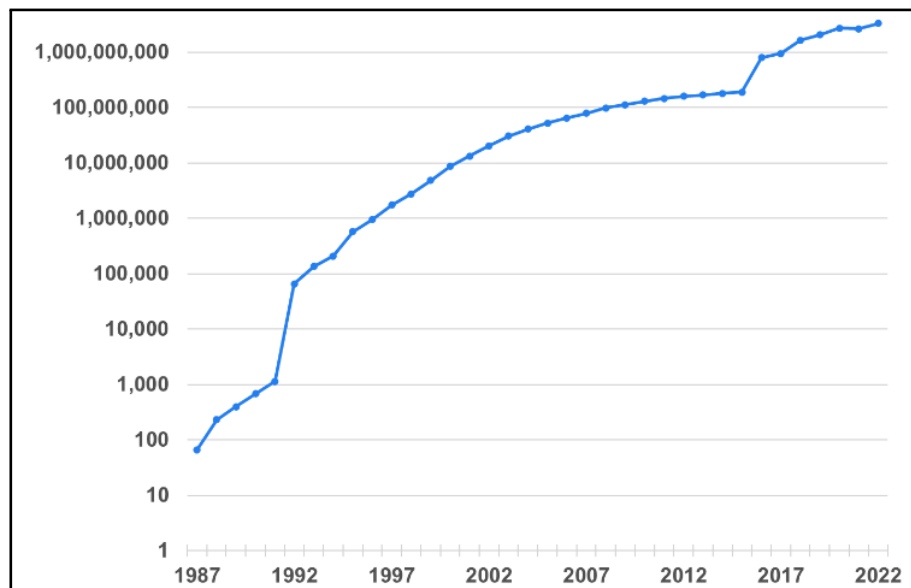
## Rapid growth of biological data

- volume of genetic sequence data grown exponentially as sequencing technology evolved
- more than 1,700 databases incorporating data on genomics, protein sequences, protein structures, plants, metabolic pathways, *etc.*, *e.g.*
  - open-source public database
    - Protein Data Bank, US-funded data center - more than *terabyte of three-dimensional structure data* for biological molecules, *e.g.*, proteins, DNA, RNA
  - proprietary database
    - Ginkgo Bioworks - more than *2B protein sequences*
  - public research groups
    - Broad Institute - produces roughly *500 terabases of genomic data per month*
- great potential value in aggregate volume of genetic datasets that can be collectively mined to discover and characterize relationships among genes

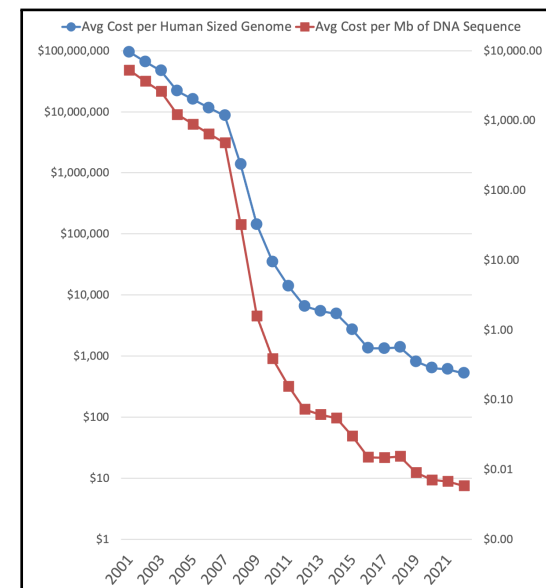
## Volume and sequencing cost of DNA over time

- volume of DNA sequences & DNA sequencing cost
  - data source: National Human Genome Research Institute (NHGRI) [Wet23] & International Nucleotide Sequence Database Collaboration (INSDC)
- *more dramatic than Moore's law!*

# sequences in INSDC



DNA sequencing cost



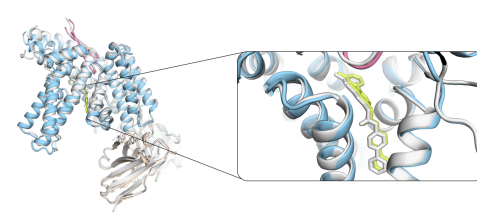
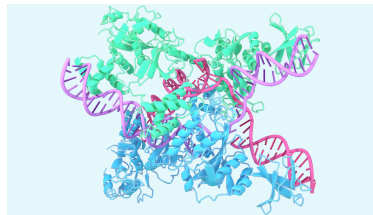
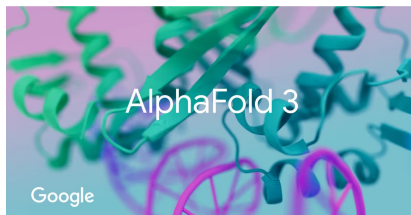
## Bio data availability and bias

- US National Security Commission on Artificial Intelligence (NSCAI) recommends
  - US fund and prioritize development of a biobank containing *“wide range of high-quality biological and genetic data sets securely accessible by researchers”*
  - establishment of database of broad range of human, animal, and plant genomes would
    - *enhance and democratize biotechnology innovations*
    - *facilitate new levels of AI-enabled analysis of genetic data*
- bias - availability of genetic data & decisions about selection of genetic data can introduce bias, *e.g.*
  - training AI model on datasets emphasizing or omitting certain genetic traits can affect how information is used and types of applications developed - *potentially privileging or disadvantaging certain populations*
  - access to data and to AI models themselves may impact communities of differing socioeconomic status or other factors unequally

# Emerging Trends in Biotech

# AlphaFold

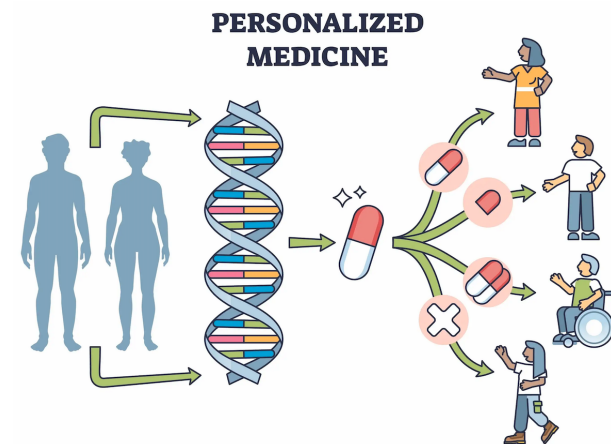
- solving 50-year-old protein folding problem, *“one of biology’s grand challenges”*
  - definition - given amino acid sequence, predict how it folds into a 3D structure
  - proteins fold in microseconds, but predicting computationally nearly impossible
- AlphaFold 1 (2018) - DL + physics-based energy functions → AlphaFold 2 (2020)
  - attention-based NN solving protein folding “in principle” → AlphaFold 3 (2024) - diffusion-based DL, drug-protein interactions, protein complexes
- AlphaFold protein structure database
  - >200MM protein structures - nearly every known protein, used by >2MM researchers
- Applications & implications
  - drug discovery - target identification, lead optimization, side effect prediction
  - enzyme engineering, agriculture, environmental, vaccine development



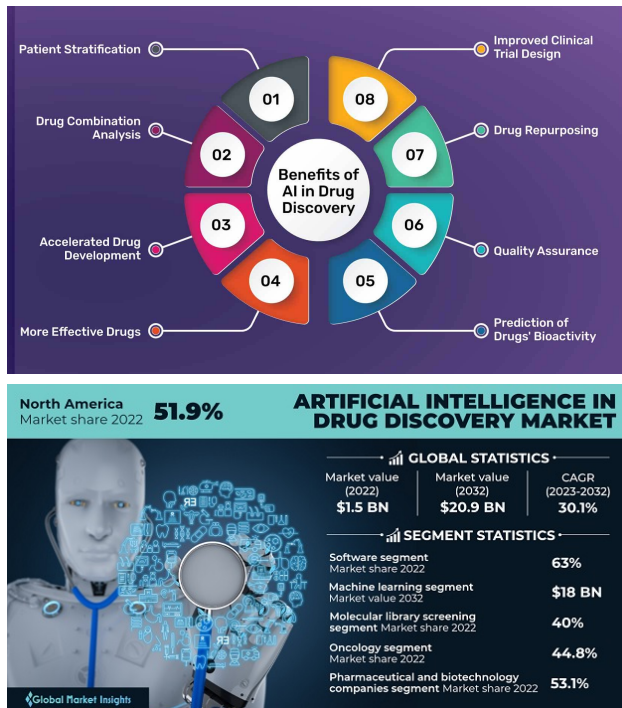


## Personalized medicine

- *shift from one-size-fits-all approach to tailored treatments*
- based on individual genetic profiles, lifestyles & environments
- AI enables analysis of vast data to predict patient responses to treatments, thus enhancing efficacy and reducing adverse effects
- *e.g.*
  - custom cancer therapies
  - personalized treatment plans for rare diseases
  - precision pharmacogenomics
- companies - Tempus, Foundation Medicine, *etc.*



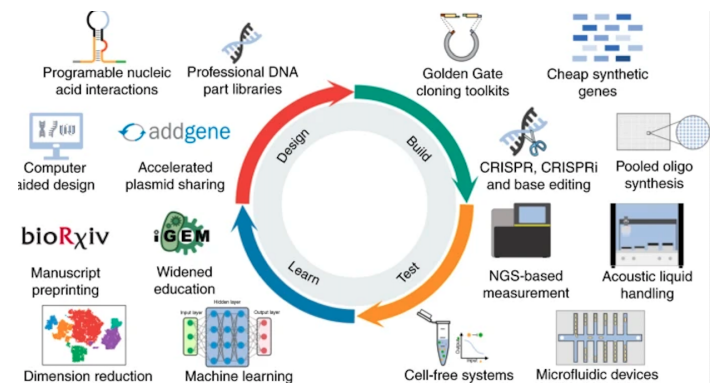
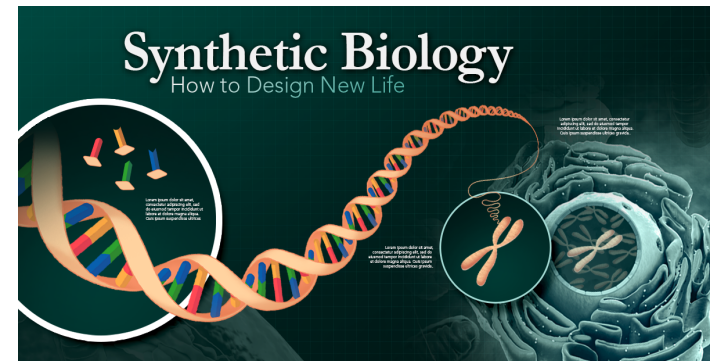
## AI-driven drug discovery



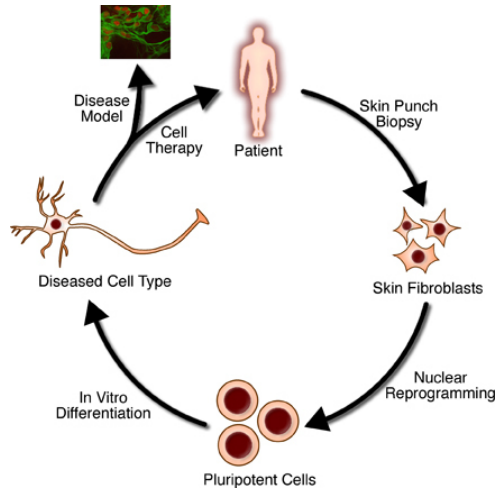
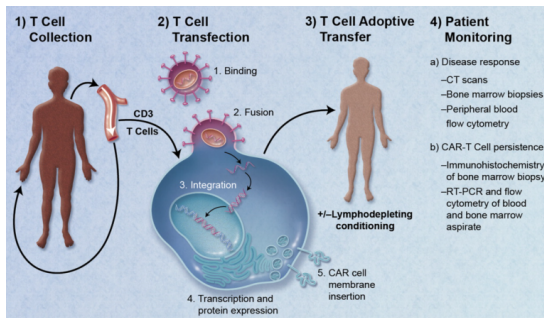
- traditional drug discovery process - time-consuming and costly often taking decades and billions of dollars
- AI streamlines this process by predicting the efficacy and safety of potential compounds with more speed and accuracy
- AI models analyze chemical databases to identify new drug candidates or repurpose existing drugs for new therapeutic uses
- companies - Insilco Medicine, Atomwise.

# Synthetic biology

- use AI for gene editing, biomaterial production and synthetic pathways
- combine principles of biology and engineering to design and construct new biological entities
- AI optimizes synthetic biology processes from designing genetic circuits to scaling up production
- company - Ginkgo Bioworks uses AI to design custom microorganisms for applications ranging from pharmaceuticals to industrial chemicals



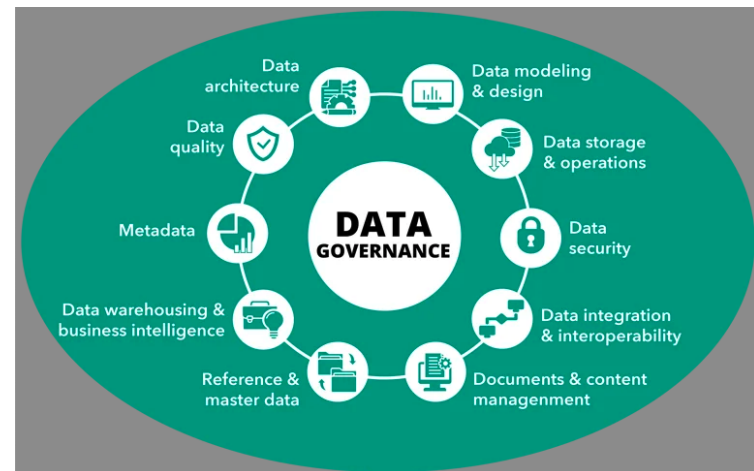
## Regenerative medicine



- AI advances development of stem cell therapies & tissue engineering
- AI algorithms assist in identifying optimal cell types, predicting cell behavior & personalized treatments
- particularly for conditions such as neurodegenerative diseases, heart failure and orthopedic injuries
- company - Organovo leverages AI to potentially improve the efficacy and scalability of regenerative therapies, developing next-generation treatments

## Bio data integration

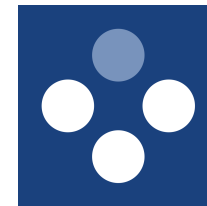
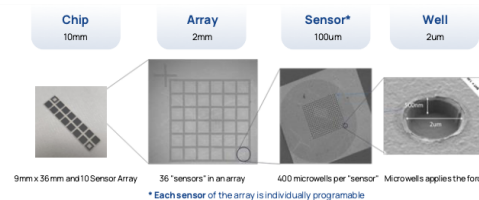
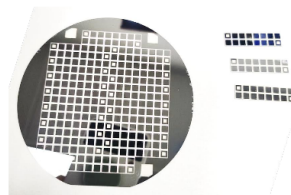
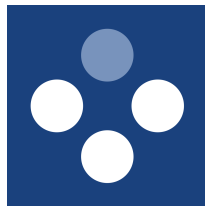
- integration of disparate data sources, including genomic, proteomic & clinical data - one of biggest challenges in biotech & healthcare
- AI delivers meaningful insights *only when* seamless data integration and interoperability realized
- developing platforms facilitating comprehensive, longitudinal patient data analysis - vital enablers of AI in biotech
- company - Flatiron Health working on integrating diverse datasets to provide holistic view of patient health



**Erudio Bio**

## Powering AI-driven medicine with ground-truth binding data

- problems we solve
  - 90% of drugs fail in clinical trials due to poor early-stage prediction
  - multiplexed diagnostics suffer from false positives and cross-reactivity
- *Erudio Bio's Innovation*
  - VSA platform uses patented “dynamic force spectroscopy” to generate 1000x more high-quality binding data from single sample ( $\sim 10\mu\text{L}$ )
  - measuring not just presence, but *strength* and *kinetics* of molecular interactions
- *dual business model*
  - diagnostics - multi-cancer biomarker detection with clinical institutions & hospitals (Seoul National University Hospital Bundang, Keimyung University Dongsan Hospital)
  - drug discovery - bioTCAD<sup>TM</sup> platform providing ground-truth labels to train & validate pharma AI models, reducing preclinical cycles



## Validated technology, proven team, clear path to market

- validated impact
  - *\$1M Gates Foundation Grant* (2025) to democratize drug development for global health
  - partnerships with top research institutions (KRIBB, KAIST)
- unique team - *Stanford-trained founders* combining
  - semiconductor TCAD expertise & force spectroscopy innovation (20+ years)
  - AI & optimization leadership (Samsung, Amazon, SK hynix, Gauss Labs)
- market entry
  - *Korea → Asia hub & US* strategy with 2026 regulatory milestones and expanding pharma partnerships

Gates Foundation



**Biological assays struggle with scale & accuracy**

## Data is expensive

- so we make decisions with *incomplete* picture
- status quo
  - limited, small-scale testing confirms diagnosis
  - outcome only as good as doctor's ability to determine which tests, limiting the picture
  - cross reactivity prevents larger scale testing
- Erudio creates
  - *comprehensive, large-scale* testing will drive diagnosis without assumptions
  - increased scale enables enhanced scientific discovery leading to
    - *better patient care*
    - *reduced time to diagnosis*
    - *cost reduction*



**Erudio Bio starting Revolution**

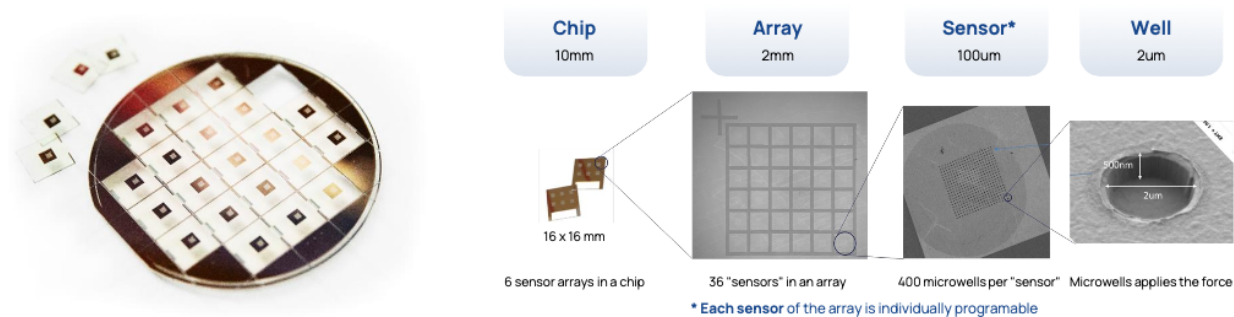
## Erudio Bio starts revolution with Gates Foundation's support

- more data
  - comprehensive data from single biological sample
  - multiplexed analysis of nucleic acid, protein, cells, and more!
  - *multi-omic platform*
- actionable data
  - combined quality score from all data sources for comprehensive & conclusive assessment
- earlier data
  - complete data early to drive accurate decision making



# **Versatile Smart Assay (VSA) Platform**

## VSA technology



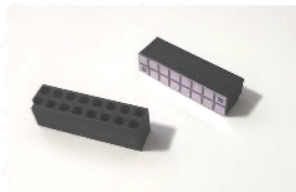
- generates *1000x more data* than the prevailing technology
  - scalable multi-omic microarray sensor
- *21 patents* in US, Canada, China, and Europe
- indicates how good the data is in real time
  - patented “dynamic force spectroscopy” and “powerful Bayesian inference” method provides our data *quality score* to know their accuracy for actionable data
- AI software extracts a detailed, interpretable picture for quick diagnosis
  - leads to *AI knowledge discovery* resulting in *data-driven diagnosis*

## Enabling comprehensive data acquisition

- antibodies - versatile tools in biology
  - can engineer to target virtually *anything* we want
  - problem
    - indiscriminate interactions severely limits use of antibodies in multiplex formats
    - error-prone results due to non-specific binding
- solution - comprehensive data with *dynamic force spectroscopy*
  - comprehensive binding strength to distinguish specific from non-specific binding
  - *quality score* discerns noise from useful data to enable multiplexing



## Erudio Bio's business models



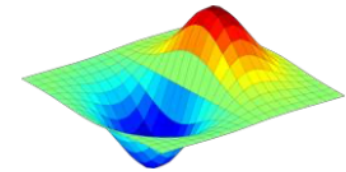
Consumable chip  
& flowcell



Instrument



Consumable  
reagent kit



Software  
AI/ML & SaaS

- VSA platform
  - instrument - recurring revenue with high margin
  - modular licensable software - AI based data interpretation and feature extraction
- SaaS
  - subscription based pre-validation of reagent database
  - AI feature extraction and knowledge discovery

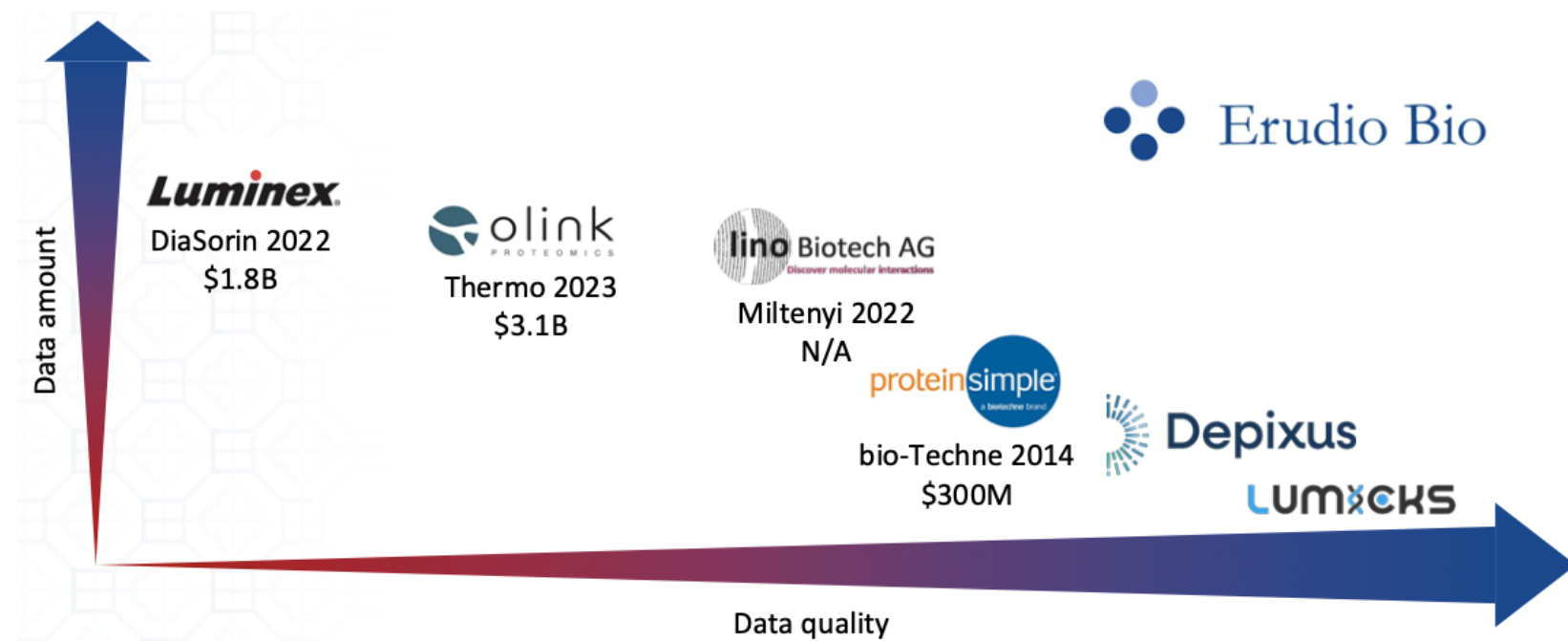
# Milestones

## Erudio Bio key milestones

- IP developed at Stanford School of Medicine under mentorship by father of microarrays  
- Dr. Ronald Davis
- data vetted by Analog Devices (\$115B market cap semiconductor company), Harvard Medical School & Massachusetts General Hospital
- commercial partnership with Analog Devices to manufacture at scale
- JDA with Shanghai General Hospital's National Clinical Research Center for Eye Diseases
- JDA with Seoul National University General Hospital (SNUBH) for multiplexed cancer biomarker detections
- partnerships with
  - Keimyung University Dongsan Hospital, KRIBB, KAIST NanoFab, Lulumedic



## Competitive landscape



- Erudio Bio
  - *only company* providing both high quality data and large data output
- efficient workflow integration facilitates customer adoption

**Erudio Bio engaging with Customers**

## Validating out technology in clinical settings



- joint development agreement signed with *Shanghai General Hospital's National Clinical Research Center for Eye Diseases*
  - co-develop multiplexed diagnostic test for uveitis
  - addresses low sample volume and diagnostic inaccuracies
- globally unique partner, customer so large that it is a market by itself
  - 45 large hospitals with 83M patient visits per year
  - standard of care for smaller hospitals in Shanghai to access additional 280M patients

## Clinical validation to market leadership in Korean preventive care



- market opportunity - *preventive care* is foundation of Korean healthcare
  - ~ 15M health screenings performed in S. Korea testing
  - ideal market segment for Erudio Bio's multi-omic multiplexed VSA platform
  - multi-billion dollar addressable market for multi-cancer early detection
- joint development agreed with *Seoul National University Hospital Bundang (SNUBH)*
  - premier hospital of national importance
  - enabling expansive proactive health assessment for efficient health care system
  - collaboration with target of *multiplexed cancer biomarker medical equipment business*

# Teams

## Team & advisory board

- team
  - Sunghee Yun, Ph.D. (CTO) - AI, optimization, business development, software
  - Kee-Hyun Paik, Ph.D. (CEO) - chip, microfluidics, instrumentation
  - Susanne Baumhueter, Ph.D. - biology, immunology, project management
  - Leon Chen, MBA, CFA (COO) - business development, product, operations
  - Jin Young Huh (CLO) - chief legal officer, business development in Korea
- advisory board
  - Michael Cola - CEO of AEVI Genomic Medicine (\$62B sales to Takeda)
  - Tim Germann - CCO of Carterra Bio
  - Karyn Eliot - retired CIA Sr. Executive
  - Ronald W. Davis - Director of Stanford Genome Tech Center (\$15B+ exits)
  - William J. Greenleaf - Prof. Genetics and Applied Physics, Stanford University



# **Gates Foundation Grant**

## Erudio Bio wins \$1M Gates Foundation Grant - scaling bioTCAD

Gates Foundation



- \$1M Grant Award (August 2025)
  - Gates Foundation recognizes Erudio Bio’s potential to transform drug development for global health
- mission alignment - democratizing medicine by making preclinical drug design faster, yet reliable & accessible
  - lowering development costs for diseases affecting low- and middle-income countries (LMICs)
  - addressing the 90% clinical trial failure rate that drives up drug costs
- funded project - scale bioTCAD<sup>TM</sup> platform to generate ground-truth binding datasets
  - expand force spectroscopy measurements across high-burden disease targets
  - train AI models with kinetics-resolved binding data (on/off rates, unbinding forces)
  - enable pharma/biotech to prioritize candidates earlier with higher confidence

**K-PAI - Silicon Valley  
Privacy-Preserving AI Forum**

## Silicon Valley Privacy-Preserving AI Forum (K-PAI)

- pioneering community of professionals dedicated to building privacy-preserving AI solutions, products, and systems
- comprehensive expertise across AI domains
  - biotechnology, healthcare, and medical research
  - industrial applications and data centers
  - cloud infrastructure, storage solutions, mobile technologies
  - customer service platforms, multi-agent systems
  - RAG implementations, vector databases, agentic AI frameworks
- vision
  - *shaping future where AI innovation and privacy protection go hand in hand*
- active community with [homepage](#) & KakaoTalk collaboration platform for members



## Our journey - forum history

- Nov-Dec 2024 - “The AI Strikes Back” & “Free Your Data”
  - Prof. Jung Hee Cheon (homomorphic encryption revolution)
- Jan 2025 - “The AI Knight Rises”
  - [Sunghee Yun](#) @ Erudio Bio on deep learning to flourishing societies
- Feb 2025 - “Silicon Citadel”
  - Chanik Park @ MangoBoost on AI data infrastructure
- Mar 2025 - “Blockchain Awakens”
  - Daejun Park @ a16z crypto on decentralized AI
- Apr 2025 - “Advancing Humanity”
  - Stanford Medicine team on bio/medical AI
  - co-hosting with K-BioX
- May 2025 - “The Autonomous Alliance”
  - Microsoft, GitHub, Uclone, SK Hynix on AI agents

## Our journey - forum history

- Jun 2025 - “Silicon Companions”
  - Altos Ventures on robotics & smart devices
- Aug 2025 - “The Human-Centric AI Revolution”
  - address legal and ethical issues related to AI
- Nov 2025 - “The AI Silicon Race”
  - Korea-US Innovation Leadership at K·ASIC



## Strategic partnerships & ecosystem

- *Perpetual Partnership with KOTRA Silicon Valley as Strategic Alliance*
- 2026 co-hosting partners
  - K-ASIC (Korea AI & IC Innovation Center)
  - K-BioX (biotech innovation)
  - KOTRA Silicon Valley (trade & investment)
  - Korean Consulate General, San Francisco (diplomatic support)
  - KABANC (Korean American Bar Association of Northern California - legal expertise)
- building bridges between Silicon Valley innovation and Korean institutional networks
- creating comprehensive support ecosystem: technical, legal, business, diplomatic



## Community & engagement

- membership requirements
  - attend 2+ K-PAI Forums to qualify
- member benefits
  - networking with AI professionals across all domains
  - knowledge sharing and collaboration opportunities
  - direct access to world-class speakers and experts
- forum format - 5pm-8pm, typically Wednesdays at premier Silicon Valley venues
- venues - Stanford, KOTRA, SK Hynix, Altos Ventures, K-ASIC, and more
- active community engagement and professional development



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**Thank You**



**Sunghee Yun**  
Co-Founder & CTO @ Erudio Bio / K-PAI  
Leader / Global Managing Partner @ LULU...

