

AI Infrastructure

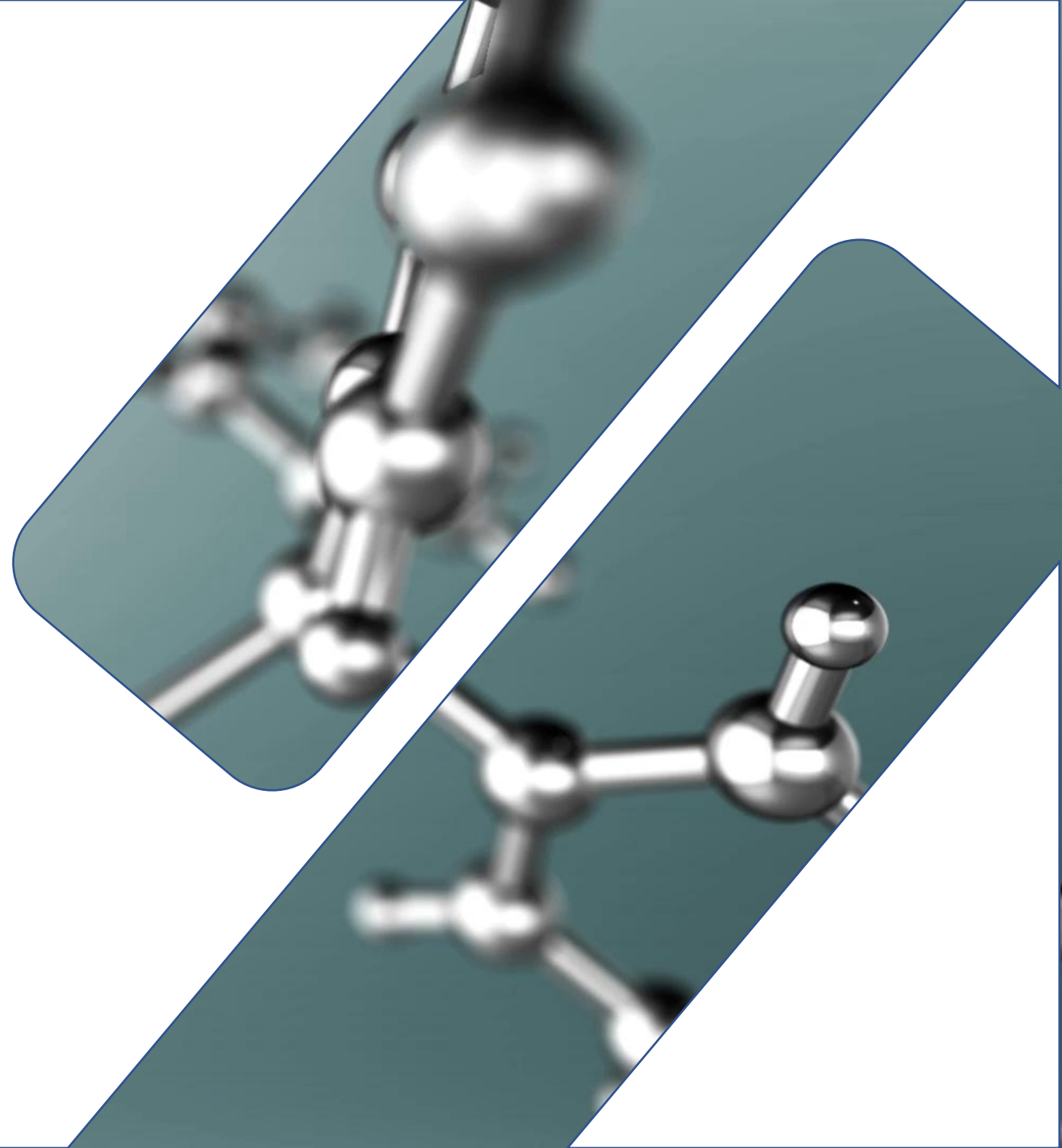
Dr. Sadid Muneer

Associate Professor

Electrical and Electronic Engineering

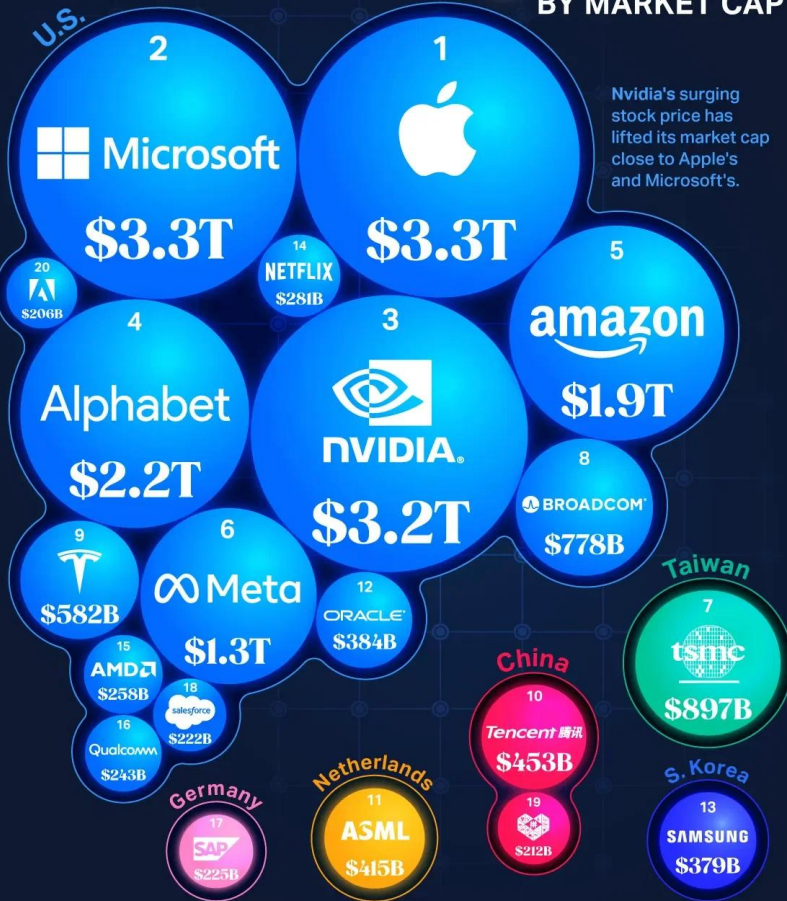
United International University

Research area: Semiconductor Devices,
Phase Change Memory



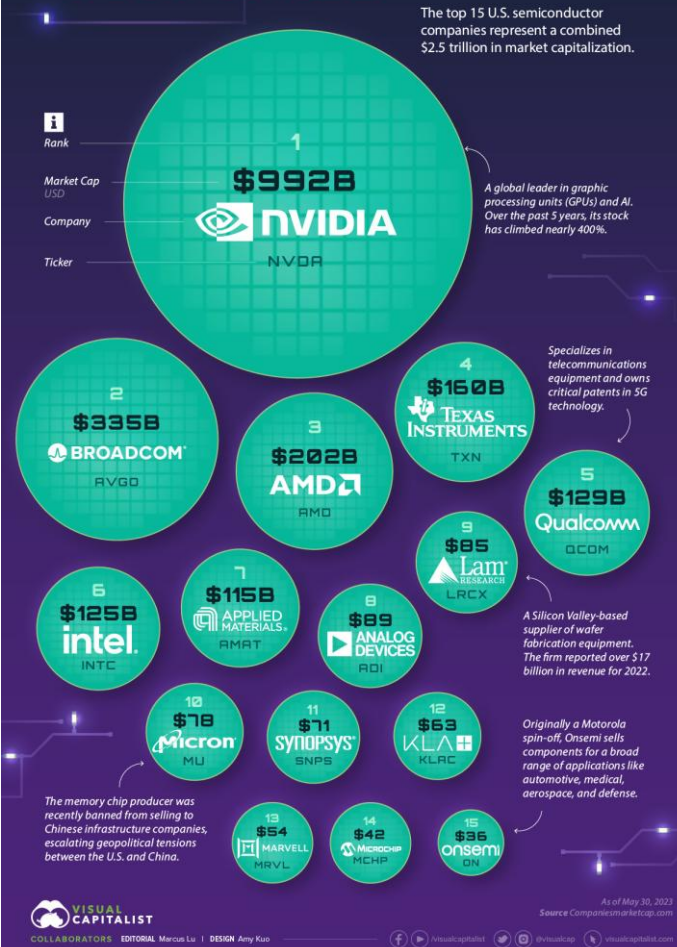
Shift in Computing Infrastructure

TOP 20 Tech Companies BY MARKET CAP



Source: Companiesmarketcap.com as of June 13, 2024

America's Largest SEMICONDUCTOR COMPANIES



Source: Companiesmarketcap.com as of May 30, 2023

<https://www.visualcapitalist.com/ranked-americas-largest-semiconductor-companies/>

CPU:

- Central Processing Unit
- General purpose brain

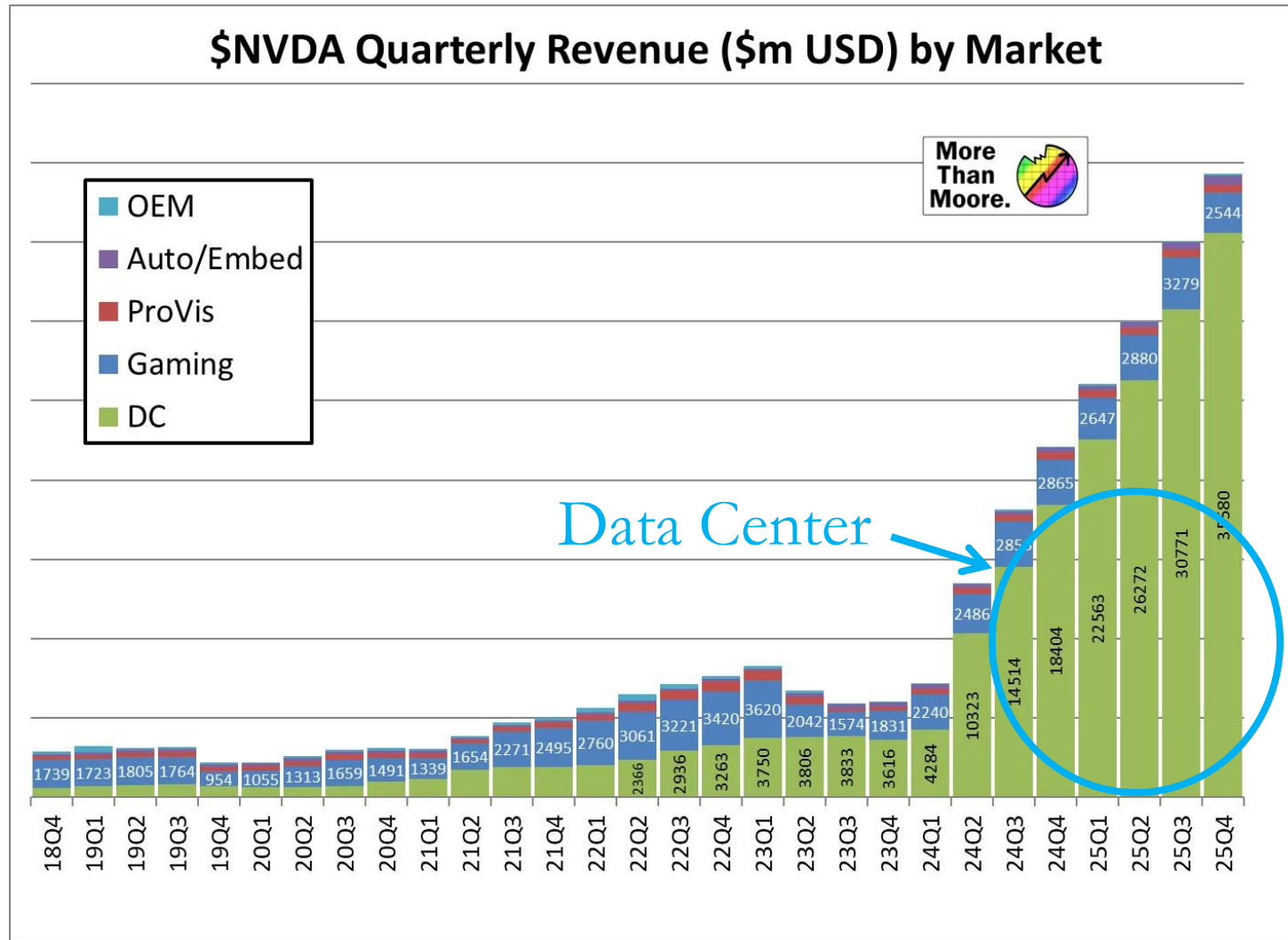


GPU:

- Graphics Processing Unit
- Parallel processing of small tasks over and over and very fast
- Video Gaming and (3D) graphics
- Very useful for AI models and neural networks
- ChatGPT etc. requires extensive training



Shift in Computing Infrastructure



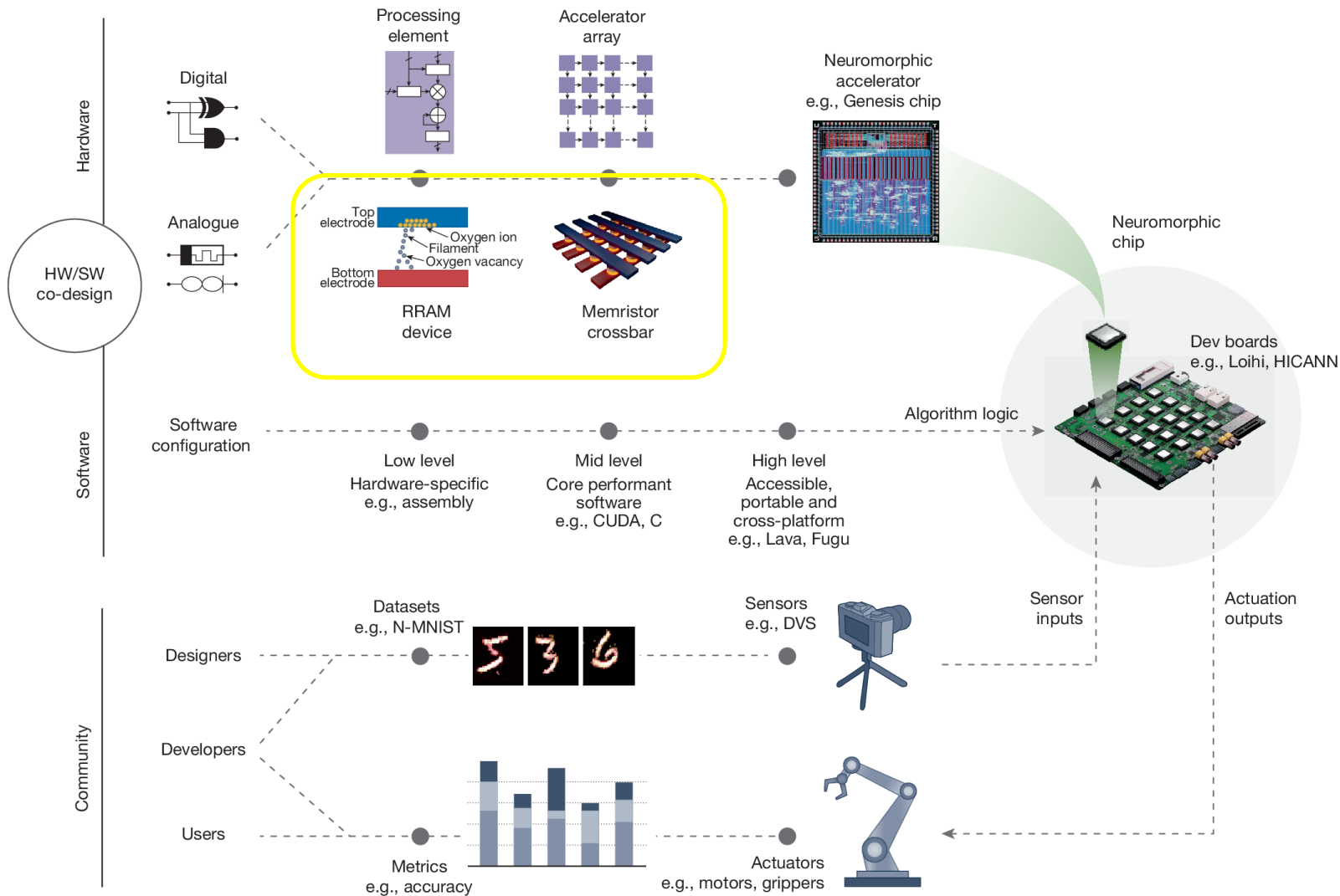
<https://morethanmoore.substack.com/p/nvidia-2025-q4-financials>

How long NVIDIA can hold its dominance?



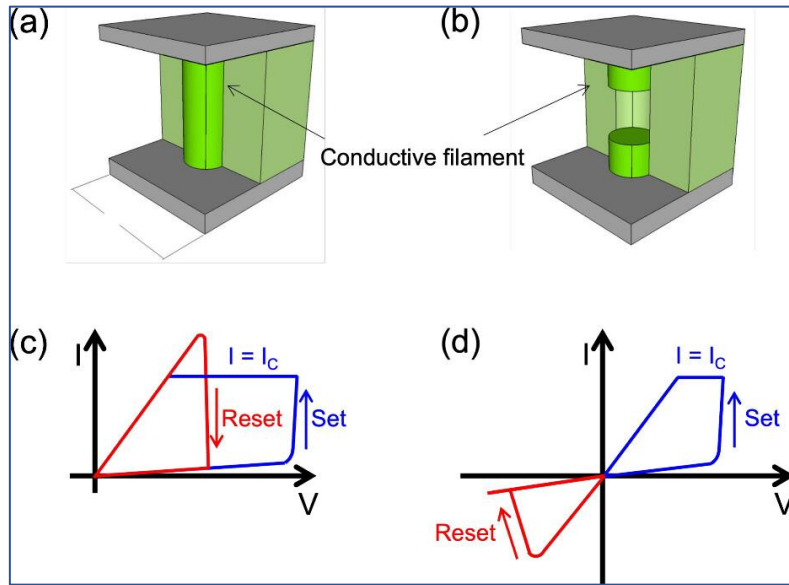
Train Smarter not Harder

Neuromorphic Computing

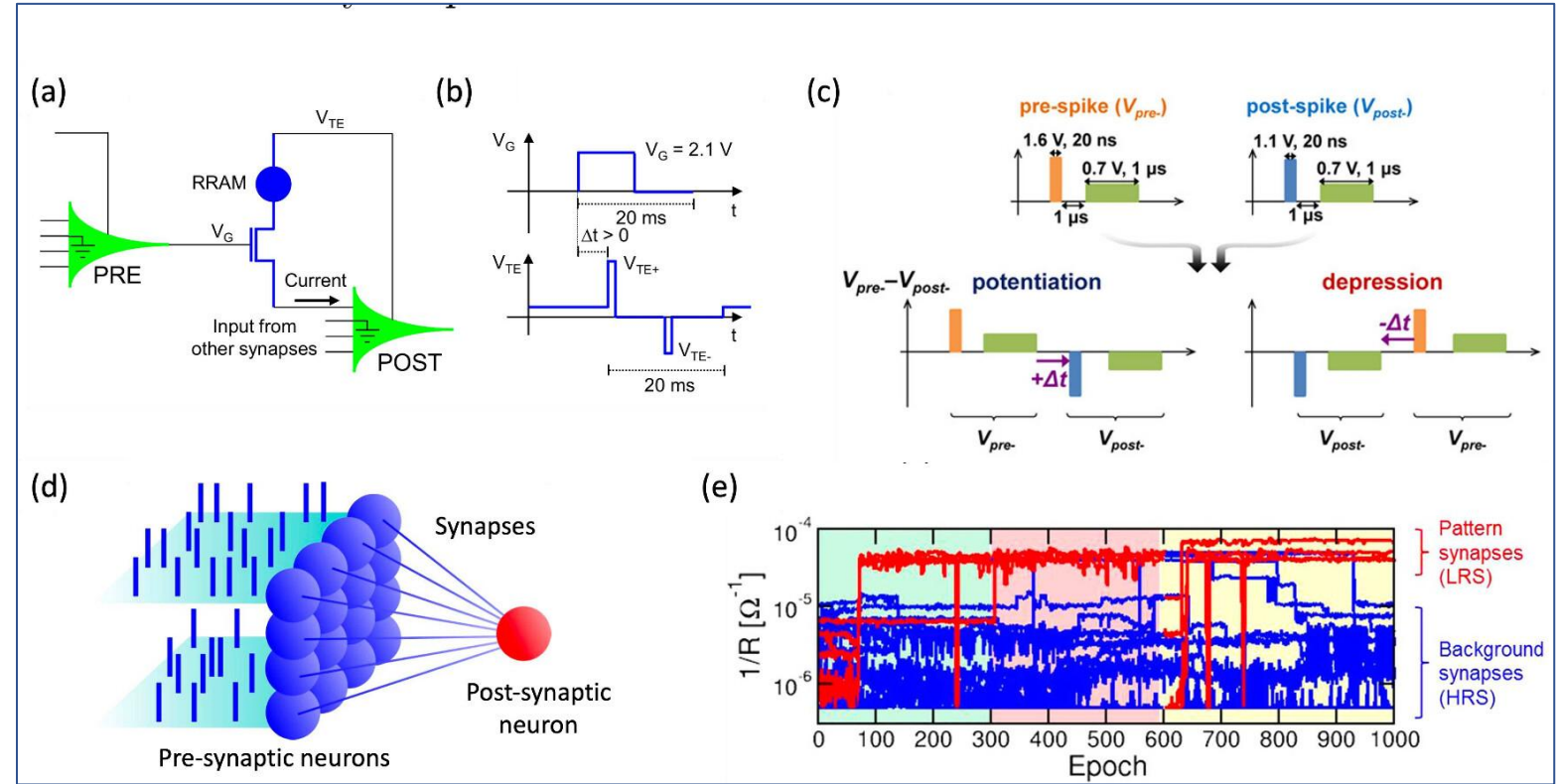


- Neuromorphic systems show an enormous **potential** for future artificial intelligence (AI) applications.
- These systems can solve AI related problem with extremely **low power** budget and **latency**.

Neuromorphic Computing

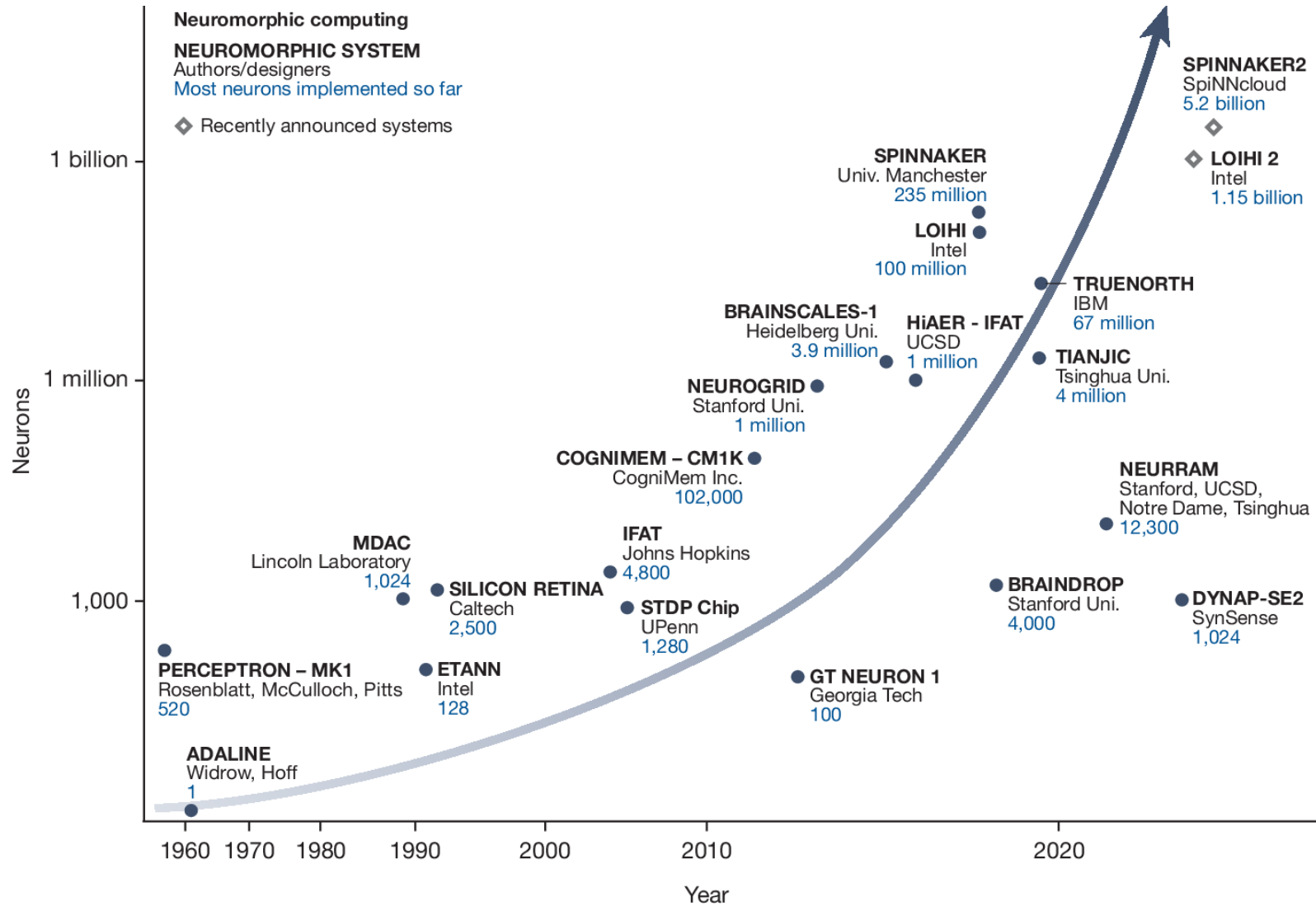


Resistive Switching Random-Access Memory (RRAM) Device



Structure and operation of an artificial synapse using RRAM Device

Neuromorphic Computing



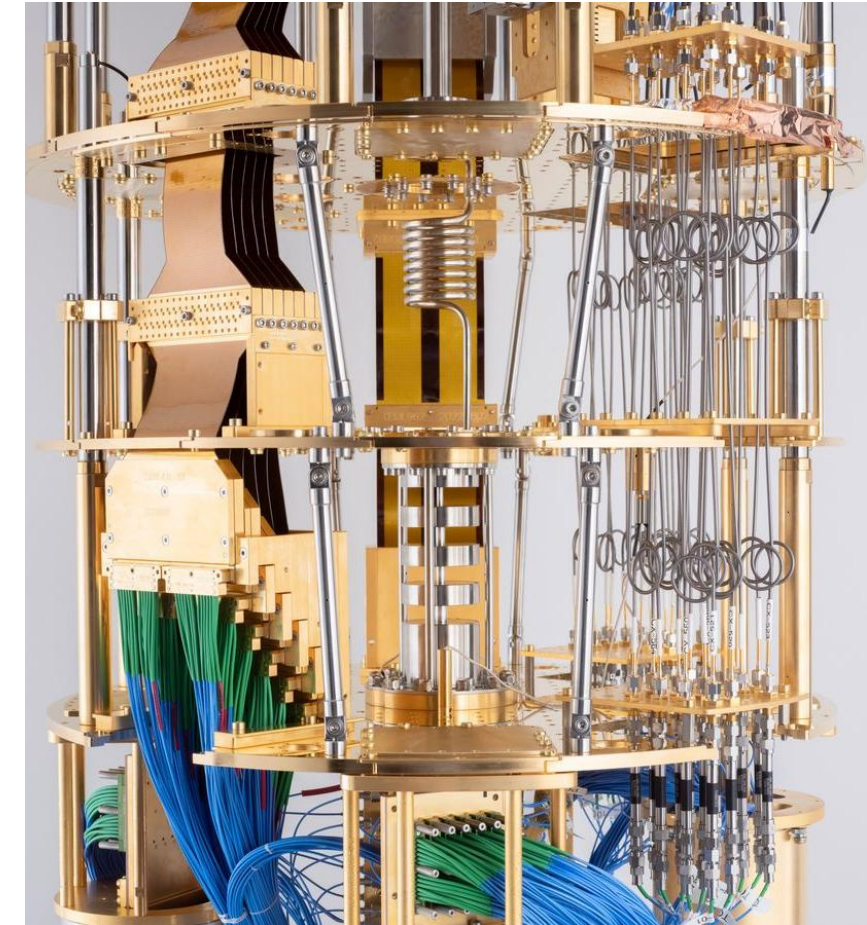
Kudithipudi, D., Schuman, C., Vineyard, C.M. et al. Neuromorphic computing at scale. Nature 637, 801–812 (2025). <https://doi.org/10.1038/s41586-024-08253-8>

Quantum Computing

Leading quantum computing companies

From sources across the web

	IBM	▼		IonQ	▼		Microsoft	▼
	D-Wave Syst...	▼		Intel	▼		Rigetti Comp...	▼
	Xanadu	▼		Google	▼		Quantinuum	▼
	Quantum Artif...	▼		ColdQuanta	▼		Atom Comput...	▼
	Honeywell	▼		Atos	▼		AWS	▼
	Nvidia	▼		Origin Quantum	▼		Oxford Quant...	▼



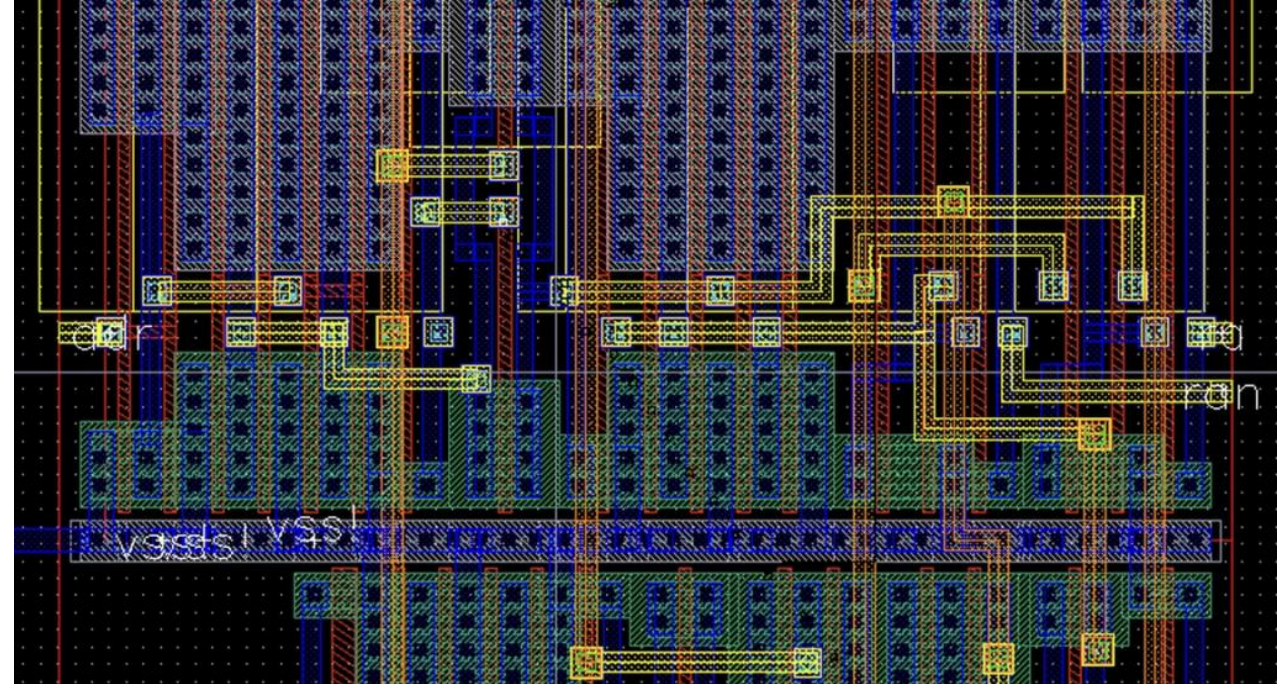
The interior view of the cryostat that cools the IBM Quantum Eagle, a 127-qubit quantum processor.

<https://spectrum.ieee.org/practical-quantum-computing-ibm>

Our Responsibility as Educator and Researcher

Update our **curriculum**, and also **research** focus:

- Novel **computing and memory devices** and architectures, not only semiconductor devices.
- **Neuromorphic** computing
- **Quantum** computing
- Use of AI in different disciplines, such as: automation in analog and digital circuit design and verification (**VLSI industry**).



Physical design of VLSI chips. How much can we automate this process and other steps in this thriving industry?

Thanks!