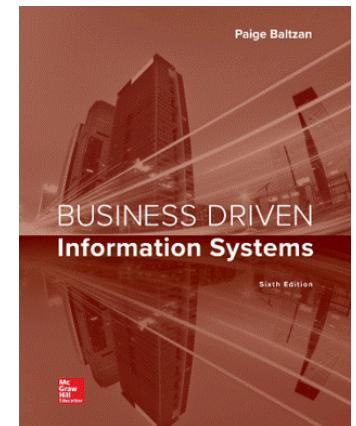




MIS 311: Information Systems

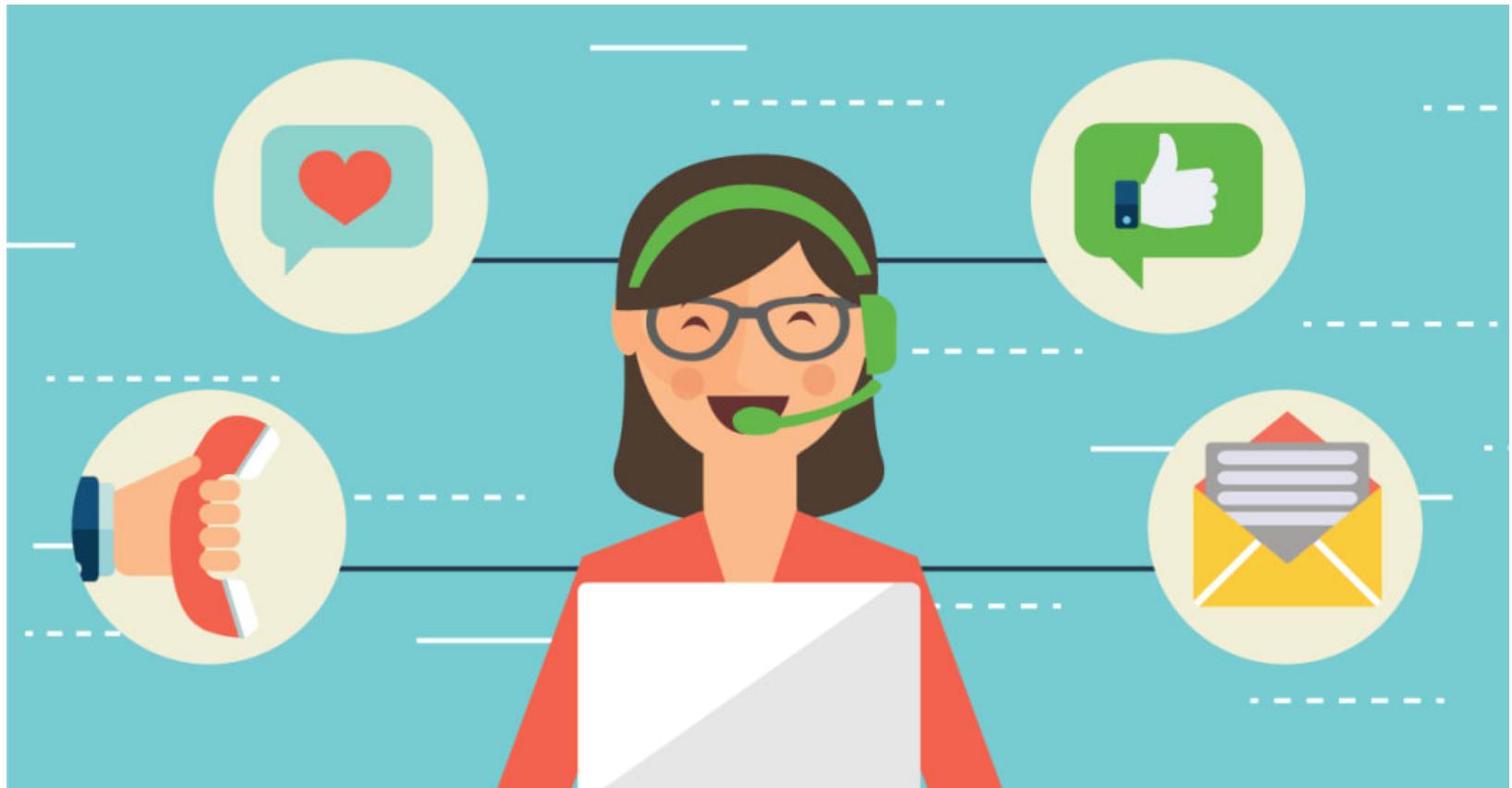
Patrick Shannon

Guest Lecturer: Ron Welch



BINGHAMTON
UNIVERSITY
STATE UNIVERSITY OF NEW YORK

Our world today





Whatever Happened to the World of Tomorrow?



*“We wanted flying cars,
instead we got 140
characters.”*

Peter Thiel - Founder of PayPal.
Entrepreneur, Venture Capitalist, Futurist



William Gibson

*"The future is
already
here, it's just not
very evenly
distributed."*

William Gibson – Author, Futurist. Coined the term “cyberspace”

Introduction



Obtaining a broad view of emerging trends and new technologies as they relate to business can help an organization anticipate and prepare for the future



Organizations that can most effectively grasp the deep currents of technological evolution can use their knowledge to protect themselves against sudden and fatal technological obsolescence

Top Reasons to Study Trends



Generate ideas and identify opportunities – Find new ideas and innovations by studying trends and analyzing publications.



Identify early warning signals – Scan the environment for potential threats and risks.



Gain confidence – A solid foundation of awareness about trends can provide an organization with the confidence to take risks.



Beat the competition – Seeing what is coming before others can give an organization the lead time it requires to establish a foothold in the new market.

Top Reasons to Study Trends, cont'd



Understand a trend – Analyzing the details within a trend can help separate truly significant developments from rapidly appearing and disappearing fads.



Balance strategic goals – Thinking about the future is an antidote to a “profit now, worry later” mentality that can lead to trouble in the long term.



Understand the future of specific industries – Organizations must understand everything inside and outside their industry.



Prepare for the future – Any organization that wants to compete in this hyperchanging world needs to make every effort to forecast the future.

Strategies for Spotting Trends



Trend analysis – The examination of a trend to identify its nature, causes, speed of development, and potential impacts

Trend monitoring – Trends viewed as particularly important in a specific community, industry, or sector are carefully monitored, watched, and reported to key decision makers

Trend projection – When numerical data are available, a trend can be plotted to display changes through time and into the future

Strategies for Spotting Trends, cont'd



Computer simulation – Complex systems can be modeled by means of mathematical equations and different scenarios can be run against the model to determine “what if” analysis

Historical analysis – Historical events are studied to anticipate the outcome of current developments



There is something even more interesting and valuable than trends though...

Radical Change: when Trends converge



Trend Lifecycle Phases

Individual trends have relatively minor impact initially.

But over time, as multiple trends converge, secondary effects accumulate and we get **significant disruption** at inflection points.

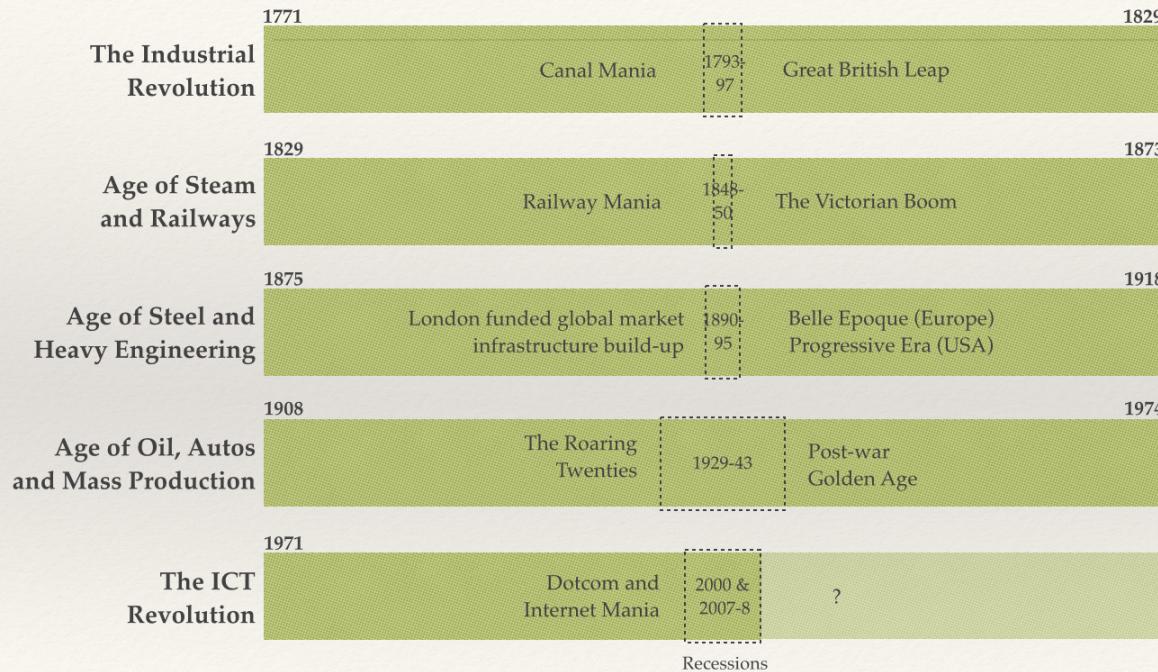
The 30 Year Cycle for Inflections



- Discoveries result in new inventions
 - Creates entrepreneurs but little widespread impact
- Ecosystems begin to emerge
- Secondary inventions converge and create new business models
- New business models drive large scale growth

Technological Surges over the last 250 Years

Great Surges of Development

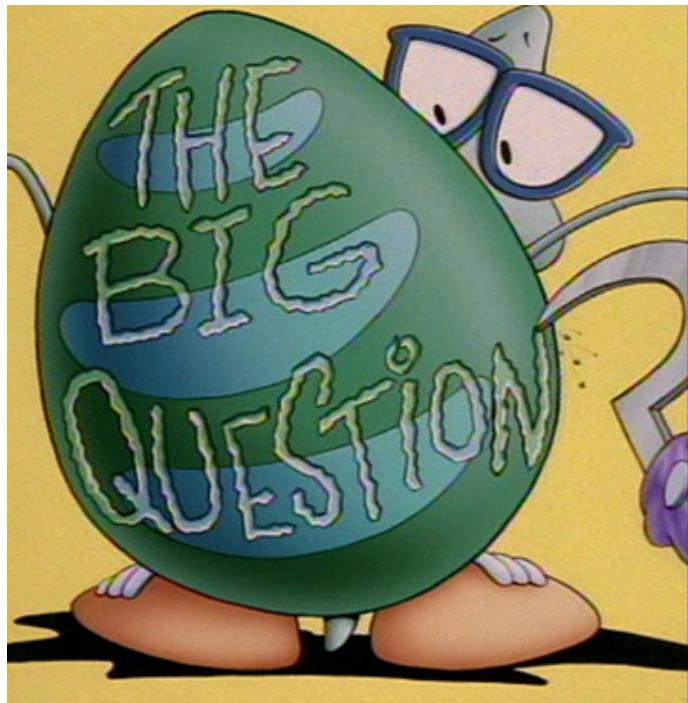


Technological Revolutions and Financial Capital: The Dynamics of Bubbles and Golden Ages - Carlota Perez (2002)

Inflections - Signs to Look for

- A Lack of Dissenting Opinions
 - Everyone is heading in the same direction
 - Group Think
 - Example: Housing crisis
- Extrapolation of current trends leads to absurd conclusions
 - Example: Out of whack evaluation – Internet Bubble
- Vast changes in cost structures
 - Example: Newspapers profits are evaporating due drop in cost of distribution dropping to essentially zero

Are we near an inflection point today?



Even if we are years away, an inflection in the span of your careers is virtually **inevitable**.

So what are the trends that might come together and cause an inflection?

Inflection Trend 1

New Computing Architectures to Enable Artificial Intelligence, Machine Learning and the Blockchain

- Moore's law is reaching physical limits
- Quantum Computing is showing promise
 - Could massively impact cryptography
- Neuromorphic Architectures
 - Evolution of GPUs
 - Optimized for Artificial Neural Networks enabling machine learning
- Web 3.0
 - IPFS, dfinity, Etherium 2.0, Solana, Polkadot, Cardano etc

The quest for quantum-proof encryption just made a leap forward

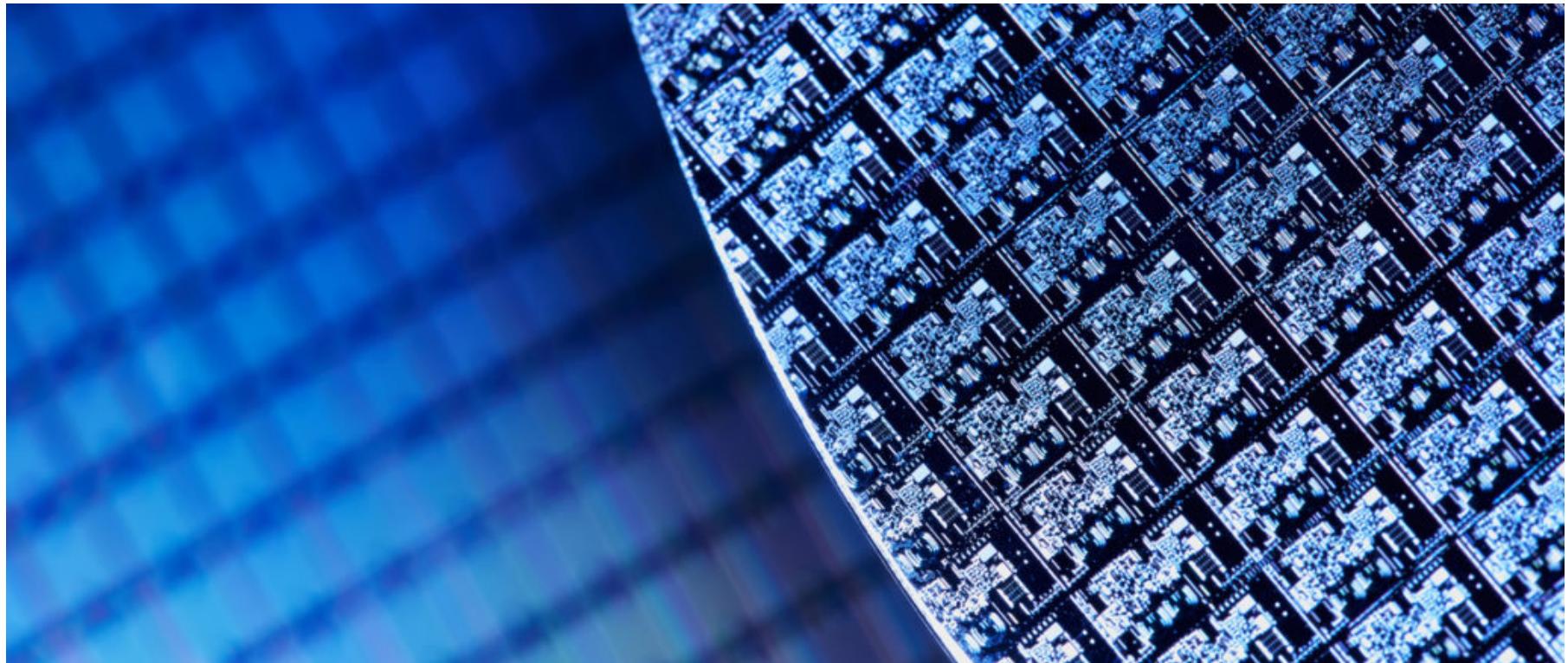
August 3, 2020 - MIT Technology Review



<https://www.technologyreview.com/2020/08/03/1005891/search-for-quantum-proof-encryption-computing-nist>

Gutting Decades of Architecture to Build a New Kind of Processor

July 12, 2021 - The Next Platform



<https://www.nextplatform.com/2021/07/12/gutting-decades-of-architecture-to-build-a-new-kind-of-processor/>

Inflection Trend 2

Synthetic Biology and Genetics

- Human Genome Project completed in 2003
- CRISPR discovered in 2012
 - Enables both read and write access to DNA
- Combination with Trend 1 is powerful
 - Biologically engineered materials (synthetic fossil fuels)
 - DNA based information processing and storage

Scientists ‘program’ living bacteria to store data

January 11, 2021 - Science



CRISPER Study is the First to Change DNA in Participants

May 21, 2021 - Healthline



<https://www.healthline.com/health-news/crispr-study-is-first-to-change-dna-in-participants>

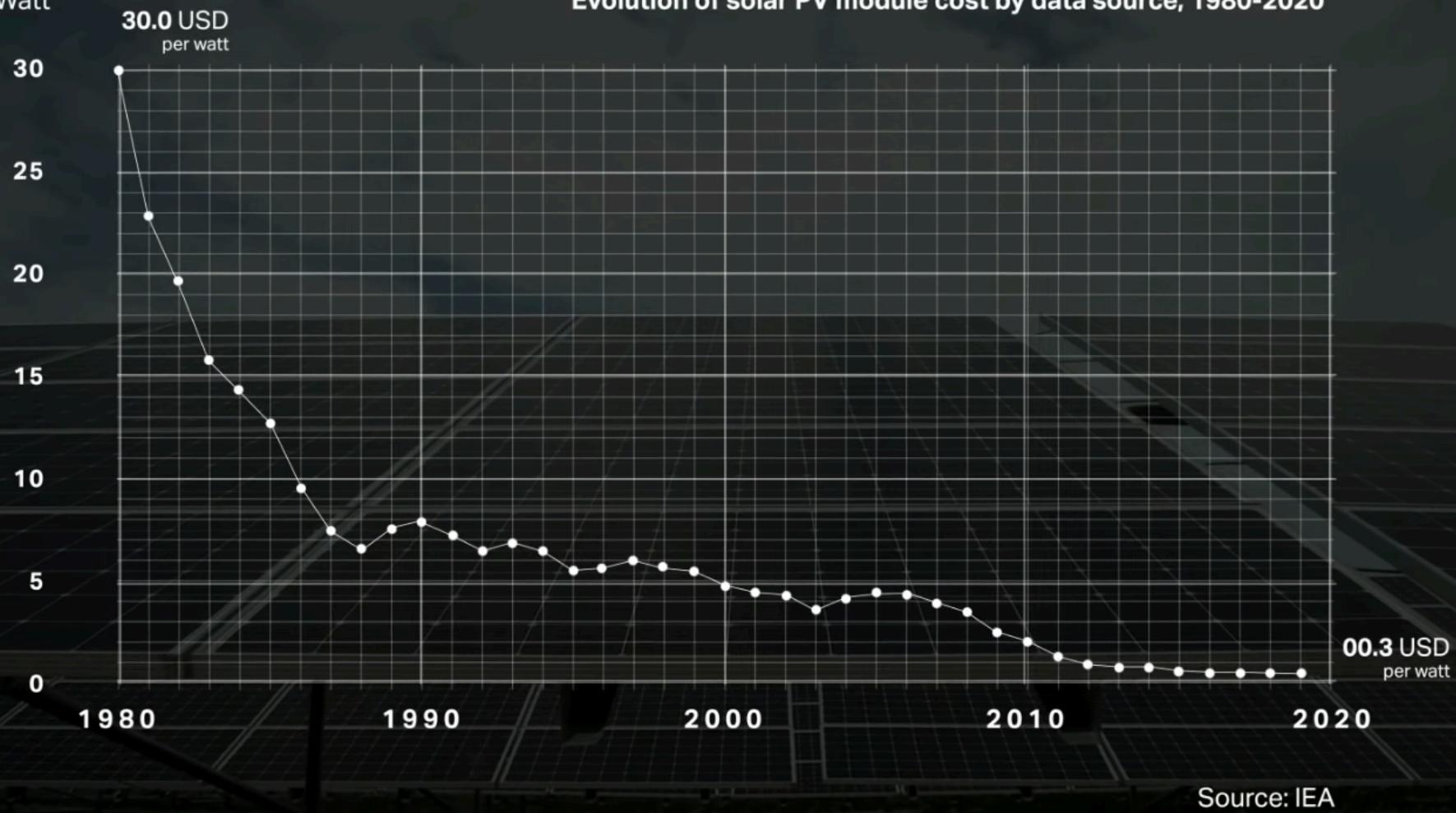
Inflection Trend 3

Energy Industry Revolution

- Massive Investments are starting to pay off
 - Price of solar energy is down 70 % in the last decade
 - Wind and solar are now cheaper than coal in North America (World Economic Forum Report)
 - Significant impact on developing world
- Combination with Trend 1 is powerful
 - Energy Storage (batteries) remains an issue but machine designed materials are showing promise
- Challenges around distribution remain

USD per Watt

Evolution of solar PV module cost by data source, 1980-2020



Source: IEA

Lithium Ion Batteries Just Made a Big Leap in a Tiny Product

September 8, 2021 - MIT Technology Review



<https://www.technologyreview.com/2021/09/08/1035143/sila-whoop-lithium-ion-battery-fitness-wearable-evs>

Inflection Trends **Ad Infinitum**

- Nanotechnology
- Robotics
- Networks and Sensors (5G, IOT etc.)
- 3-D Printing
- Augmented / Virtual Reality
- etc



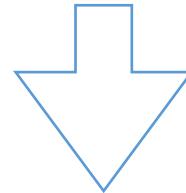
There is something even more interesting and valuable than infection points though...



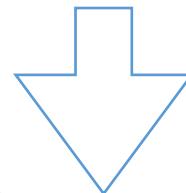
Individual inflections
disrupt products,
services and markets

Convergent inflections
wash them away, along
with the structures that
support them

Cell Phones + 5G = Massively Distributed Computing



Massively Distributed Computing
+ AI + Sensors + Quantum = The
Internet of Things



Internet of Things + MicroPayments +
Blockchain (Privacy) = New Digital
Economy

Evidence of Acceleration



Energy Harvesting Card Treats 5G Networks as Power Grids

March 28, 2021 - New Atlas

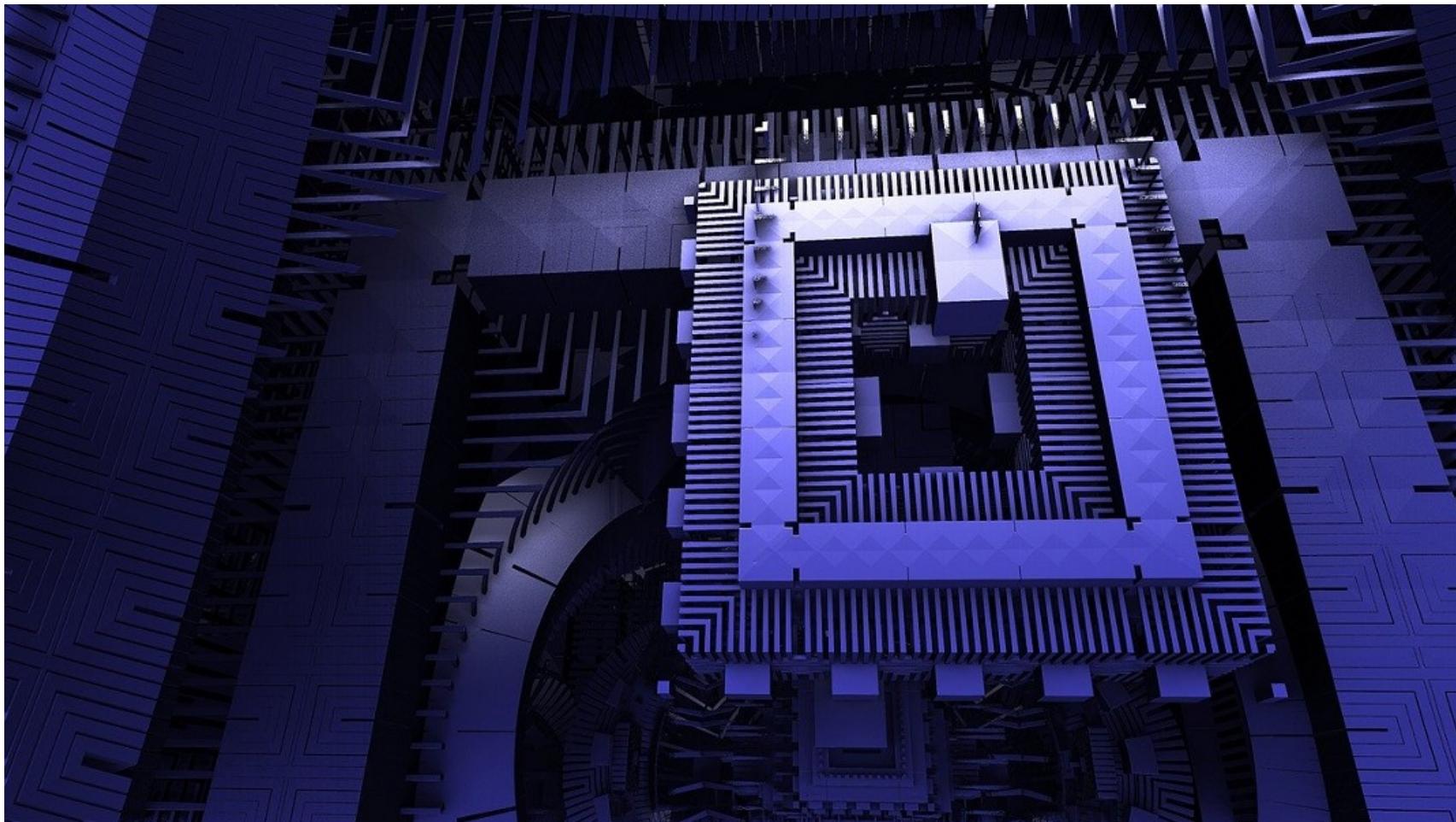


A team from Georgia Tech has just announced a world-first: a 3D-printed rectifying antenna the size of a playing card that can harvest electromagnetic energy from 5G signals and use it to power devices, turning 5G networks into wireless power grids.

https://newatlas.com/energy/5g-energy-harvesting-wireless-power/?utm_source=tldrnewsletter

How Quantum Computers Can Be Used to Build Quantum Computers

October 4, 2021 - Singularity Hub



<https://singularityhub.com/2021/10/04/how-quantum-computers-can-be-used-to-build-better-quantum-computers/>

A Nanowire Network That Mimics the Brain Could Inspire new Designs in AI

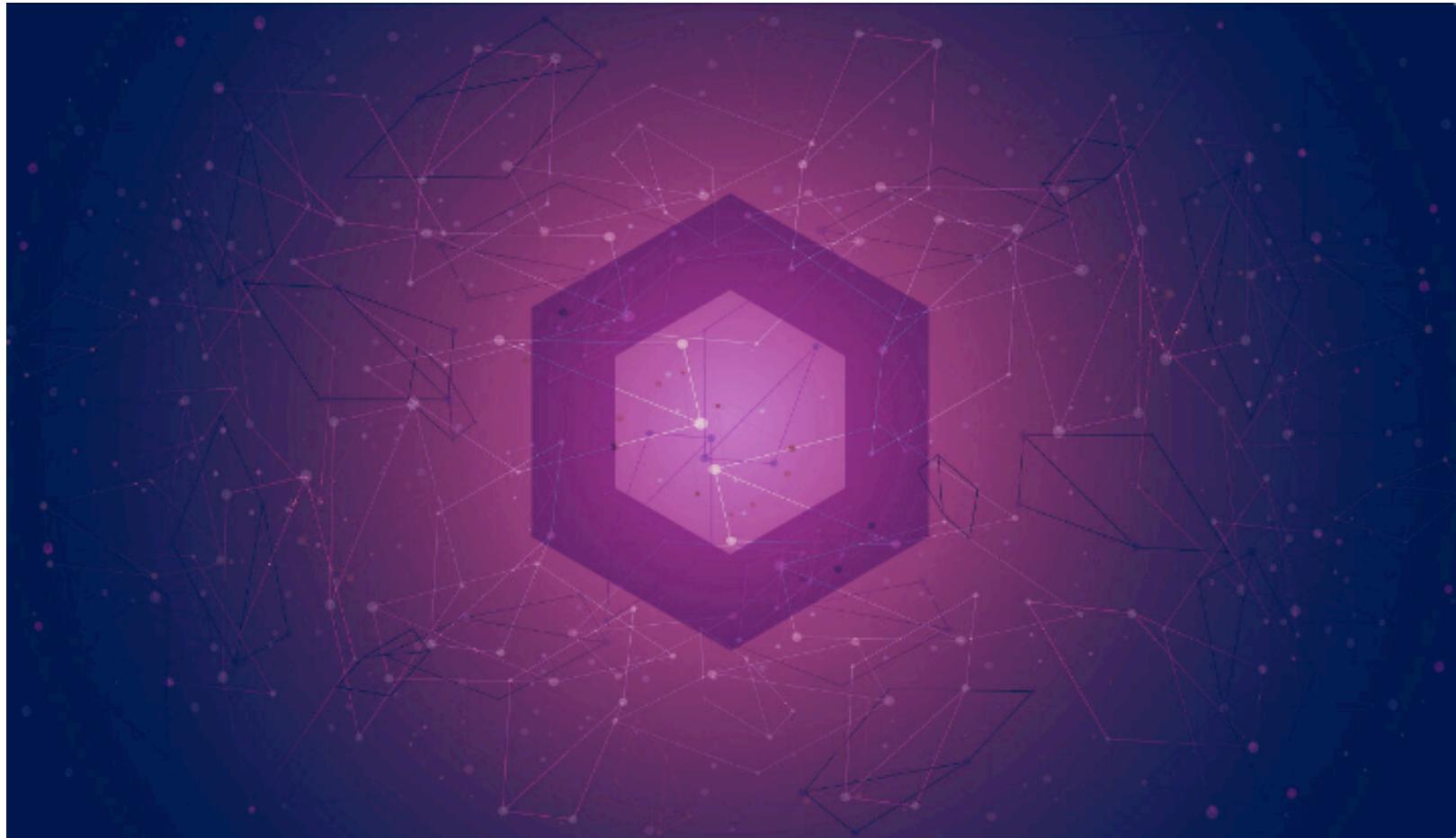
July 5, 2021 - Singularity Hub



<https://singularityhub.com/2021/07/05/a-nanowire-network-that-mimics-the-brain-could-inspire-new-designs-in-ai/>

Associated Press Tap Chainlink to Provide Untamperable News Data

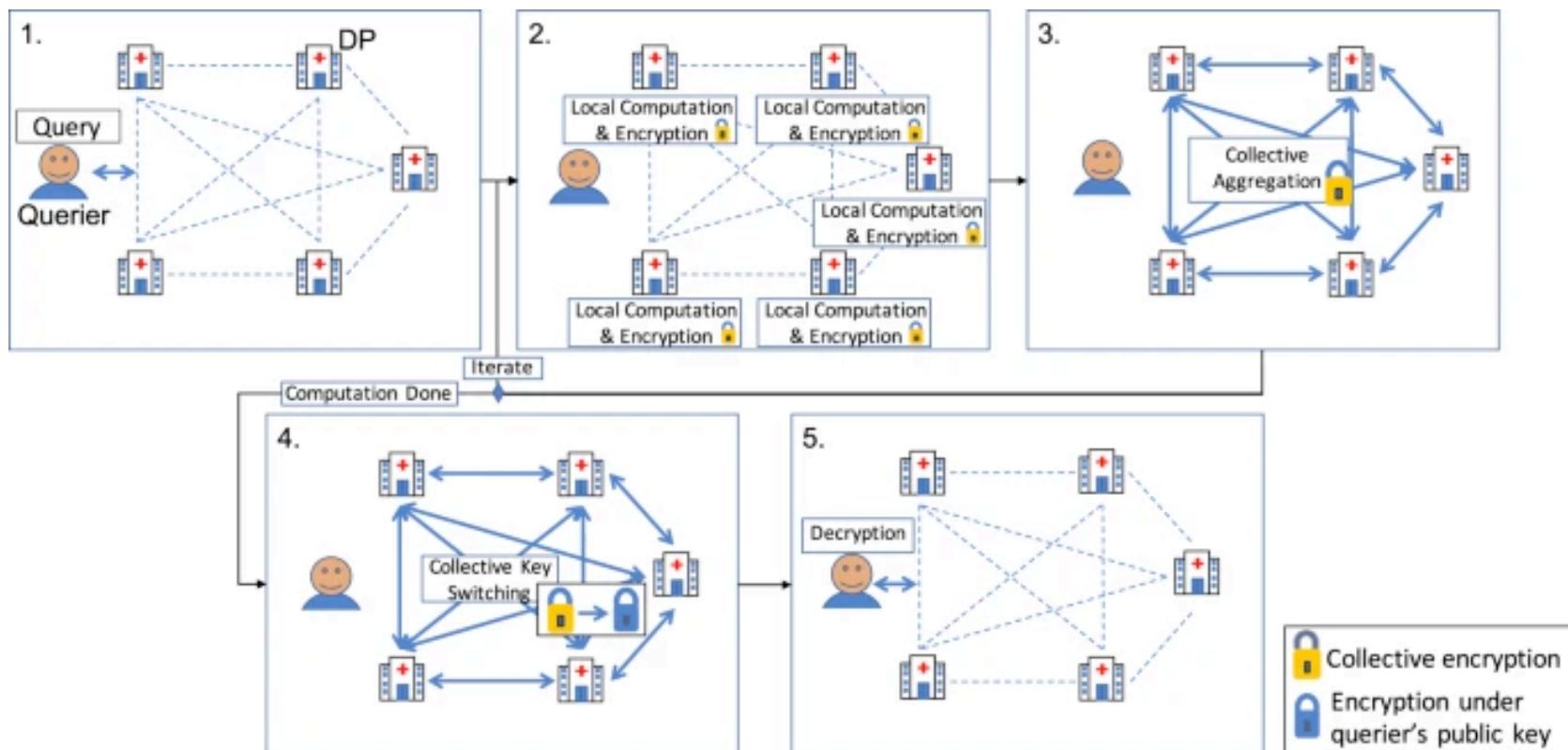
October 21, 2021 - Decrypt



<https://decrypt.co/83867/associated-press-ap-chainlink-news-data>

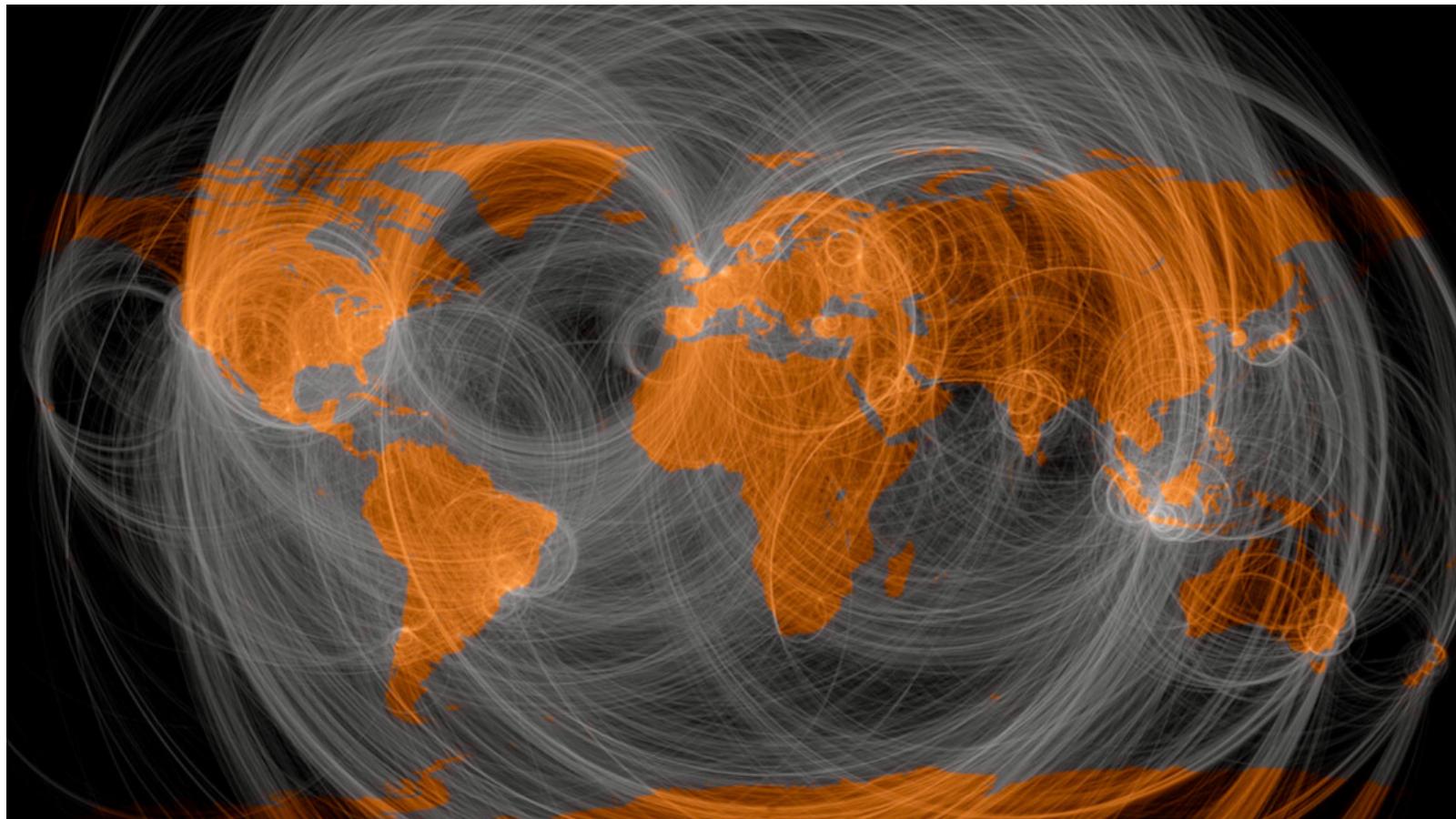
Truly Privacy-Preserving Federated Analytics for Precision Medicine with Multiparty Homomorphic Encryption

October 11, 2021 - Nature



How to Embed Trust into the Foundations of the Internet

September 19, 2021 - SingularityHub



<https://singularityhub.com/2021/09/19/how-to-embed-trust-into-the-foundations-of-the-internet/>

Researchers Successfully Store Data Inside DNA of Living Bacteria

January 15, 2021 - Science Mint



https://sciencemint.com/researchers-successfully-store-data-inside-dna-of-living-bacteria/?utm_source=tldrnewsletter

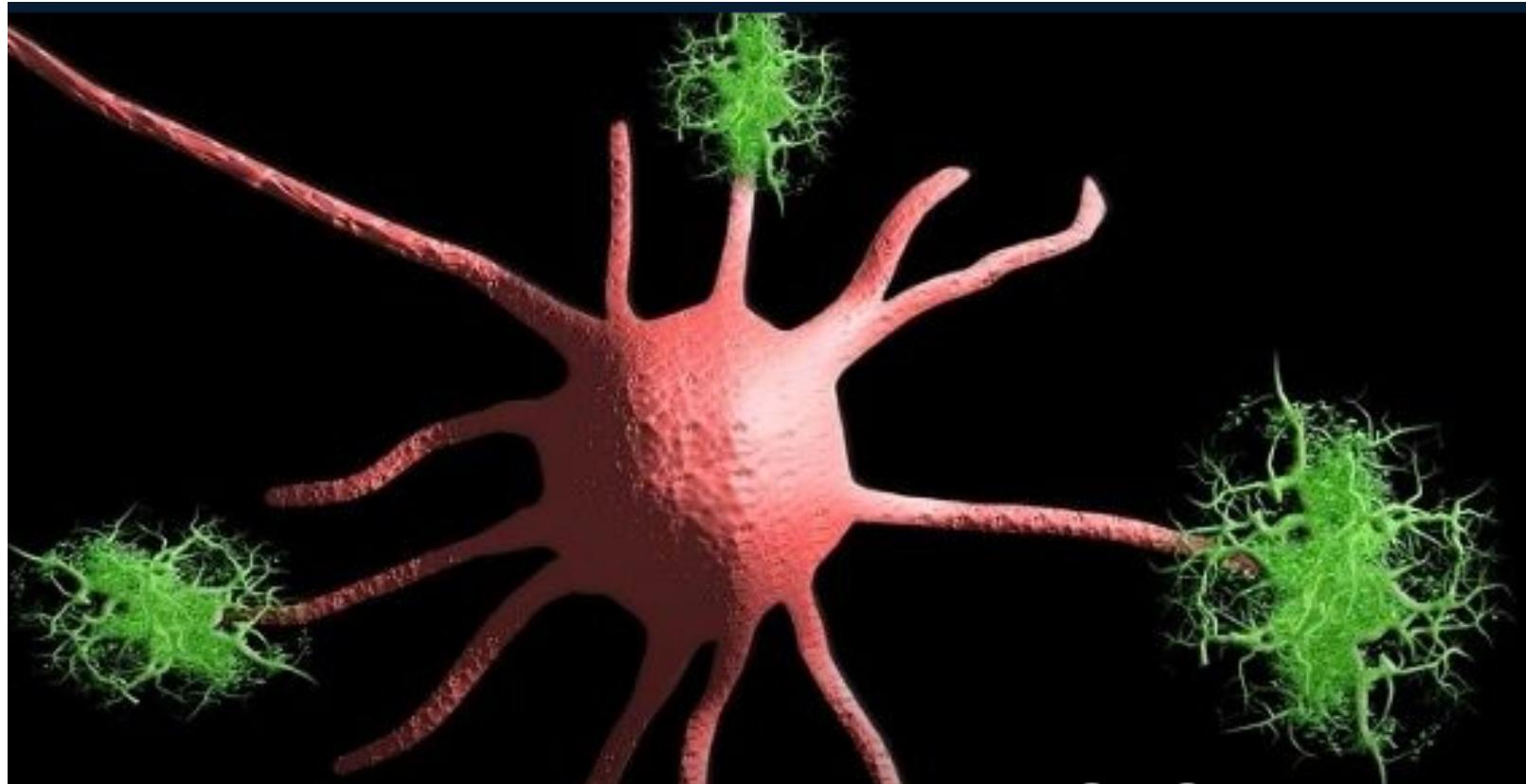
CRISPR was just used in a bid to restore sight to a blind person

March 4, 2020 - MIT Technology Review



A Massive New Gene Editing Project Out to Crush Alzheimer's

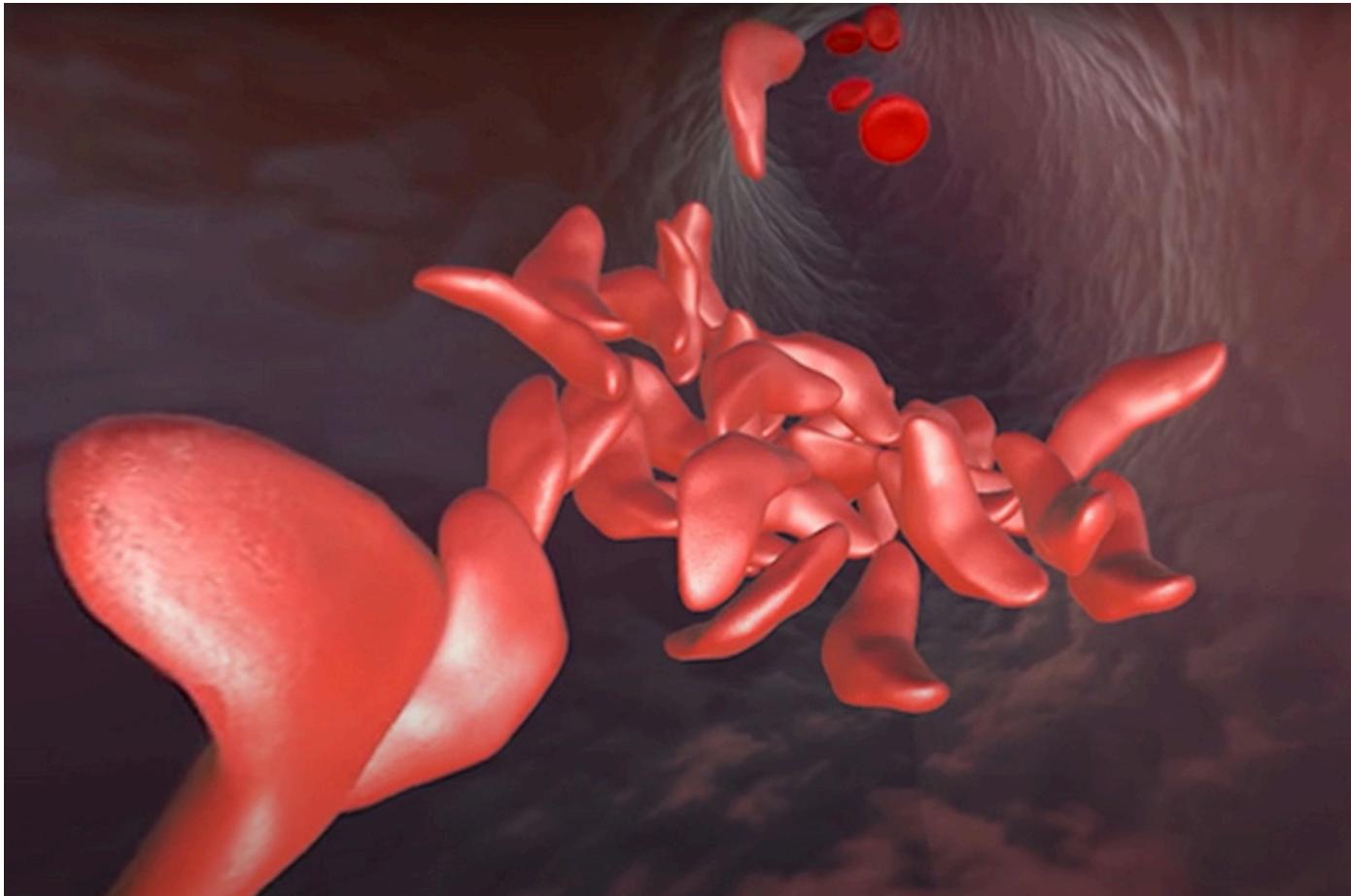
April 13, 2021 - SingularityHub



<https://singularityhub.com/2021/04/13/a-massive-new-gene-editing-project-is-out-to-crush-alzheimers>

FDA approves first test of CRISPR to correct genetic defect causing sickle cell disorder

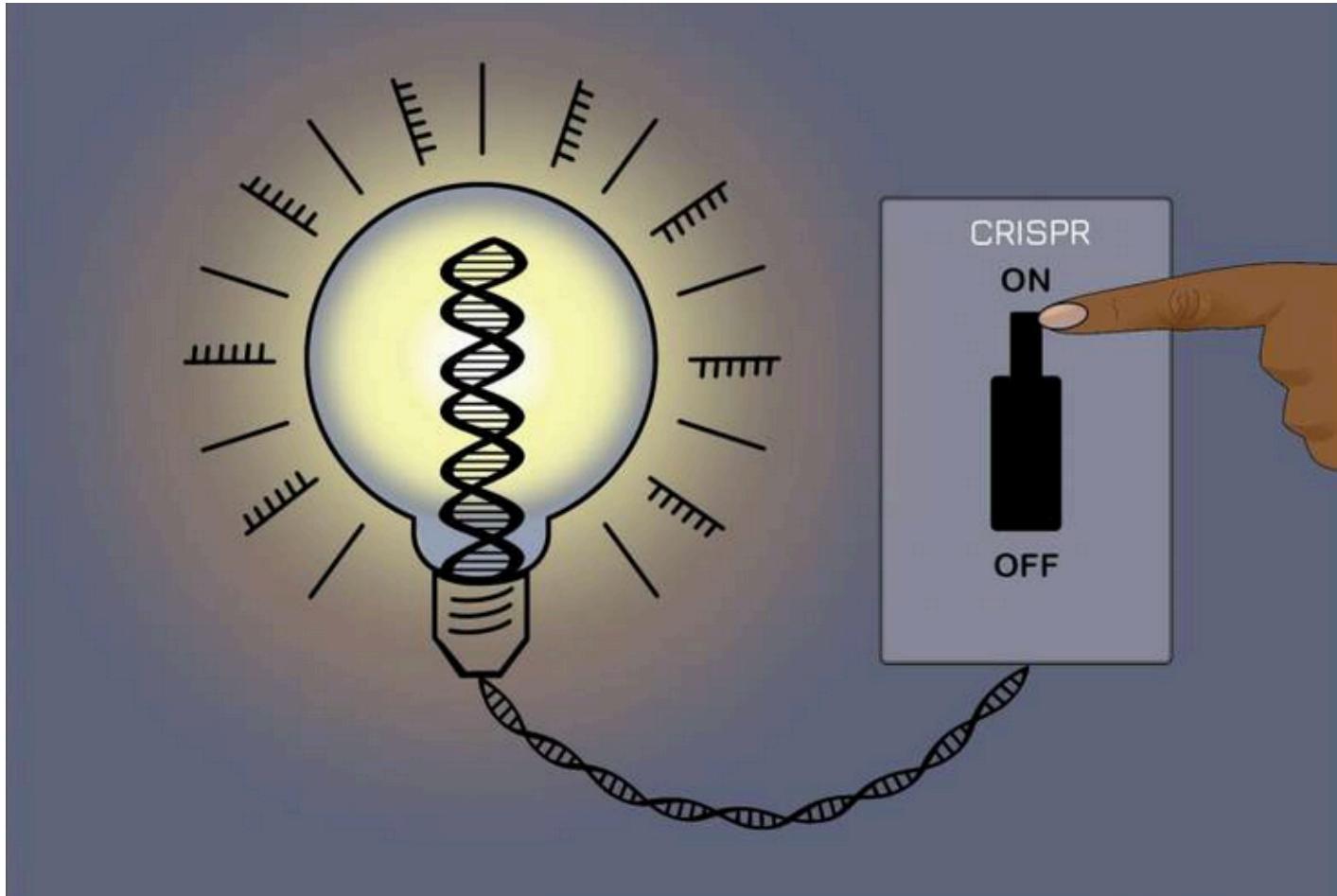
March 30, 2021 - SingularityHub



<https://news.berkeley.edu/2021/03/30/fda-approves-first-test-of-crispr-to-correct-genetic-defect-causing-sickle-cell-disease/>

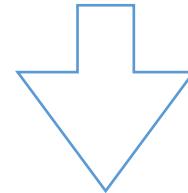
New, reversible CRISPR method can control gene expression while leaving underlying DNA sequence unchanged

April 9, 2021 - SingularityHub

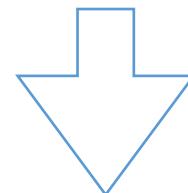


<https://phys.org/news/2021-04-reversible-crispr-method-gene-underlying.html>

Cell Phones + Solar Power =
Battery Technology



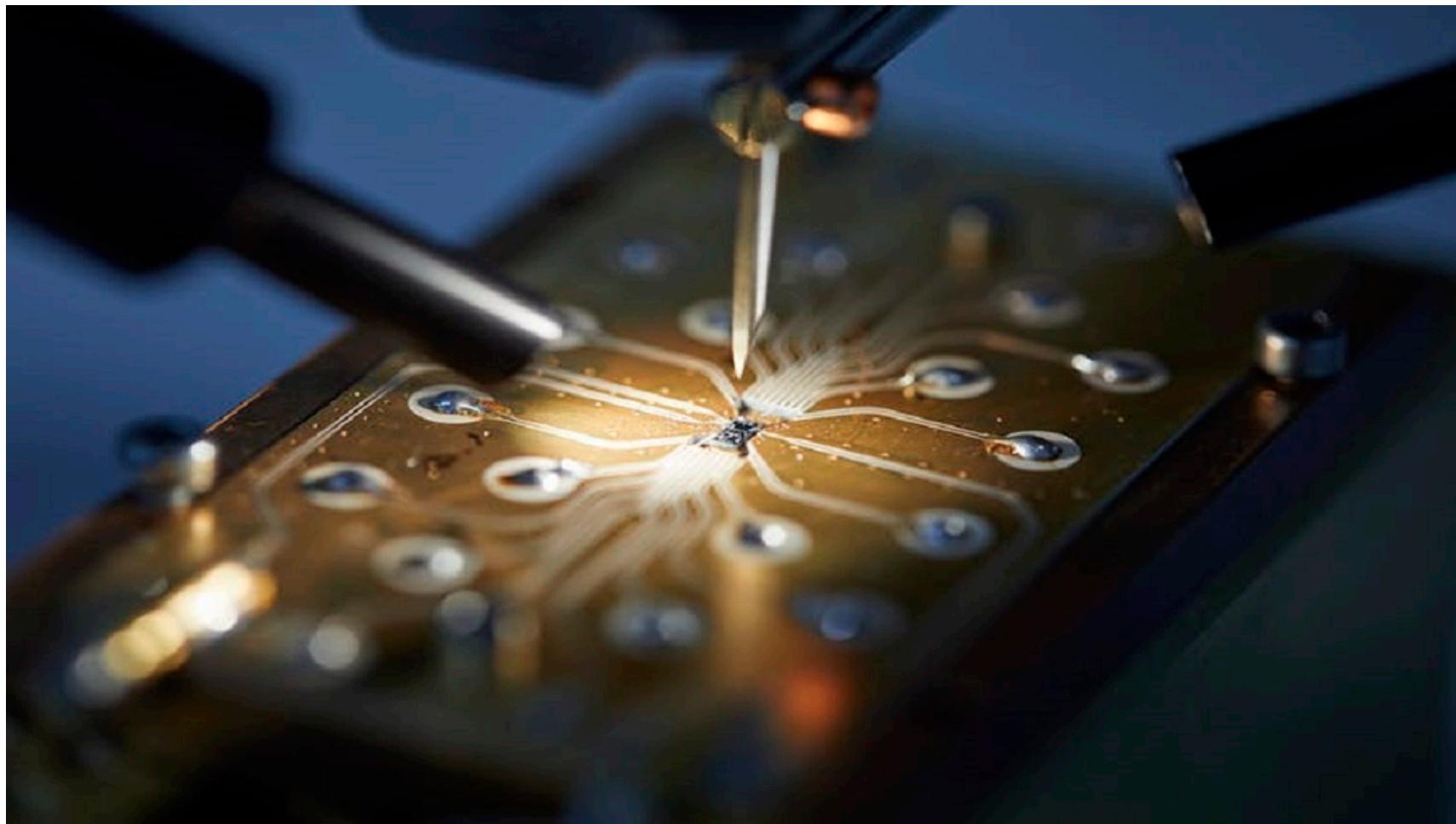
Battery Technology + AI + Sensors /
Big Data = Machine Learning



Machine Learning + Materials + 3-D
Printing = *Transportation
transformed*

Simple Crystal Could Help Pave the Way to Full Scale Quantum Computing

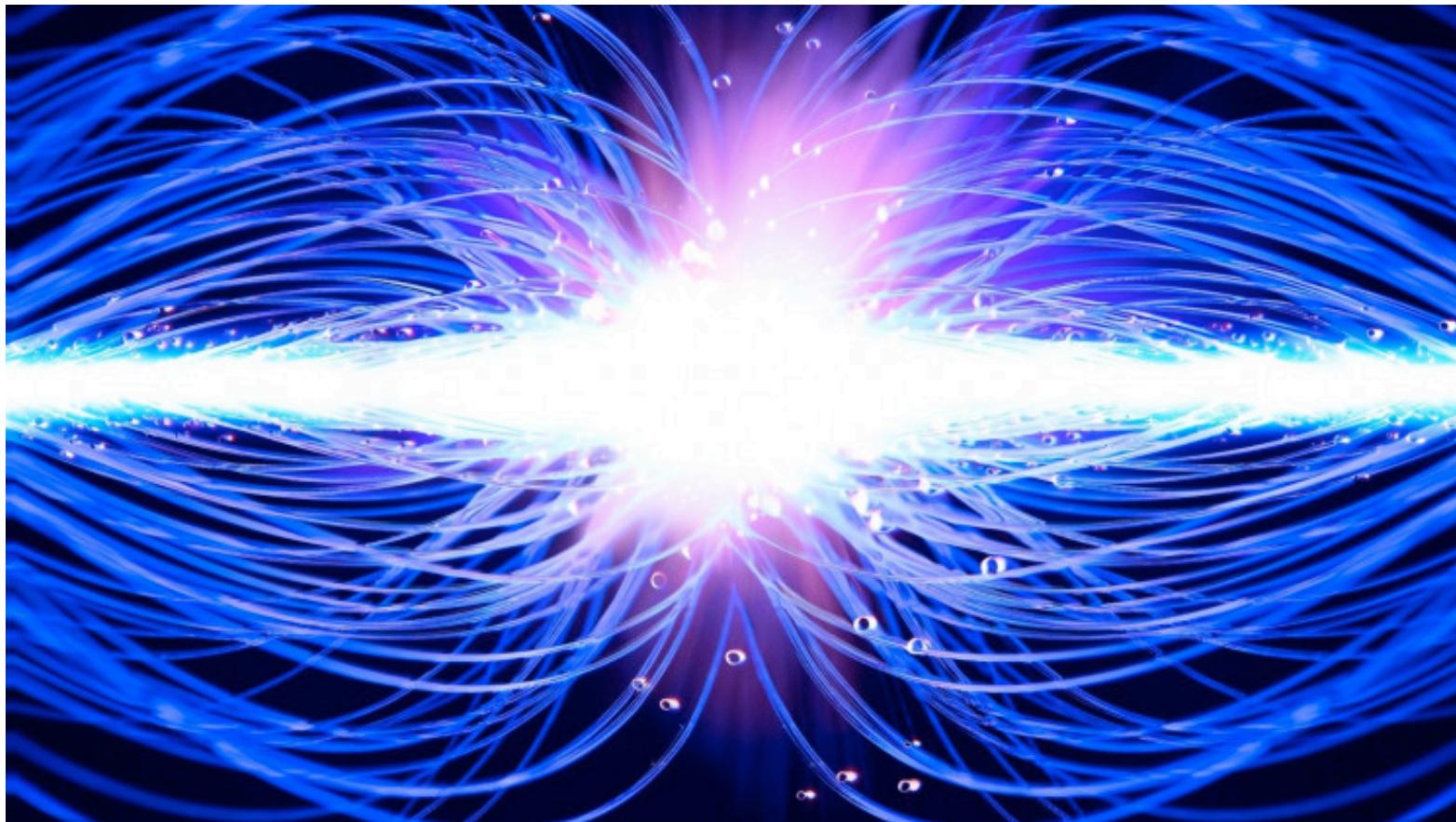
August 1, 2021 - Singularity Hub



<https://singularityhub.com/2021/08/19/how-a-simple-crystal-could-help-pave-the-way-to-full-scale-quantum-computing>

Scientists Have Created a Novel Metal That Allows Fluid-like Electron Motion

September 6, 2021 - Interesting Engineering



<https://interestingengineering.com/scientists-created-novel-metal-allows-fluid-like-electron-motion>

AI Is Throwing Battery Development Into Overdrive

October 12, 2020 - Wired

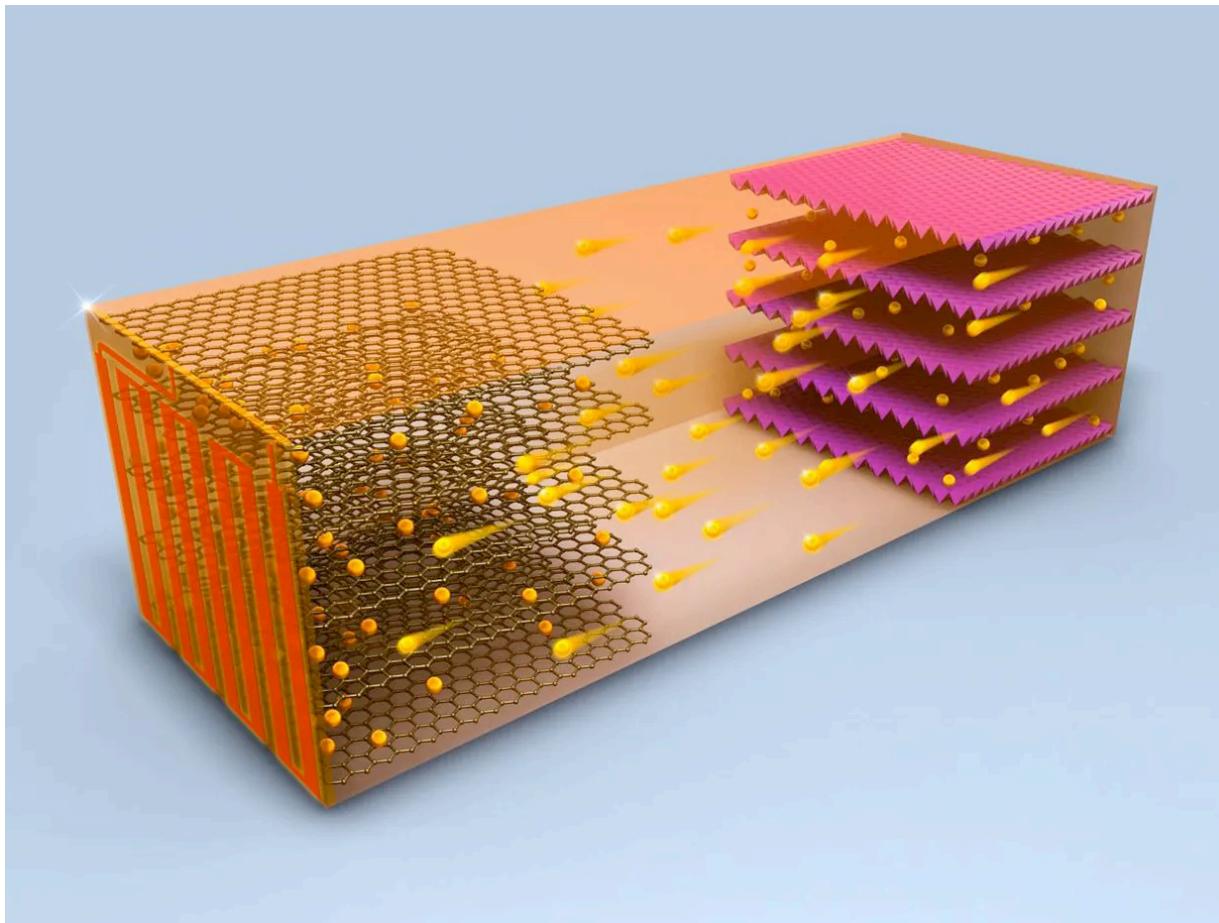


<https://www.wired.com/story/ai-is-throwing-battery-development-into-overdrive>

Electric Flying Cars May be Possible with New Batteries

June 15, 2021 - IEEE Spectrum

Lithium-ion cells with nickel foil can handle fast charging and could sustain 80-kilometer flights



Tiny Personal Aircraft Costs Under \$100K and Can Take Off from Your Driveway

October 27, 2021 – SingularityHub

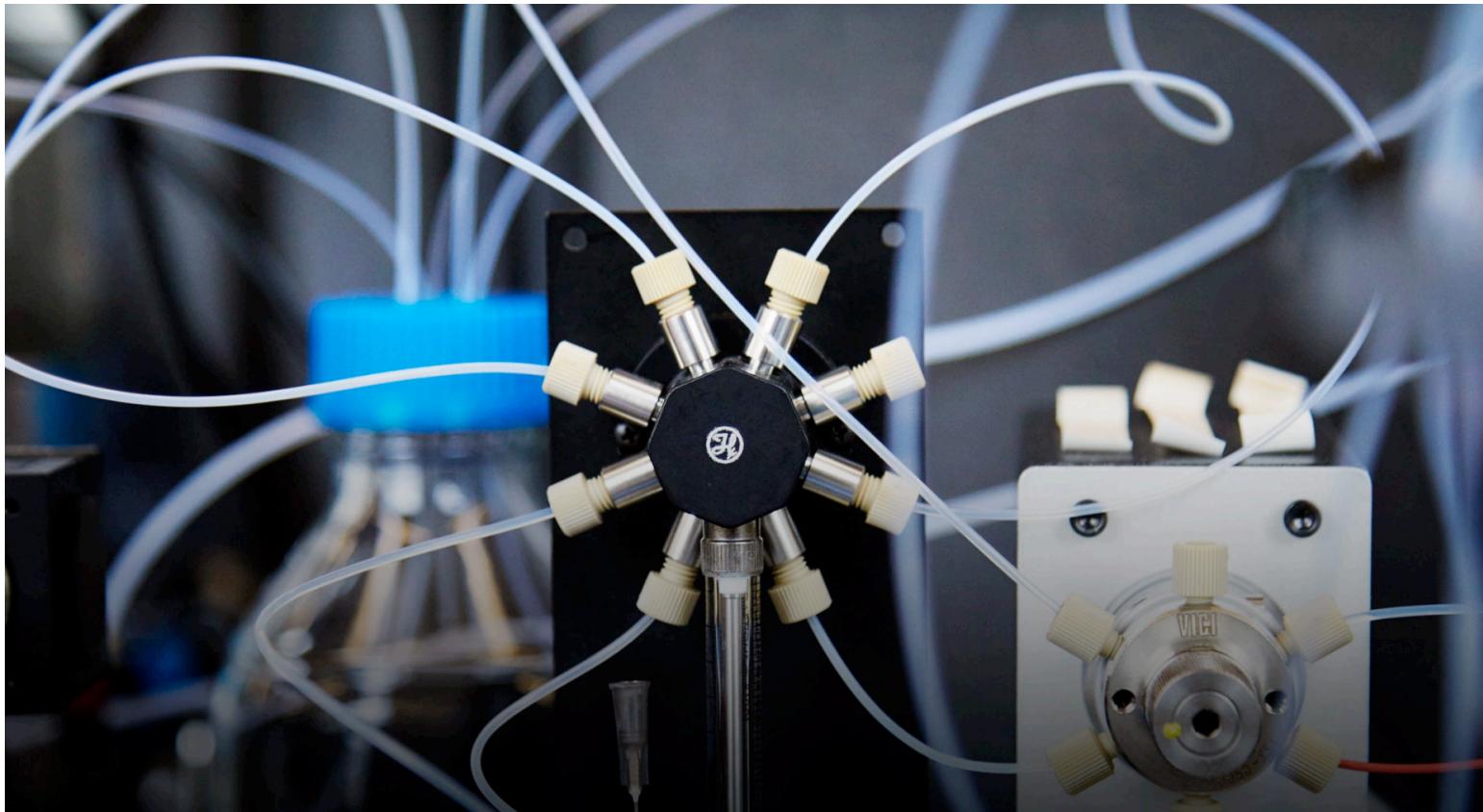


<https://singularityhub.com/2021/10/27/this-tiny-personal-aircraft-costs-under-100k-and-can-take-off-from-your-driveway/>

This Chemist is Reimagining the Discovery of Materials Using AI and Automation

October 27, 2021 - MIT Technology Review

Alan Aspuru-Guzik is using AI, robots, and even quantum computing to create the new materials we will need fight climate change.



Convergent Inflection points are here



Industry disruption is widespread
and rapidly accelerating

A dynamic photograph of a surfer riding a massive, curling blue wave. The surfer, wearing a dark wetsuit, is positioned in the center-left of the frame, leaning into the wave's face. The wave's white spray is visible at the top right. In the background, a green, hilly coastline is visible under a clear blue sky.

**YOU CAN'T
STOP THE WAVES
BUT YOU CAN
LEARN TO SURF**

Example 2: The Digital Revolution (cont)



The best way to predict the future is to invent it.

(Alan Kay)

IZ Quotes

What will the future world look like?

You Get To Decide