



## Show Notes January 19, 2024

**Story 1: WaterCube: World's first home air-to-water generator makes 120 gallons a day - \*\*\*featured at last week's CES\*\*\***

Source: Interesting Engineering

Story by Shubhangi Dua

Link: <https://interestingengineering.com/innovation/worlds-first-home-air-to-water-generator>

See also <https://genesissystems.com/ces-ibs/>

See video here: <https://www.youtube.com/watch?v=4iwO7Cb1o8A>



- At last week's CES [Genesis Systems](https://genesissystems.com/ces-ibs/) showcased its WaterCube (WC-100).

- It has been promoted as the world's first and only home device that generates water from air, harnessing 120 gallons a day of pure fresh water 24 hours a day [*my note, under ideal conditions*].
- The design is an automated system that uses the moisture present in the air, employing a condensation method to harness drinkable water through the company's proprietary technology.
- The WaterCube employs fans to bring air in and then a proprietary process to remove the water from the air, filter it and deliver pure water. Additionally, multiple WC-100 units can be combined to increase water output for larger households.
  - Per the video shot at CES last week - the system uses a UV purifier and a high Micron rating filter. Air is drawn in on one side and passed through filters.
  - Side note:
    - UV air purifiers are devices that use UV light technology to capture air and pass it through a filter. The air then goes through a small internal chamber where it becomes exposed to UV-C light. Some air purifiers then filter the air again before releasing it back into the room.
    - A micron is a metric unit of measurement, also known as a micrometer, a micron is a millionth of a meter or a thousandth of a millimeter. Micron ratings refer to the size of the holes or pores in the filter surface and thus the size of particle that a filter can remove from the water passing through it.
- The firm says that they successfully yielded 100 + gallons of pure water per day. This data is driven by testing the WaterCube at 80 degrees Fahrenheit and at 60 percent relative humidity.
- The model has been crafted to operate in humidity ranges between 40 percent to 100 percent with ideal climatic conditions involving temperatures greater than 59 degrees Fahrenheit.

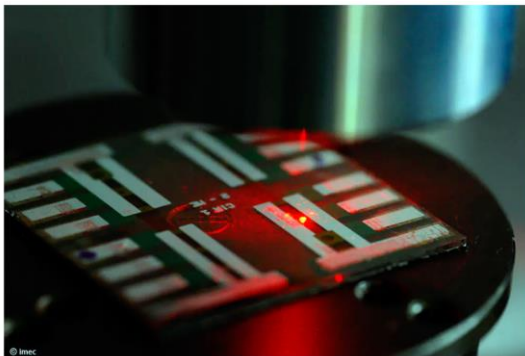
- Furthermore, the water yield meets the water quality standards with that required by US, National Science Foundation, and international standards as well.
- According to the official website of Genesis Systems, the WC-100 WaterCube costs \$19,995.

## Story 2: Perovskite LED stack emits light 1000x brighter than regular OLEDs – Key trend, here come PeLEDs!

Source: Optics.org

Link: <https://optics.org/news/15/1/8>

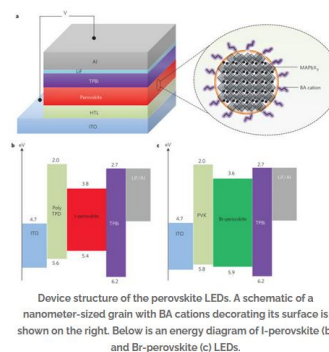
See also: <https://www.msn.com/en-us/news/technology/thousand-times-brighter-than-oled-how-cheap-material-bound-to-revolutionize-solar-panels-could-one-day-also-make-your-laptop-display-finally-readable-in-bright-sunlight/ar-AA1mT5Kg>



Power up: transparent perovskite light emitting diodes on sapphire substrate with scaled emission area for injection of ultrahigh current densities. Image: imec, Jade Liu


- OLEDs are widely used in products such as smartphone screens and employ organic thin-film materials as a semiconductor.
  - First, what are OLEDs - OLED stands for organic light-emitting diode. Each pixel in an OLED display is made of a material that glows when you jab it [*stimulate*] with electricity. **What's the "organic" part?** The specific electroluminescent materials used in OLED displays are organic compounds, which means they contain carbon plus some other ingredients. Each color requires a different organic compound.

- However, their maximum brightness of OLEDs remains limited – for example, when one considers trying to read a smartphone screen under very sunny conditions.
- Meanwhile, perovskites – a class of materials with a specific crystal structure – are proving their worth beyond solar cells. With excellent optoelectrical properties, low-cost processability and efficient charge transport, these materials have emerged in the last ten years as interesting candidates for light emission applications, such as LEDs.
  - What is a perovskite LED –
    - **First, what is perovskite?** – Perovskite is a mineral composed of calcium titanate. It is named after Russian mineralogist Lev Perovski . Perovskites are a family of crystals that show promising properties for applications in nanotechnology, especially nanostructured solar cells.
    - In most perovskite LEDs, electrodes sandwiching the light-emitting material deliver charges—negatively charged electrons and positively charged electron vacancies.
      - When the charges meet at the center of the sandwich, electrons fill the vacancies and give up a bit of their energy as a photon of light.
      - The color of the photon depends on the perovskite's chemical constituents, enabling researchers to tune the color by changing the perovskite's recipe. See also: <https://www.perovskite-info.com/perovskite-led>



*Also check out the link embedded in image.*

- **Optional Side Note - there is QLED technology also - [What is QLED?](#)**  
*The name came about in 2017 because the TVs use quantum dot technology on an LED panel. Quantum dot + LED = QLED. We explain more about quantum dots below. Although there was quite a song and dance about the new technology at launch, it wasn't actually new. It was an evolution of the quantum dot technology in Samsung's TVs, first introduced in 2015. The evolution of the name was really a marketing move to rival OLED (organic light emitting diode) at the high-end.*
- **Finally, here's the big news:** Belgium-based research and innovation hub [Interuniversity Microelectronics Centre](#) (IMEC) has developed a new type of perovskite LED stack as part of its [ULTRA-LUX project](#), which, it says, emits light one thousand times brighter than state-of-the-art OLEDs.
- This result, say its creators, is a “*pivotal milestone towards a perovskite injection laser, promising exciting applications in image projection, environmental sensing, medical diagnostics, and beyond.*”
  - **Optional side note - [What is meant by injection laser?](#)** *A laser diode or injection laser diode is a device in which the p–n junction of a diode is used as a lasing medium. The energy is supplied in the form of the biasing of the diode, similar to that found in a light-emitting diode. The laser diode normally emits coherent light, while the LED emits incoherent light.*
- In the ULTRA-LUX project, the Interuniversity Microelectronics Centre team showed for the first time a perovskite LED [PeLED] architecture with low optical losses and pumped these perovskite LEDs to current densities that support the stimulated emission of light.
- This novel architecture of transport layers, transparent electrodes, and perovskite as the semiconductor active material, can operate at electrical current densities ***tens of thousands of times higher than conventional OLEDs can.***



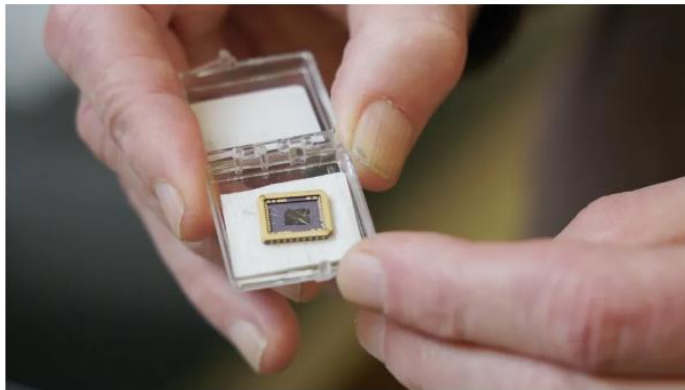
**Story 3: World's 1st graphene semiconductor could power future quantum computers** - *Scientists overcame a limitation in graphene to harness the material as a working semiconductor at terahertz frequencies with 10 times the mobility of silicon.*

Source: LiveScience.com

Story by Keumars Afifi-Sabet

Link: <https://www.livescience.com/technology/electronics/worlds-first-graphene-semiconductor-could-power-future-quantum-computers>

See also: <https://www.nature.com/articles/s41586-023-06811-0.epdf>



Like light, electrons in graphene have quantum mechanical wave-like properties that can be accessed in devices, making such a semiconductor a good choice for use in future quantum computers.  
(Image credit: Christopher McKenney/Georgia Tech)

- An international team of scientists from China and the [Georgia Institute of Technology](#) in the United States have created the world's first working graphene-based semiconductor, which could pave the way for chips that power much faster PCs and quantum computers in the future.
  - **Side note, what is a quantum computer?** *A quantum computer is a computer that leverages the principles of quantum mechanics to perform computations. It uses quantum bits (qubits) instead of classical bits to store and process information . Unlike classical bits, qubits can exist in a superposition of states and can be entangled with other qubits, allowing for the creation of quantum algorithms that can solve certain problems exponentially faster than classical algorithms.*
- The new semiconducting material, made from epitaxial graphene (a particular crystal structure of carbon chemically bonded to silicon carbide), allows for more mobility than silicon, meaning electrons move with less resistance.
  - Transistors made in this way can operate at terahertz frequencies — 10 times faster than the silicon-based transistors used in chips today — the researchers wrote in a study published [Jan. 3 in the journal Nature](#).

- Semiconductors have properties of both conductors and insulators. At the right temperature range, electrons move through the semiconductor material — but only if a certain amount of energy is applied.
- Almost every chip today uses a semiconductor made from silicon, but the material is reaching its limits. These limits include the maximum speed at which transistors can "switch" between their on-off positions, the heat they generate through resistance, and the smallest size people can make them.
- This means the rapid advancements we've seen throughout the history of computing are beginning to slow. [My note, think Moore's Law]
- Graphene, meanwhile, is made from a single layer of carbon atoms tightly bound in a hexagonal lattice, and is a better conductor than silicon, meaning electrons move with less resistance through the material.
- Despite its favorable properties, graphene has never been harnessed in electronics because of the lack of a "band gap" — a minimum amount of energy needed to move electrons when an electric field is applied to it. Band gaps are what enable transistors to switch on and off.
- To function as a working transistor, graphene must be treated in some way, but in the past, this has damaged its properties.
- But the researchers from China and the Georgia Institute of Technology worked around this challenge by fusing graphene onto silicon carbide using special furnaces and a special heating and cooling process.
- By putting atoms on the graphene that "donate" electrons to the system, which is known as "doping", they created a functional graphene semiconductor with a band gap. Which, again, makes it possible to create a working semiconductor at terahertz frequencies with 10 times the mobility of silicon.



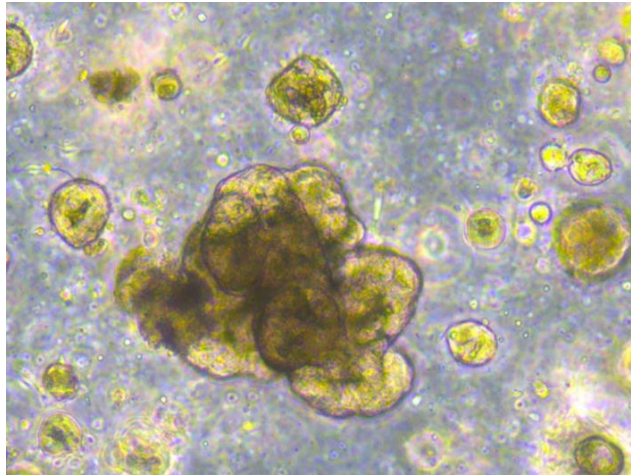
**Story 4: New analysis of cancer cells identifies 370 targets for smarter, personalized treatments** - *Cancer drug discovery accelerated as hundreds of overlooked targets prioritized.*



Source: News-Medical.net      Story by Communications Team Sanger Institute

Link: <https://www.news-medical.net/news/20240113/New-analysis-of-cancer-cells-identifies-370-targets-for-smarter-personalized-treatments.aspx>

See also: [https://www.sanger.ac.uk/news\\_item/cancer-drug-discovery-accelerated-as-hundreds-of-overlooked-targets-prioritised/](https://www.sanger.ac.uk/news_item/cancer-drug-discovery-accelerated-as-hundreds-of-overlooked-targets-prioritised/)



- A new, systematic analysis of cancer cells has identified 370 candidate priority drug targets across 27 cancer types, including breast, lung, and ovarian cancers.
  - **Side note, what is a drug target?** - *A drug target can be thought of as a dart board, where the drug molecules are the darts. Strong, accurate binding of a drug to its target is important for successful activity; by analogy, hitting a high scoring section of the dart board (like the bull's eye in the middle) helps to win the game.*
  - *The drugs that bind strongly and selectively to their biological targets are analogous to a dart that sticks firmly to a dart board in a high scoring position. Many drugs bind weakly to a number of targets, giving rise to both desirable and non-desirable side effects.*
  - Source: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7120710/>
- In the most comprehensive study of its kind [to date], researchers from:
  - The [Wellcome Sanger Institute](#) [a world leader in genome research that delivers insights into human, evolutionary and pathogen biology]
  - A research outfit called [Open Targets](#)



- And their collaborators pooled together data from 930 cancer cell lines.
- They then used machine learning methods to find the drug targets that show the most promise for developing new treatments, and the patients who would most benefit from such treatments.
  - This involved assessing the occurrence of these targets in actual patient tumors and linking them to specific biological markers and genetic and molecular features found in the tumors.
- The findings, published 11 January in Cancer Cell, not only bring researchers one step closer to producing a full Cancer Dependency Map of every vulnerability in every type of cancer, but help guide focused efforts to accelerate the development of targeted cancer treatments.
- With over 20,000 potential anti-cancer targets in the genome, determining which are suitable to target for specific types of cancers and patients is a significant challenge.
- In this new study, the research team set out to narrow down potential drug targets. By analyzing data available from the Cancer Dependency Map project, which involved CRISPR technology to disrupt every gene inside 930 human cancer lines one at a time, they were able to produce the most comprehensive view of potential new cancer targets to date.



## HONORABLE MENTIONS:

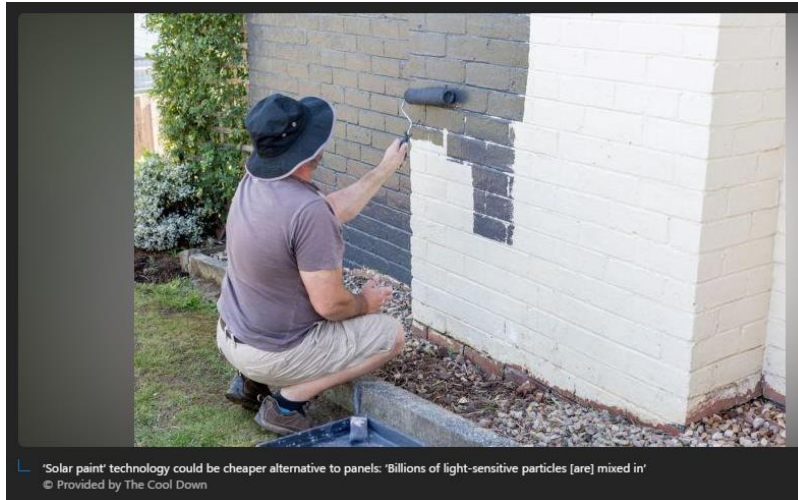
### Story: 'Solar paint' technology could be cheaper alternative to panels

Source: The Cool Down

Story by Laurelle Stelle

Link: <https://www.msn.com/en-us/lifestyle/lifestyle-buzz/solar-paint-technology-could-be-cheaper-alternative-to-panels-billions-of-light-sensitive-particles-are-mixed-in/ar-AA1mKv0U>

See also: <https://solaractionalliance.org/solar-paint/>



- Solar panels are already an affordable energy solution since they generate enough power over their lifetimes to pay for themselves and then some. However, they do take some investment up front, and some people (and homeowners associations) dislike the way they look.
- So, what if you could get that power to make electricity from sunlight without having to install solar panels? That's the beauty of solar paint, [as reported by Solar Action Alliance](#).
- The idea behind solar paint (aka photovoltaic paint) is simple: It'd be like ordinary paint but with billions of light-sensitive particles mixed in [[see Understand Solar notes](#)].
- When you paint it onto a surface, such as the wall of a house, it would turn that surface into a stealthy solar panel, generating electricity when the sun hits a surface with circuitry attached, [see article in [Treehugger](#)].
- According to the Solar Action Alliance, this isn't just theory. The University of Buffalo has developed a light-sensitive material for use in solar paint, and the University of Toronto has developed a spray-on substance to make what is essentially solar wallpaper — which could lead to a direct spray-paint application.
- What keeps that dream from being a reality so far is efficiency, as noted by the Solar Action Alliance. Right now, typical solar panels have around 20% efficiency, meaning they turn about 20% of the sunlight that hits them into electricity. Experts cited by Solar Action Alliance estimate that solar paint would need about 10% efficiency to make sense as a commercial product.

- The best-performing solar paint formula anywhere has only 8% efficiency, according to the alliance, but this developing technology is getting closer and closer to the point where it could be functional.

## Story: NASA, Lockheed Martin Reveal X-59 Quiet Supersonic Aircraft

Source: NASA.gov

Link: <https://www.nasa.gov/news-release/nasa-lockheed-martin-reveal-x-59-quiet-supersonic-aircraft/>



- NASA and Lockheed Martin formally debuted the agency's X-59 quiet supersonic aircraft Friday, January 12. Using this one-of-a-kind experimental airplane, NASA aims to gather data that could revolutionize air travel, paving the way for a new generation of commercial aircraft that can travel faster than the speed of sound.

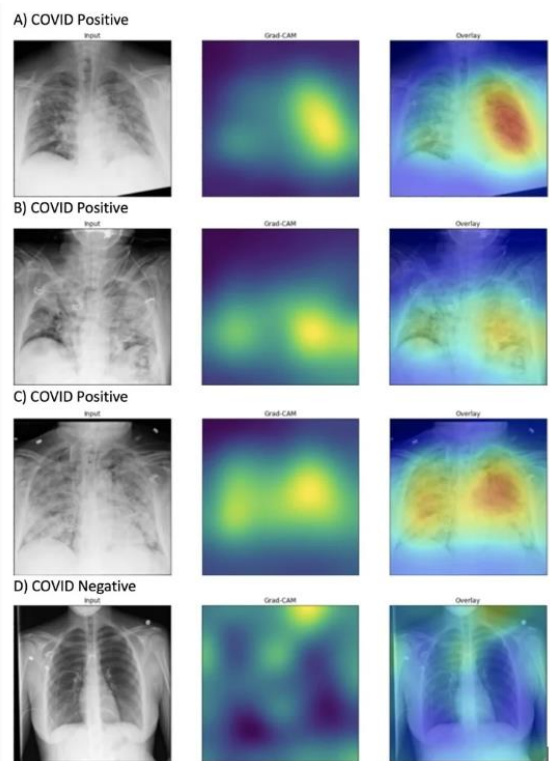
- The X-59 is at the center of [NASA's Quesst mission](#), which focuses on providing data to help regulators reconsider rules that prohibit commercial supersonic flight over land. For 50 years, the U.S. and other nations have prohibited such flights because of the disturbance caused by loud, startling sonic booms on the communities below. The X-59 is expected to fly at 1.4 times the speed of sound, or 925 mph. Its design, shaping and technologies will allow the aircraft to achieve these speeds while generating a quieter sonic thump.

## Story: New A.I. is fast and accurate at detecting COVID-19 from chest X-rays

Source: news-medical.net

Story by Sarah Moore

Link: <https://www.news-medical.net/news/20201124/New-AI-is-fast-and-accurate-at-detecting-COVID-19-from-chest-X-rays.aspx>



*Image Credit: Northwestern University*

- A team of researchers at Northwestern University, Illinois, USA, have innovated a platform that uses artificial intelligence (A.I.) to detect COVID-19 at higher levels of accuracy than specialized thoracic radiologists.

- The breakthrough will likely be instrumental in preventing the spread of the virus, particularly amongst hospital patients and staff, by providing a rapid and accurate method for screening patients admitted to hospital either with or without COVID-19 symptoms by merely scanning their chest x-rays.
- The technology will act as an early warning system, highlighting those who need to self-isolate even before symptoms develop and, additionally, picking up on those who may have never been aware of their need to isolate.