Students, are you prepared for the future? Your assignment is to peruse the technology developments below and find some that interest you. Then after reviewing the “Brief Discussions” of the technologies on the pages that follow, choose at least one and provide your teacher with a 1-2 paragraph discussion about why the technology development interests you, and how you might apply it to develop a new product or service, or problem or pain point solution.
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HOW TO USE THIS DOCUMENT

Select a Blue Hyperlink (e.g. Agriculture (to the left) or Coffee Power (page 3)
Right click on the title or word.
Scroll to highlight “Hyperlink” – Click “Open Hyperlink”.
This will take you to additional detail about that title.

From any page, click on the home icon in the upper left corner to return to the this page.

Note... Page 3, the Interactive Navigation Page, is a complete list of the technologies for which detail is available.
EMERGING TECHNOLOGIES

HEALTH AND MEDICINE
- AI Remote Monitoring
- Antibiotic Envelope
- Breathalyser Cars
- Bempedoic Acid
- Biologic for Orthopaedics
- Cancer-detecting Smart Needles
- 10X Genomics
- Closed-Loop Spinal Cord Stimulation
- CRISPR-CAS9
- CRISPR-EDIT-R-ALL-IN-ONE
- Diastolic Heart Failure (HFpEF)
- DNA/RNA Sequencing
- Dual-Acting Osteoporosis Drug
- Genome Analyst
- Glucose Monitoring
- Heart Monitoring T-Shirt
- Lightning Optofluidic Platform
- Live Cell Imaging Microscope
- Mass Photometry
- Measuring Volatile Organic Compounds
- Mitigation of Peanut Allergies
- Mitral Valve Surgery
- PARP Inhibitors
- Regenerative Medicine
- Silencing RNA
- Tattoo Removal
- Therapeutic Cloning
- Transthyretin Amyloid Cardiomyopathy
- Tumor Profiling

SPACE
- Aerospace Technologies
- Reusable Rockets
- Space Balloon

CLIMATE
- Coffee Power
- CO₂ Removal
- CO₂ Conversion
- Desalination
- Forest Fire Mitigation
- Ocean Farming
- Ocean Plastic Removal
- Methane Gas Removal

ARTIFICIAL INTELLIGENCE
- AI in Automation
- AI in Manufacturing
- AI Remote Monitoring
- AI Scientist
- Silicon Chips

ROBOTICS
- Robot Assistants
- Living Robots

TECHNOLOGY & INTERNET
- Aerogels
- Edge Computing
- Internet for Everyone
- Internet of Things (IoT)
- IoT Kitchen Appliances
- Personal Translators
- Quantum Computing Commercialization
- Quantum Computing
- Self-Healing Concrete
- Silicon Chips
- Smart Food Labels
- Social Media Management
- Voice Assistants
- 5G & Starlink

AGRICULTURE
- Agriculture Technologies
- Autonomous Farming
- Floating Farms
- Ocean Farming

MACHINES & VEHICLES
- Autonomous Driving
- Breathalyzer Cars
- Driverless Vehicles
- Fast Charging Batteries
- Self-Driving Trucks
- 760 MPH Trains

FINANCIALS
- BlockChain
- CryptoCurrency

EMERGING TECHNOLOGIES

AUGMENTED REALITY
- Wearable AR
- AR & Mixed Reality
- Tactile Virtual Reality

FINANCIALS
- BlockChain
- CryptoCurrency
AGRICULTURE

AGRICULTURAL TECHNOLOGIES

In agriculture, companies that offer products using computer vision, AI, and big data stand out. In 2020, it will become common to monitor crop growth by computer vision cere imaging (U.S.), Taranis (israel), farmwise (U.S.). Robots, such as those by abundant robotics, that harvest plants and fruits will become more common. The technology for improving crop growth efficiency will also be enhanced by indoor farming companies, such as Bowery Farming (U.S.), funded by GV.

AUTONOMOUS FARMING

With the world population growing and arable land shrinking, investors are betting heavily on indoor farming. Earlier this year, Korean IoT startup N.Thing raised $2.2 million in series A funding to build out Planty Cube, an indoor modular farming solution. Back in 2015, N.Thing released Planty smart pot, which monitors the potted plant’s light, temperature and humidity levels. N.Thing’s Planty cube is significantly more ambitious: the autonomous farming system will use an insulated, modular environment to grow greens in dry environments. Planty Cube is currently being tested in the United Arab Emirates. AgTech entrepreneurs will develop similar solutions for other environments and crops. Tropical fruits may eventually be grown in Arctic environments. Stackable indoor solutions will be particularly popular in cities, where real estate is at a premium.


5 Innovations that will dominate CES 2020, By Peter Daisyme, Co-founder of Host; Entrepreneur Media, December 2019, https://www.entrepreneur.com/article/344124
AGRICULTURE

FLOATING FARMS

The UN predicts there will be two billion more people in the world by 2050, creating a demand for 70 per cent more food. By that time, 80 per cent of us will be living in cities, and most food we eat in urban areas is brought in. So farms moored on the sea or inland lakes close to cities would reduce food miles. A new design by architect Javier Ponce of Forward Thinking Architecture shows a 24m-tall, three-tiered structure with solar panels to provide energy. The middle tier grows a variety of veg over using nutrients in liquid. These nutrients and plant matter would drop into the bottom layer to feed fish, which are farmed in an enclosed space. A single smart floating farm measuring can produce an estimated 8.1 tons of vegetables and 1.7 tons of fish a year. The units are designed to bolt together.


OCEAN FARMING

There is a new generation of ocean farmers, one whose singular connection to the water is coupled with a passion for the environment. They are growing shellfish and kelp on farms, located in the waters of the great salt pond, using sustainable fishing methods that both preserve the ocean's ecosystems and fight climate change.

ARTIFICIAL INTELLIGENCE

AI IN AUTOMATION

Some of the world’s biggest brands are increasingly turning to automation in order to better serve customers and to reduce costs. Big-box retailers use automated warehouses to sort and ship products, while social media networks use automation to moderate comments, and credit card companies use automation to detect fraud. For example, synapse is building a network that gives anyone the ability to contribute his or her data and train automation and machine-learning models. The implications here are massive, because a new AI economy, including decentralized blockchain AI, could change the way businesses operate and learn around the world.


AI IN MANUFACTURING

In 2020, emotion recognition and computer vision will scale and AI will have a breakout moment in manufacturing. U.S. startups Vicarious, Kindred, and Osaro stand out in using AI technologies for manufacturing. Kindred’s technology is used to automate part of distribution for apparel brands such as GAP. Vicarious is attracting investment from Mark Zuckerberg, Jeff Bezos, and Elon Musk.

**ARTIFICIAL INTELLIGENCE**

**AI REMOTE MONITORING**

Most remote health monitoring devices to date have used biometric sensors to read vital signs, such as heart rate monitors. But thanks to advances in computer vision, relatively inexpensive devices are now able to gauge health from afar. Earlier this year, researchers at the MITs IBM Watson AI lab configured computer vision models to run on low-power devices that will be smarter, smaller and wearable-free. For example, the newest smart baby monitor uses computer vision and AI technology to track breathing rate, movement and sound. Parents can receive alerts when their baby falls asleep or wakes up and track sleep data over time via the connected app. Hospitals will be able for monitoring patients overnight, retailers for preventing theft and home security systems for recognizing faces.


**AI SCIENTIST**

Cut off a flatworm’s head, and it’ll grow a new one. Cut it in half, and you’ll have two new worms. Fire some radiation at it, and it’ll repair itself. Scientists have wanted to work out the mechanisms involved for some time, but the secret has eluded them. Enter an AI coded at Tufts University, Massachusetts. By analyzing and simulating countless scenarios, the computer was able to solve the mystery of the flatworm’s regeneration in just 42 hours. In the end it produced a comprehensive model of how the flatworm’s genes allow it to regenerate. Although humans still need to feed the AI with information, the machine in this experiment was able to create a new, abstract theory independently – a huge step towards the development of a conscious computer, and potentially a landmark step in the way we carry out research.

ARTIFICIAL INTELLIGENCE

SILICON CHIPS

Scientists have found a way to attach artificial neurons onto silicon chips, mimicking the neurons in our nervous system and copying their electrical properties. This work is paradigm-changing because it provides a robust method to reproduce the electrical properties of real neurons in minute detail. “But it’s wider than that, because our neurons only need 140 nanowatts of power. That’s a billionth the power requirement of a microprocessor, which other attempts to make synthetic neurons have used.” Researchers hope their work could be used in medical implants to treat conditions such as heart failure and Alzheimer’s as it requires so little power.

WEARABLE AR

Early AR technologies were smartphone- and tablet-based applications. Entrepreneurs are now building AR into next-generation wearable devices. Named a “best of” innovation in Consumer Electronics Show (CES) 2020’s headphones and personal audio category, Human Capable’s Norm Glasses were recently shown at CES Unveiled New York. Despite containing an android-based computer, norm glasses feel and look like normal frames. When voice-activated, Norm Glasses generate a heads-up display through which users can listen to music, send texts, make phone calls and more. The glasses include dual speakers and are lighter than many eyeglasses that contain no electronics.

AR & MIXED REALITY

Just a few years ago, it was unclear whether augmented or mixed reality would take off. Given the fact that tech giants like Apple are investing billions of dollars in augmented reality hardware, it's pretty clear that it's only a matter of time before the tech goes mainstream. For example, Apple's latest phones are equipped with augmented reality capabilities, and a recent report suggests that the company is working on an AR headset that will replace the iPhone in two to three years.


Researchers from Northwestern University have developed a prototype device using a flexible material fitted with tiny vibrating components that can be attached to skin. The system, known as epidermal VR, could be useful - a child touching a display relaying the gesture to a family member located elsewhere, to helping people with amputations renew their sense of touch. In gaming, it could alert players when a strike occurs on the corresponding body part of the game character. It uses near-field communication (NFC) technology – which is used in many smartphones for mobile payment today – to transfer the data. “The result is a thin, lightweight system that can be worn and used without constraint indefinitely,” says Professor John A. Rogers. Scientists hope that the technology could eventually find its way into clothing, allowing people with prosthetics to wear VR shirts that communicate touch through their fingertips.

https://www.youtube.com/watch?time_continue=21&v=YoEWKkJZTDs&feature=emb_logo
BBC Science Focus Magazine, Future technology: 22 Ideas about to Change our World, January, 2020,
CLIMATE

COFFEE POWER

London’s coffee industry creates over 200,000 tons of waste every year, so what do we do with it? Entrepreneur Arthur Kay’s big idea is to use his company, Bio-Bean, to turn 85 per cent of coffee waste into biofuels for heating buildings and powering transport.


CO₂ REMOVAL

Carbon removal can take numerous forms, from new technologies to land management practices. Forest - photosynthesis removes carbon dioxide naturally. Farms - soils naturally store carbon, but agricultural soils are running a big deficit due to intensive use. Bio-energy - with carbon capture and storage (BECCS) is uses photosynthesis to combat climate change. AIR - direct air capture is the process of chemically scrubbing carbon dioxide directly from the ambient air, and then storing it either underground or in long-lived products. Mineralization - some minerals naturally react with CO₂, turning carbon from a gas into a solid. Ocean - approaches aim to accelerate natural carbon cycles in the ocean.

World Resources Institute, Six Ways to Remove Carbon Pollution from the Sky, June 2020, https://www.wri.org/blog/2020/06/6-ways-remove-carbon-pollution-sky#:~:text=Direct%20air%20capture%20is%20the,or%20in%20long%2Dlived%20products.&text=The%20direct%20air%20capture%20technology,result%20in%20net%20carbon%20removal.
CLIMATE

CO₂ CONVERSION
Emerging and novel technologies, approaches, and current barriers exist for the conversion of CO₂ to methanol through heterogeneous catalysis, homogenous catalysis, electrochemical, photochemical, and photoelectrochemical conversion, which will contribute to the economic growth and mitigate the hazardous emissions for cleaner environment.

DESALINATION
Each day 100 million gallons of seawater are pushed through semi-permeable membranes to create 50 million gallons of water that is piped to municipal users. Carlsbad, which became fully operational in 2015, creates about 10 percent of the fresh water the 3.1 million people in the region use, at about twice the cost of the other main source of water.


Yale School of the Environment, As Water Scarcity Increases, Desalination Plants Are on the Rise, https://e360.yale.edu/features/as-water-scarcity-increases-desalination-plants-are-on-the-rise
CLIMATE

FOREST FIRES MITIGATION

Forest fires could one day be dealt with by drones that would direct loud noises at the trees below. Since sound is made up of pressure waves, it can be used to disrupt the air surrounding a fire, essentially cutting off the supply of oxygen to the fuel. At the right frequency, the fire simply dies out, as researchers at George Mason University in Virginia recently demonstrated with their sonic extinguisher. Apparently, bass frequencies work best.

OCEAN FARMING

There is a new generation of ocean farmers, one whose singular connection to the water is coupled with a passion for the environment. They are growing shellfish and kelp on farms, located in the waters of the great salt pond, using sustainable fishing methods that both preserve the ocean’s ecosystems and fight climate change.


OCEAN PLASTIC REMOVAL

Ocean Cleanup has been hard at work on creating a device to attack the plastic waste crisis for seven years, by creating a device that captures plastic in its fold like a giant arm, according to business insider. The company announced that it was able to capture and hold debris ranging from large cartons, crates and abandoned fishing gear — or "ghosts nets," which are a scourge to marine life — to microplastics that are as small as one millimeter, according to an Ocean Cleanup press release.


METHANE GAS REMOVAL

In a new commentary, Stanford researchers propose a wild idea that would intentionally release more carbon dioxide (CO2) into the atmosphere, while getting rid of an even worse greenhouse gas - methane. A crystalline material, known as zeolite, has the potential to act as a sponge, they say, soaking up methane from the atmosphere.

FINANCIALS

BLOCKCHAIN

As blockchain grows, payment-type venture companies and venture companies in security — such as Chainalysis, which develops money laundering countermeasure technology — are attracting attention. In 2020, major institutions will introduce blockchain to prevent large-scale information leakage and internet fraud. IBM set up an accelerator program specializing in blockchain. China approved the introduction of blockchain in services such as ICBC (China Industrial and Commercial Bank), Alibaba Group, China Southern Airlines, etc. In 2020, blockchain will be put to practical use.

CRYPTOCURRENCY

A single coin is worth thousands of dollars. Cryptocurrency has steadily become increasingly mainstream. Some of the largest hedge funds are betting on Bitcoin. Platforms like TrustToken are poised to connect the global trading power of blockchains with real-world assets. On the TrustToken platform, the owners of an asset, a home, a small business or gold, would be able to sell factions of those assets, and coordinate the asset’s ownership through unique blockchain-based tokens. As a result, sellers can make illiquid assets liquid and buyers can gain control of a diverse portfolio of assets. Other crypto platforms like HybridBlock are designed to give greater access to silo-trading markets, helping to expand the industry. By offering mobile-friendly products, HybridBlock is providing the Asia market with a new form of crypto education and the tools to execute crypto trades.


HEALTH & MEDICINE

AI REMOTE MONITORING

Most remote health monitoring devices to date have used biometric sensors to read vital signs, such as heart rate monitors. But thanks to advances in computer vision, relatively inexpensive devices are now able to gauge health from afar. Earlier this year, researchers at the MITs IBM Watson AI lab configured computer vision models to run on low-power devices that will be smarter, smaller and wearable-free. For example, the newest smart baby monitor uses computer vision and AI technology to track breathing rate, movement and sound. Parents can receive alerts when their baby falls asleep or wakes up and track sleep data over time via the connected app. Hospitals will be able for monitoring patients overnight, retailers for preventing theft and home security systems for recognizing faces.

ANTIBIOTIC ENVELOPE FOR CARDIAC IMPLANTABLE DEVICE INFECTION PREVENTION

Antibiotic-embedded envelopes, made from mesh material to prevent infection, are now available to surround cardiovascular implantable electronic devices (CIED), which are administered to roughly 1.5 million patients each year. Infection within these patients can cause potentially life-threatening complications, and the use of this material to encase CIED effectively prevents this risk.

5 Innovations That Will Dominate CES 2020, By Peter Daisyme, Co-founder of Host; Entrepreneur Media, December 30, 2019, https://www.entrepreneur.com/article/344124

HEALTH & MEDICINE

BREATHALYSER CARS

The US national highway traffic safety administration has developed devices that can monitor alcohol levels by sniffing a driver’s breath or scanning the blood in their fingertips via the steering wheel, immobilizing the car if levels are too high. Drivers using the system could be offered lower insurance premiums.

BEMPEDOIC ACID FOR CHOLESTEROL LOWERING IN STATIN INTOLERANT PATIENTS

The use of bempedoic acid in lowering low-density lipoprotein cholesterol provides patients with an alternative approach to treating their high cholesterol. As some patients experience unacceptable muscle pain with statin use, which is the typical treatment for patients with high cholesterol, the new treatment provides the nearly 40% of adults in the united states who suffer from high cholesterol levels with a viable alternative.


HEALTH & MEDICINE

BIOLOGICS IN ORTHOPEDIC REPAIR

The use of biologics, such as cells, blood components, growth factors, and other natural substances, assist in replacing or harnessing power within the body and promote healing. The use of these elements can improve treatment for patients after orthopedic surgery, which can take months to years to recover. Potentially expediting improved outcomes will benefit patients undergoing this surgery.

CANCER-DETECTING ‘SMART NEEDLES’

A “smart needle” has been developed which could speed up cancer detection and diagnosis times. Researchers believe the technology could be particularly helpful in diagnosing lymphoma. The new device uses a technique known as Raman spectroscopy to shine a low-power laser into the part of the body being inspected, with the potential to spot concerns within seconds. The Raman smart needle can measure the molecular changes associated with disease in tissues and cells at the end of the needle. If a lump or bump of interest can be reached with the needle tip, it can be assessed as healthy or not.


HEALTH & MEDICINE

10X GENOMICS

In 2013, researchers at Stanford University reported a new chromatin interrogation method called ATAC-seq (Assay for Transposase Accessible Chromatin). It treats cells with a transposase, an enzyme that cuts open stretches of DNA and adds adapters to those nucleic acids, allowing scientists to then amplify and sequence the fragments. 10x Genomics developed a single-cell RNA sequencing using a droplet-based approach. The two technologies combined to provide the chromium single cell ATAC solution. The product partitions individual cell nuclei into droplets and uses genetic barcodes to tag relevant sequences. The DNA can then be sequenced and sorted bioinformatically to determine which fragments came from which cells.


CLOSED-LOOP SPINAL CORD STIMULATION

Spinal cord stimulation has served as a popular treatment for chronic pain, but unsatisfactory outcomes deriving from subtherapeutic or overstimulation events have common occurrence. Closed-loop stimulation will ameliorate these instances by allowing for better communication between the device and the spinal cord, providing more optimal stimulation and lessening the need for prescribed opioid medication.

CRISPR-CAS9

CRISPR Cas-9 (an abbreviation standing for "clustered regularly interspaced short palindromic repeats") is a gene-splicing technology capable of finding and removing mutated sections of DNA. Once this material is eliminated, CRISPR technology can replace the mutated sections with non-mutated variants. As a result, CRISPR has the power to permanently eliminate certain types of genetic diseases from blood lines. The technology has already been used to eliminate cancer in some patients, and early results show that it may be possible to cure genetically caused blindness as well.

CRISPR-EDIT-R-ALL-IN-ONE

The Edit-R-all-in-one lentiviral sgRNA combines the sequences for Cas9 and the single guide RNA (sgRNA) that leads the enzyme to the appropriate spot in the genome, all packaged into a viral vector. Predesigned guide RNAs can knock out any gene in the human, mouse, or rat genomes.


HEALTH & MEDICINE

DIASTOLIC HEART FAILURE

Heart failure with preserved ejection fraction (HFPEF), also known as diastolic heart failure, is a condition where ventricular heart muscles contract normally, but do not relax as usual which can cause the heart to not properly fill with blood and inhibit the relay of pumped out blood in the body. The use of sodium glucose cotransporter 2 inhibitors, a class of medications used in the treatment for type 2 diabetes, is now under consideration for treatment of HFPEF, providing a possible new option for patients.

DNA AND RNA SEQUENCING

Pacific Biosciences has multiplied the capacity of its previous DNA- and RNA-sequencing instrument, Sequel. Sequel II can generate about eight times as much data as its predecessor. Inside each of its sample chambers, termed zero-mode waveguides, the instrument detects bases as a polymerase adds them to a nucleotide chain, yielding sequence information. The result is long-read DNA or RNA sequences, now delivered more quickly and at lower cost. Long reads allow researchers to identify structural variants in the genome. Sequel II is adept at de Novo Genome sequencing in species for which no reference genome is yet available; the long-read sequencing is also good for analyzing highly repetitive or homologous regions of the genome.

DUAL-ACTING OSTEOPOROSIS DRUG

A recent FDA approval of a new dual-acting osteoporosis drug, Romosozumab, has given patients with the disease a new preventive treatment for managing the risk of bone fractures. The drug will serve as a unique treatment that displays both anabolic and antiresorptive qualities that contribute to slowing down bone loss while building new bone results in more bone building.

GENOME ANALYSIS

Under the theme of prevention, digital health care has seen much innovation. In the U.S., Startups 23andme and color lead in genome analysis, while genesis healthcare stands out in Japan and genoplan in Korea. These companies use genomic analysis to learn of diseases and provide prevention methods. The evolution of AI will improve the quality of treatment. In 2020, many medical images taken using MRI, CT scans, and x-rays will be diagnosed using AI. Startups Enlitic and Zebra Medical Vision stand out as leaders.


GLUCOSE MONITORING SYSTEM

With a swipe of a cellphone across a sensor attached to the back of the arm, you can instantaneously check glucose levels. There are no painful finger pricks, and no hassle trying get enough blood on test strips to measure glucose. The size of two stacked quarters, a sensor measures glucose through what looks like a pin inserted into the interstitial fluid, a liquid that surrounds the cells just below the skin. Patients can check their glucose by swiping a smartphone loaded with the freestyle librelink app across the sensor, or buy the freestyle libre reader for a one-time cost. The Bluetooth-enabled sensor allows users to set sound or vibration alarms to alert them when their blood sugar is too low or too high. Alerts are extremely helpful to children and other high-risk patients.

[Website](https://www.The-scientist.Com/features/2019-top-10-innovations-66738#.Xlvbybdgjdy)

HEART MONITORING T-SHIRT

Wearable sports bands that measure your heart rate are nothing new, but as numerous studies have shown, the accuracy can vary. But for professionals, accuracy is everything. Using a single lead ECG printed into the fabric, this new t-shirt from smart materials company KYMIRA will accurately measure heart beats and upload them to the cloud via Bluetooth. Once there, algorithms process the data to accurately detect irregular heartbeats such as arrhythmia heart beats, which could prove life saving. And it’s not just athletes who could benefit. This can be used for clinical applications to allow those who may already suffer with heart conditions enough warning of a heart attack.

HEALTH & MEDICINE

LIGHTNING OPTOFLUIDIC PLATFORM

Berkeley lights’s lightning optofluidic platform enables researchers to precisely study the behaviors of single cells within a defined time period by recording video of them throughout the data collection process. The platform works via a microfluidic section with a postage stamp–sized silicon chip containing miniscule nan opens, long and narrow chambers that isolate and culture individual cells. Medical oncologists, who study endogenous T cell therapy, use the device in cancer centers. Every single cell is tracked from beginning to end. Researchers using other optofluidic devices have to use multiple instruments to perform cell assays and take a snapshot of the cells on each instrument. In addition to consolidating equipment, the lightning platform runs protocols on python script, making it accessible to researchers worldwide.

LIVE CELL IMAGING MICROSCOPE – NANOLIVE CX-A

CX-A, a live-cell microscope, promises to answer important questions about cellular interactions. The instrument observes mitochondrial fission and fusion, the way groups of cells interact and react to one another, and other cellular phenomena. CX-A reconstructs a three-dimensional hologram based on how the sample refracts light. In a cell, each organelle refracts light differently. CX-A accounts for the variations in refraction and reconstructs the 3D image formed by the interference of the refraction of the cellular components in its field of view. The new technology builds on the 3D cell explorer design and is automated so scientists can program the various fields of view they would like to observe in a single slide or in 96-well plates, then walk away and let the machine do the work.

Mass photometry measures the weight of single molecules by the way they scatter light. Instead of moving samples into a vacuum as native mass spectrometry requires, mass photometry allows them to stay in their buffer solution, reading just a few microliters of a nanomolar concentration solution. The processing time is about a minute or two, compared to an hour or so for chromatography.

EVOC probes allow scientists to administer small doses of safe volatile organic compounds, such as terpenes, as probes and then measure the concentration of the products of reactions involving those compounds to assess liver function or drug metabolism. “The big advantage is that you know what you’re looking for,” says Billy Boyle, cofounder and CEO of Owlstone Medical. “Rather than having to try and find the tiny needle in the haystack, you’re able to introduce a much larger signal into the system.”
HEALTH & MEDICINE

MITIGATION OF PEANUT ALLERGIES

Development of a new oral immunotherapy medication to gradually build tolerance to peanut exposure provides an exciting opportunity for 2.5% of Americans who have peanut allergies. The oral biologic drug palforzia, which was recommended for approval by an FDA expert panel last month, will possibly be the first-ever drug to treat life-threatening peanut allergies in children and assist in lessening fears of exposure.


MITRAL VALVE SURGERY

In approximately 1 in 10 individuals over the age of 75, the mitral valve, which allows blood flow from the heart’s left atrium to the left ventricle, becomes defective, causing regurgitation, known as mitral valve regurgitation (MR). A device to treat MR, named transcatheter, has revolutionized the cardiac industry and provided patients with a less invasive solution for their regurgitation. In March 2019, the FDA expanded the use of the device to include people with secondary or functional MR even with optimal medical therapy, effectively increasing treatment options for this demographic.

HEALTH & MEDICINE

PARP INHIBITORS: THERAPY IN OVARIAN CANCER

For ovarian cancer treatment, the use of poly (ADP ribose) polymerase (PARP) inhibitors have shown improved progression-free survival and are now being approved for first-line maintenance therapy in advanced stage disease. PARP inhibitors block the repair of damaged DNA in tumor cells that is attributed to cell death and are set to continually improve outcomes in cancer therapy.

REGENERATIVE MEDICINE

Though it may sound like science fiction, doctors are already producing made-to-order body parts. To get started, doctors scrape cells off the body part in question and grow them in a petri dish. In time, the body part grows strong enough that it can be implanted inside the patient. One company, organovo, has developed a printer capable of 3D printing body parts. In time, this new technology will become increasingly mainstream, providing patients with lifesaving organ replacements.


10 Technologies That Are Changing the World, Entrepreneur Media, March 2018,
https://www.entrepreneur.com/article/310204
SILENCING RNA

Researchers can silence RNA by designing antisense oligonucleotides that complement the target sequence. Researchers can also target RNA with small molecules, which are easier to manufacture and deliver but don’t selectively bind to the targeted RNA. These bases are covalently linked to a charge-neutral peptide nucleic acid backbone, rather than a negatively charged sugar backbone, so the molecules can get cozy with target RNA or DNA.

TATTOO REMOVAL

Got a tattoo that you now regret? There may soon be a gentler, cheaper alternative to laser removal. Phd student alec falkenham in the US has worked out how to harness a property of your body’s own immune system. He’s developed a cream that delivers drugs to white blood cells called ‘macrophages’ (greek for ‘big eaters’), causing them to release the ink they took up in order to protect your skin during the tattooing process.

THERAPEUTIC CLONING

Cloning designed as therapy for a disease. In therapeutic cloning, the nucleus of a cell, typically a skin cell, is inserted into a fertilized egg whose nucleus has been removed. The nucleated egg begins to divide repeatedly to form a blastocyst. Scientists then extract stem cells from the blastocyst and use them to grow cells that are a perfect genetic match for the patient. The cells created via therapeutic cloning can then be transplanted into the patient to treat a disease from which the patient suffers.

TRANSTHYRETIN AMYLOID CARDIOMYOPATHY

In May 2019, an approval of 2 drug formulations of the compound known as tafamidis provided patients with 1 of the 2 main types of amyloid cardiomyopathy, known as transthyretin amyloid cardiomyopathy (ATTR-CM), a novel therapy for their disease, which currently has no existing treatments. The treatment will address an unmet need among patients with the condition, and it is cited as not only potentially improving survival, but preserving quality of life as well.


HEALTH & MEDICINE

TUMOR PROFILING

Increasing the amount of spatial information that can be mined from tumors is important because we need to catalog what cells might be present in a sample, where they are, and which cells are next to each other. That technique, called CODEX, overcomes the problem of spectral overlap—that is, when too many antibodies fluorescing different colors are added to a sample.

https://www.the-scientist.com/features/2019-top-10-innovations-66738#.XlvbybDGJDY.email}
MACHINES & VEHICLES

AUTONOMOUS VEHICLES

Autonomous driving is already a hot topic, although level 5 (fully autonomous) has not been realized. Some Tesla cars can be switched to autopilot mode on the highway, but this is only possible up to level 2 (driving support) or level 3 (operated by the driver in an emergency). Technology for understanding detailed road conditions by AI is evolving. Startups Prophesee (france), Perceptive Automata (U.S.), And Humanising Autonomy (U.K.) Stand out as leaders. They will contribute towards achieving level 5 in 2020.

BREATHALYZER CARS

The US National Highway Traffic Safety Administration has developed devices that can monitor alcohol levels by sniffing a driver’s breath or scanning the blood in their fingertips via the steering wheel, immobilizing the car if levels are too high. Drivers using the system could be offered lower insurance premiums.


MACHINES & VEHICLES

DRIVERLESS VEHICLES

Automakers like Tesla, General Motors and Volvo have already developed semi-autonomous vehicles. But self-driving technology is rapidly evolving. General Motors announced that it will launch a car that has no steering wheel or pedals by 2019. Uber, meanwhile, is leading the push for pilotless flying vehicles, and has teamed up with NASA to develop an air-traffic-control system. Uber is also working with aircraft manufacturers to develop prototypes, with the intention of launching a beta program in 2020.

FAST CHARGING CAR BATTERIES

Rapid charging of lithium ion batteries can degrade the batteries because the flow of lithium particles known as ions from one electrode to another to charge the unit and hold the energy ready for use does not happen smoothly at lower temperatures. However, they have now found that if the batteries could heat to 60°C for just 10 minutes and then rapidly cool again to ambient temperatures, lithium spikes would not form and heat damage would be avoided. The battery design they have come up with is self-heating – heating up in less than 30 seconds to warm the inside of the battery. The rapid cooling that would be needed after the battery is charged would be done using the cooling system designed into the car.

10 Technologies That Are Changing the World, by Jonathan Long
Entrepreneur Media, March 2018,
https://www.entrepreneur.com/article/310204

BBC Science Focus Magazine, Future technology: 22 ideas about to change our world, January 2020,
SELF-DRIVING TRUCKS

Driverless trucks are the logistics that make the world go round. They’ll be cheaper to run than regular rigs, driving more smoothly and using less fuel. Computers never get tired or need comfort breaks, so they’ll run longer routes. And they could drive in convoys, nose-to-tail, to minimize wind resistance. Companies like Mercedes and Peloton are already exploring these possibilities, and if the promised gains materialize, freight companies could upgrade entire fleets overnight. On the downside, it could put drivers instantly out of work, and even staff at the truck stops set up to service them, but many companies have said the trucks will still need a human passenger to ensure their cargo is safe.

760 MPH TRAINS

Hate commuting? Imagine, instead, your train carriage hurtling down a tunnel at the same speed as a commercial jet airliner. That’s the dream of Paypal, Tesla and Spacex founder Elon Musk. His Hyperloop system would see ‘train’ passengers travel at up to 760mph through a vacuum tube, propelled by compressed air and induction motors. A site has been chosen with the goal of starting test runs in two years. Once built, the loop will ferry passengers between San Francisco and LA in 35 minutes, compared to 7.5 hours by train.

ROBOTICS

ROBOT ASSISTANTS

Companies like Boston Dynamics have already developed a wide variety of robot assistants that can be used in factories or on the battlefield. The company originally started as an arm of MIT and has since pioneered the development of intelligent robots that operate effectively in the real world. Knightscope is another company working on a line of robot assistants for security applications. For example, its K5 robot features four cameras and can recognize 300 licenses plates per minute, per camera. It can also detect suspicious networks that may be operated by hackers.

LIVING ROBOTS

Tiny hybrid robots made using stem cells from frog embryos could one day be used to swim around human bodies to specific areas requiring medicine, or to gather microplastic in the oceans. “These are novel living machines,” said Joshua Bongard, a computer scientist and robotics expert at the University of Vermont, who co-developed the millimetre-wide bots, known as xenobots. “They’re neither a traditional robot nor a known species of animal. It’s a new class of artefact: a living, programmable organism.

https://www.youtube.com/watch?v=aQRBCCjaYGE&feature=youtu.be. BBC Science Focus Magazine, Future technology: 22 ideas about to change our world, January, 2020,
Mankind will begin its return to space in 2020, largely driven by the private sector. Since the cold war, technological advances have slowed. Notable companies now making aerospace advancements include SpaceX and Blue Origin. SpaceX is developing the rocket starship, which will reuse the entire vehicle body. Starship may shorten intercontinental trips to 20-30 minutes via space. In China, the government and private enterprises (example: LinkSpace) are making progress in space.

One of the costliest aspects of space exploration is the building of sophisticated and powerful rockets capable of transporting thousands of pounds of equipment into space. The fact that we have figured out how to land rockets -- even the large ones used to launch the Falcon Heavy -- will help to reduce the cost of space travel.

SPACE

SPACE BALLOON

If you want to take a trip into space, your quickest bet might be to take a balloon. The company world view enterprises wants to send tourists into the stratosphere, 32km above earth, on hot air balloons. Technically ‘space’ is defined as 100km above sea level, but 32km is high enough to witness the curvature of the earth, just as Felix Baumgartner did on his space jump. The balloon flew its first successful test flight in June, and the company will start selling tickets in 2016 – at the bargain price of just £75,000 per person!

https://www.youtube.com/watch?time_continue=6&v=pttp0fZpCxQ&feature=emb_logo. BBC Science Focus Magazine, Future technology: 22 Ideas About To Change Our World, January, 2020,
TECHNOLOGY & INTERNET

AEROGELS

There are two things the majority of people in the western world own: a refrigerator and a mobile phone. And aerogels could revolutionize the manufacture of both. An aerogel is a material that’s full of tiny holes. Made by extracting all the liquid from a gel, it can be up to 95 per cent pores. Those pores are so small – between 20 and 50 nanometers – that gas molecules can’t squeeze through them. As a result, aerogels can’t transport heat, making for a material with incredible insulating properties. The unusual electrical properties of aerogels also make them suitable as lightweight antennae for mobile phones, satellites and aircraft.


EDGE COMPUTING

2020 will see the need for higher performance from edge computing hardware since better sensors and larger AI models now enable a host of new applications. There is a growing need to infer more data and then make decisions without sending data to the cloud. Chip startups Sambanova (U.S.), Graphcore (U.K.), Cerebras (U.S.), Wave Computing (U.S.), and Syntiant (U.S.) have developed architectures to handle increased demand. High-performing AI chips, known as neuromorphic or brain chips, mimic the structure of the brain and process top AI algorithms.”

INTERNET FOR EVERYONE

We can’t seem to live without the internet but only around half the world’s population is connected. There are many reasons for this, including economic and social reasons, but for some the internet just isn’t accessible because they have no connection. Google is slowly trying to solve the problem using helium balloons to beam the internet to inaccessible areas, while Facebook has abandoned plans to do the same using drones, which means companies like Hiber are stealing a march. They have taken a different approach by launching their own network of shoebox-sized microsatellites into low earth orbit, which wake up a modem plugged into your computer or device when it flies over and delivers your data. Their satellites orbit the earth 16 times a day and are already being used internet access to very extreme of our planet.


INTERNET OF THINGS

IoT is hot but there are not as many mainstream applications today as some predicted. We anticipate that with 5G, the number of connected devices and mainstream iot applications will reach scale. Amazon recently launched Amazon go, a system that uses IoT and machine vision technologies to enable consumers to shop without manual check out. Environments will use more sensors and vision technologies, enabling more scalable iot solutions. Startups include Standard Cognition (U.S.), Accel Robotics.

IOT KITCHEN APPLIANCES

Last year, the impossible burger 2.0 stole the show, leading tech publisher digital trends to name it the “top tech of Consumer Electronics Show (CES) 2019.” Rather than engineered foods, this year’s top contenders will be the appliances used to store, prepare and cook them. Although smart appliances have been featured at prior CES events, this year’s entrants do more than recognize foods in the fridge. Scheduled for a February 2020 release, PantryOn’s IOT appliance not only monitors stored groceries but also automatically develops shopping lists, surfs the internet to find the best price, and suggests alternative ingredients. In the future, smart appliances are likely to bleed into the health services space. Consumers will expect their smart fridges and pantries to plan meals, balance macronutrients and point out dietary deficiencies.

PERSONAL TRANSLATORS

Only recently have mobile translators become viable for real-world use. Langogo’s translator, due to be shown at Consumer Electronics Show (CES) 2020, improves on translators shown in prior years in two important ways. First, it’s fast: within a second, Langogo’s device can translate speech from more than 100 languages. Second, it has an embedded eSIM, meaning it doesn’t rely on a smartphone that may or may not have service in a foreign country. Langogo’s device also serves as a wi-fi hotspot for up to five devices at once. The more training examples that translation algorithms parse -- and pocket translators mean they’re about to gain a lot more -- the more accurate they become.

We expect 2020 to begin the quantum computing era. As data increases, quantum computing will target the biggest problems in industry, such as health care and energy. In 2020, the ability to handle big data will be required for cancer treatment, nuclear energy control, and DNA analysis. Corporations IBM, Google, Intel, Microsoft, and Alibaba have moved into quantum computing. Startups Rigetti (U.S.), D-wave Systems (Canada), and QC Ware (U.S.) are disrupting quantum computing. The technology will grow as it becomes easier to use with platforms such as Amazon web services by mid-2020.

SELF-HEALING ‘LIVING CONCRETE’

Scientists have developed what they call living concrete by using sand, gel and bacteria. Researchers said this building material has structural load-bearing function, is capable of self-healing and is more environmentally friendly than concrete – which is the second most-consumed material on earth after water. The team from the university of Colorado Boulder believe their work paves the way for future building structures that could “heal their own cracks, suck up dangerous toxins from the air or even glow on command”.

SILICON CHIPS

Scientists have found a way to attach artificial neurons onto silicon chips, mimicking the neurons in our nervous system and copying their electrical properties. This work is paradigm-changing because it provides a robust method to reproduce the electrical properties of real neurons in minute detail. “But it’s wider than that, because our neurons only need 140 nanowatts of power. That’s a billionth the power requirement of a microprocessor, which other attempts to make synthetic neurons have used.” Researchers hope their work could be used in medical implants to treat conditions such as heart failure and Alzheimer’s as it requires so little power.

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TECHNOLOGY & INTERNET

SMART FOOD LABELS

UK homes throw away 30 to 50 per cent of what we buy from supermarkets, says a 2013 report by the Institution of Mechanical Engineers. The report claimed we’re guided by ‘use by’ and ‘best before’ dates on food packaging, which are kept conservative because they are driven by shops’ desire to avoid legal action. An invention called ‘bump mark’ could change all that. Originally developed for blind people, it’s a label that starts out smooth to the touch but gets bumpier as food decays. And since it decays at the same rate as any protein-based food within, it’s far more accurate than printed dates.


SOCIAL MEDIA MANAGEMENT

Social media management is a set of activities aimed at monitoring, moderating, and generating online engagement about your brand or products/services. There are six core capabilities that most Social Media Management Software (SMMS) suites have: Social listening and monitoring; Content scheduling and publishing; Social media customer service; Social media engagement analytics and tracking; Marketing campaigns across social platforms; Social campaign performance reporting

TrustRadius, 2020
https://www.trustradius.com/social-media-management
TECHNOLOGY & INTERNET

VOICE ASSISTANTS

In four years, the majority of American households are expected to own a voice assistant device like an Amazon Echo or an Apple Homepod. Thanks to the power of artificial intelligence (AI), voice assistants will grow increasingly helpful. Even today, Amazon releases regular updates to Echo in order to help owners get more from the technology. The company recently reported seeing larger-than-expected gains from its voice assistant, which is why Amazon is now doubling down on the technology. Voice assistants are making a significant impact in markets across the globe, and some observers expect that in the future we will communicate with technology through voice rather than text.”

5G AND STARLINK

5G competition between the U.S. and China is entering the main stage in 2020. There will be a new competition about who can propel 5G faster into mass consumer use. Another hot topic is the Starlink broadband business planned by Spacex. Until 2020, as many as 2,500 satellites will be launched. This marks a new era of broadband internet for some users in North America. Starlink’s broadband internet system will grow with 12,000 satellites through 2023, followed by the addition of 30,000 satellites. Spacex will provide higher speed internet starting in 2020.”

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