

Ten promising innovations

(continued on following pages)

Omics and molecular technologies

A therapeutic or diagnostic that harnesses the various types of molecules within a cell (eg, DNA, RNA, proteins). This includes engineering of these intra-cellular components (eg, genome editing) and well as analysis (eg, proteomics, transcriptomics).

Example: **CRISPR and curbing malaria**

Current treatment

Includes antimalarial prophylactics and nonpharmaceutical measures (indoor residual spraying, insecticide-treated bed netting, etc) and antimalarial medications.

Innovation

Genetic modification of malaria-carrying mosquitoes using gene-editing technologies (eg, CRISPR); this may potentially enable significant disease reduction by propagating the modified genes across the mosquito population.



Next-generation pharmaceuticals

Newer iterations of traditional chemical compounds (small molecules) and classes of molecules used as medicinal drugs, possibly with multiple and concurrent target structures.

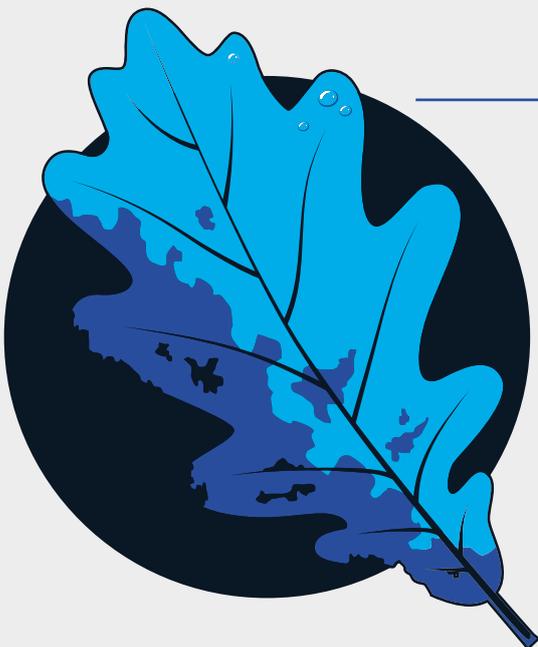
Example: **Senolytics and regulation of cellular aging**

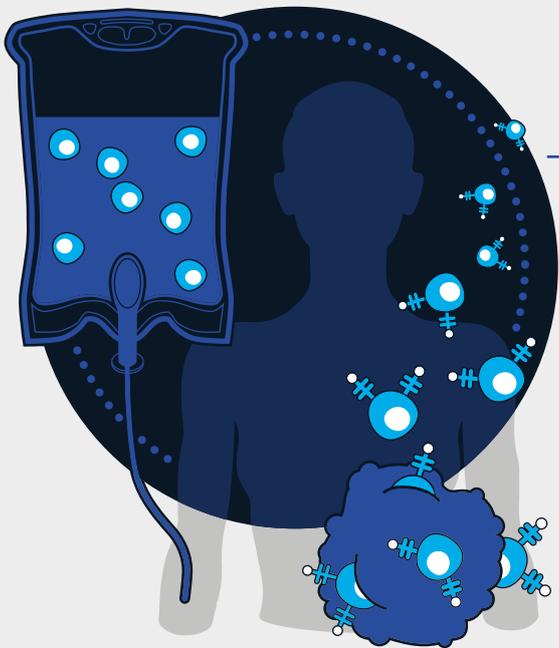
Current treatment

Cellular aging (senescence) is considered an unavoidable physiological process. It is not believed to be a viable field for drug development.

Innovation

Senolytics (a class of small molecules) may decrease or eliminate aging cells that can cause cellular inflammation, dysfunction, and tissue damage. This has implications for delaying the occurrence of age-related diseases.





Cellular therapy and regenerative medicine

Cellular therapy: A biological product, derived from living cells, that is used for therapeutic purposes to replace or repair damaged cells and/or tissue.

Regenerative medicine: A therapy with the power to restore diseased and/or injured tissues and organs, potentially decreasing reliance on transplantation.

Example: **CAR T-cell therapy and treatment of solid tumors**

Current treatment

Primarily based on unspecific radiotherapy and chemotherapeutic agents plus surgical interventions; in many cases, this is ineffective.

Innovation

CAR T-cell therapy reprograms a patient's T-cells (immune system cells) to target tumor cells; when infused into the patient, the T-cells bind to an antigen on tumor cells, attacking and destroying them.

Innovative vaccines

Substances that stimulate the immune system to respond to and destroy a bacterium or virus. Historically, vaccines have eradicated and/or controlled the spread of infectious diseases around the world.

In the future, vaccines may be used to target noncommunicable diseases (eg, cancer).



Example: **The AT04A vaccine and the lowering of cholesterol**

Current treatment

Statins (lipid-lowering medicines) are used to control and/or lower high cholesterol levels in the blood; patients with cardiovascular disease must take these daily, but adherence is often poor.

Innovation

AT04A is a vaccine made up of molecules that bind to blood cholesterol and degrade it. The vaccine would be required only once a year, potentially improving outcomes.

Advanced surgical procedures

Treatments for injuries or disorders of the body with minimally invasive incisions and/or small instruments, including robotic surgery. Also includes any technique that improves surgery-related processes outside the operating room.

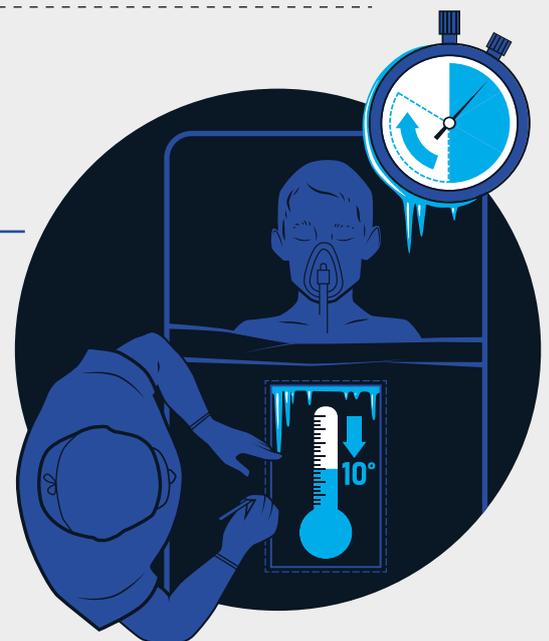
Example: **Suspended animation for severe trauma patients**

Current method

After a patient suffers acute trauma (eg, an accident), getting to the hospital for surgery may take time, which significantly decreases the chance of survival.

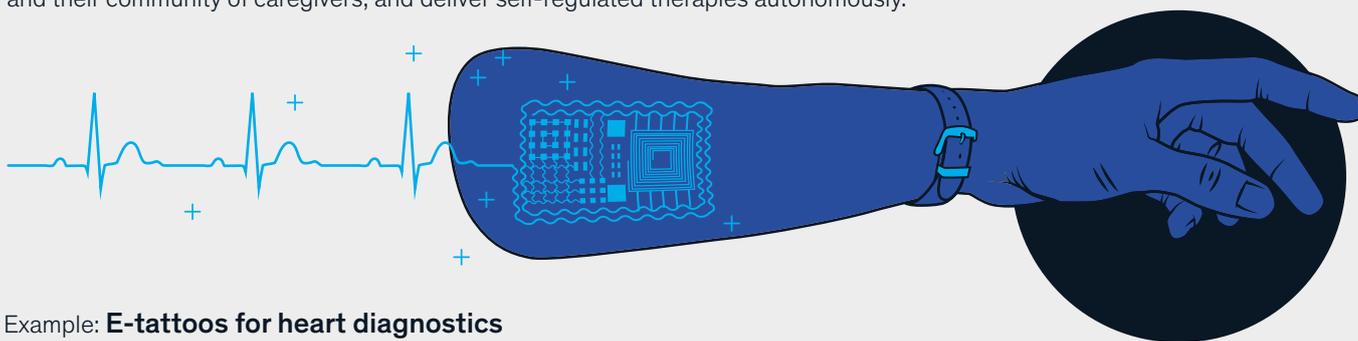
Innovation

A cold saline solution could be injected in the first contact with the patient to cool the body to 10–15°C and stop its normal functions. This would allow time for the surgeon to operate before resuscitating the patient.



Connected and cognitive devices

Portable, wearable, ingestible, and/or implantable devices that can monitor health and fitness information, engage patients and their community of caregivers, and deliver self-regulated therapies autonomously.



Example: **E-tattoos for heart diagnostics**

Current method

A Holter monitor (a battery-operated device) is used for continuous heart monitoring; its batteries last for up to 48 hours, and the procedure can cause immense patient discomfort.

Innovation

Ultra-thin e-tattoos can provide longer periods of heart monitoring and increase patient comfort while providing a wider range of data to enhance clinical decision making.

Electroceuticals

Small therapeutic agents that target the neural circuits of organs. Therapy involves the mapping of neural circuitry with neural impulses (administered via an implantable device) delivered to these specific targets.

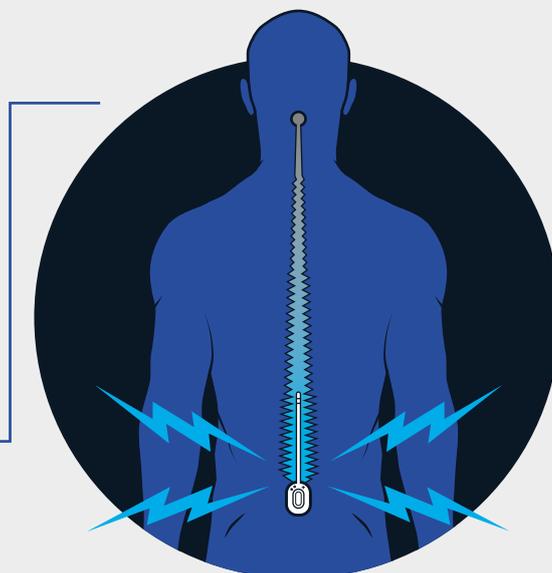
Example: **Implantable microchips and the mitigation of chronic pain**

Current treatment

Chronic pain management uses nonindividualized treatment with multiple drugs (including opioids) and late-stage surgery with low levels of effectiveness.

Innovation

Spinal cord stimulation can improve patient quality of life, allowing increased mobility, enhanced sleep, and reduced need for pain medication.



Robotics and prosthetics

A wide variety of programmable, self-controlled devices consisting of electronic, electrical, or mechanical units and artificial substitutes or replacements for a part of the body.

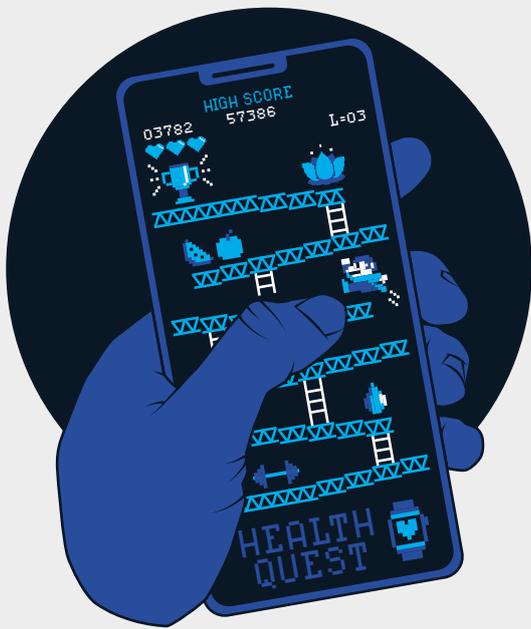
Example: **Next-generation exoskeletons and mobility support**

Current method

Mobility aids are mechanical and do not fully restore movement in the elderly, leading to loss of independence and increased risk of accidental injuries.

Innovation

Next-generation exoskeletons, powered by small motors that mimic human muscles, could allow older patients to recover their autonomy while reducing the likelihood of accidents and falls.



Digital therapeutics

Preventive and therapeutic evidence-based interventions driven by software for a broad spectrum of physical, mental, and behavioral conditions.

Example: **AI-powered app to enable behavior change**

Current treatment

Doctors have few tools at their disposal, apart from brief consultations, to help patients with chronic conditions adopt a healthy lifestyle.

Innovation

Digital therapeutics, powered by AI, patient data, and behavioral science, can help patients adopt and sustain healthy behaviors through gamification and other forms of engagement.

Tech-enabled care delivery

Technology-enabled care delivery that incorporates new and larger data sets applies new analytics capabilities to determine insights, and applies those insights to providers and patients to improve care outcomes, experience, and efficiency.

Example: **Multichannel care delivery**

Current method

Inefficient data management and poor patient-payor-provider communication hinder continuity of care, resulting in significant treatment inefficiencies.

Innovation

Multichannel care delivery using online platforms may facilitate data sharing and improve treatment efficiency. Particularly relevant for chronic diseases like diabetes because patients' glucose levels and other vital signs are continuously shared with the clinician.



Note: See technical appendix to understand how we chose these technologies and to see the sources that informed the analysis.