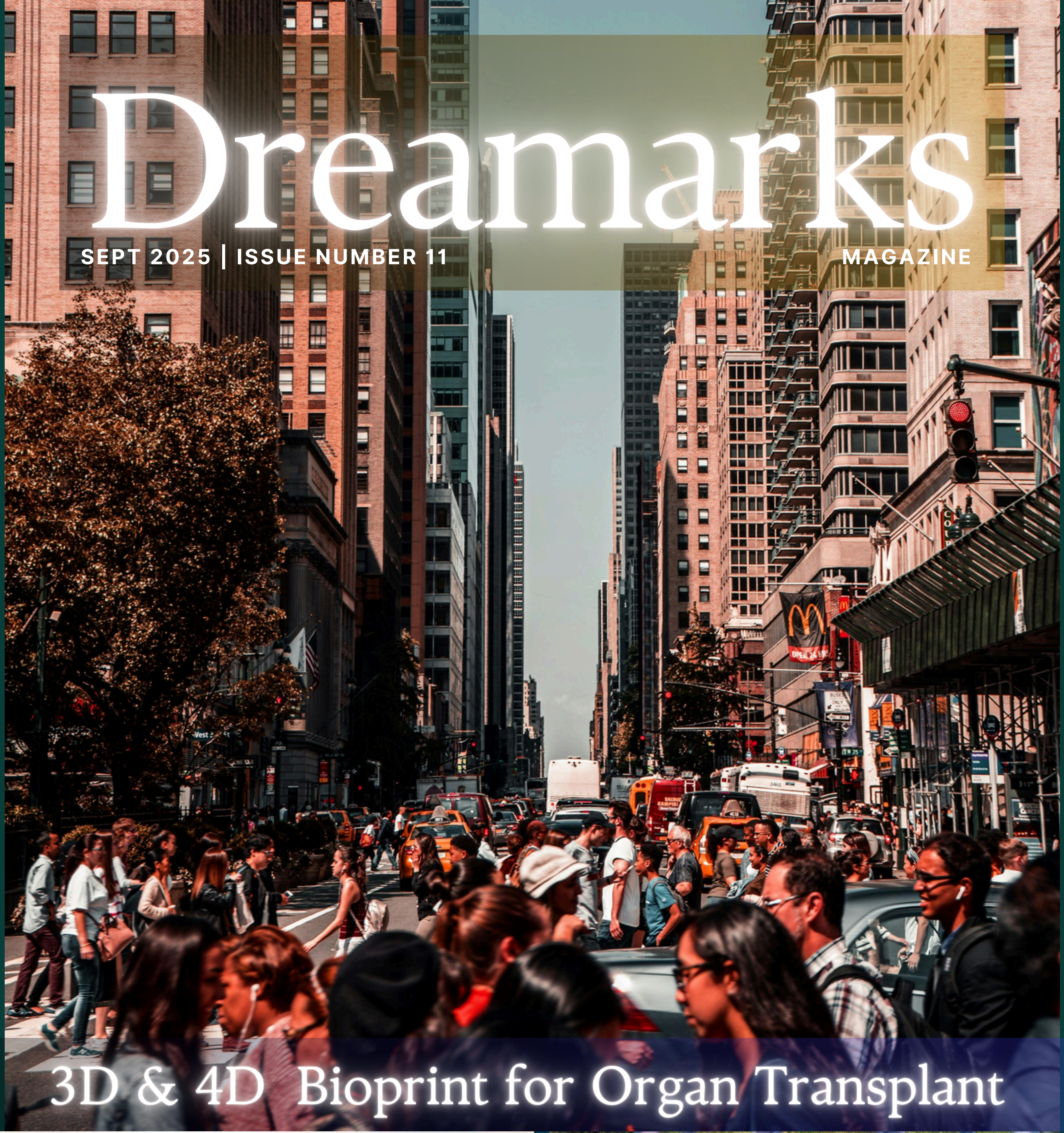

Dreamarks

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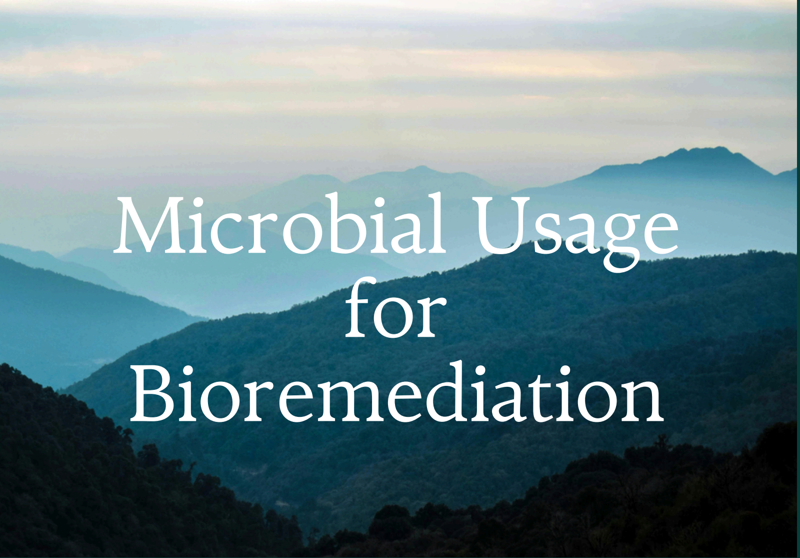
MAGAZINE

3D & 4D Bioprint for Organ Transplant



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Dreamarks Magazine

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The Frontiers of Regenerative Breakthrough in Biology & Human Capital

Science Fiction and pseudoscience has now creating their way into reality. Either its from blockbuster movies, popular TV series or bestselling novels. It begins from inspiring the younger generations to make what they see in the movies to come to life. One of them is the humanistic capabilities to create medicine and health breakthrough for creating non-invasive procedures, or to heal many illnesses with painless medicine methods.

In today world, we still have to search or receive organ donors if we are experiencing acute illnesses. But now, we have the regenerative medicine breakthrough. One of the invention in this field is the 3D Printer for Biological matters by using hydrogels as the ink for the tissue printing of certain organs. Or by using scaffolds to create real biological pattern of the targeted organ, the bio-tissue then can be made to form certain organ from DNA-specific cells from the patient who needs it.

While in the field of work, there's also many problems that arisen because of the AI breakthrough, creating various disruptor in many field of business. The development of AI are very helpful for many person who are lacking at writing or summarizing their works. AI has enable people who are struggling with verbal skills. AI now has also create superior breakthrough at many capabilities such as creating images from verbal hints, and even to create videos with the voice almost similar to the original artist. Creating disruption to many visual designers and visual artists.

We can see this phenomenon has two sides. As disruptor, or as chances. It is as importance to learn the new technology, but packed it up with the regular originality of our works. We can even show whats the AI capable to do, and create what we done, and show to the management, the comparison, as also show them the incapability of the AI on the field that we are working on.

By showing the comparison between the AI results and our original results, can give clear views of our capability and can be a great way to show other people, the weak side of AI that are still unrepairable. At the same time, there are also various side of corporation that suppose to be private and secretive, then becoming weak and fragile because several employees are using AI for working with what suppose to be non disclosure documents or images and even films, that suppose to be kept private as the company privacy.

There's also many proportions of AI misperception when we forced the application to subtitute human thinking. AI is created to create linkage between one idea and with the AI acquired data, to gives out any top definitions, summarizations, or analysis, but it cannot ever replace human reasoning. When a writer are giving out their piece of artsy writing, there are many piece of originality that we can not feel when we 're reading, seeing or watching AI made art pieces.

Gina Al Ilmi

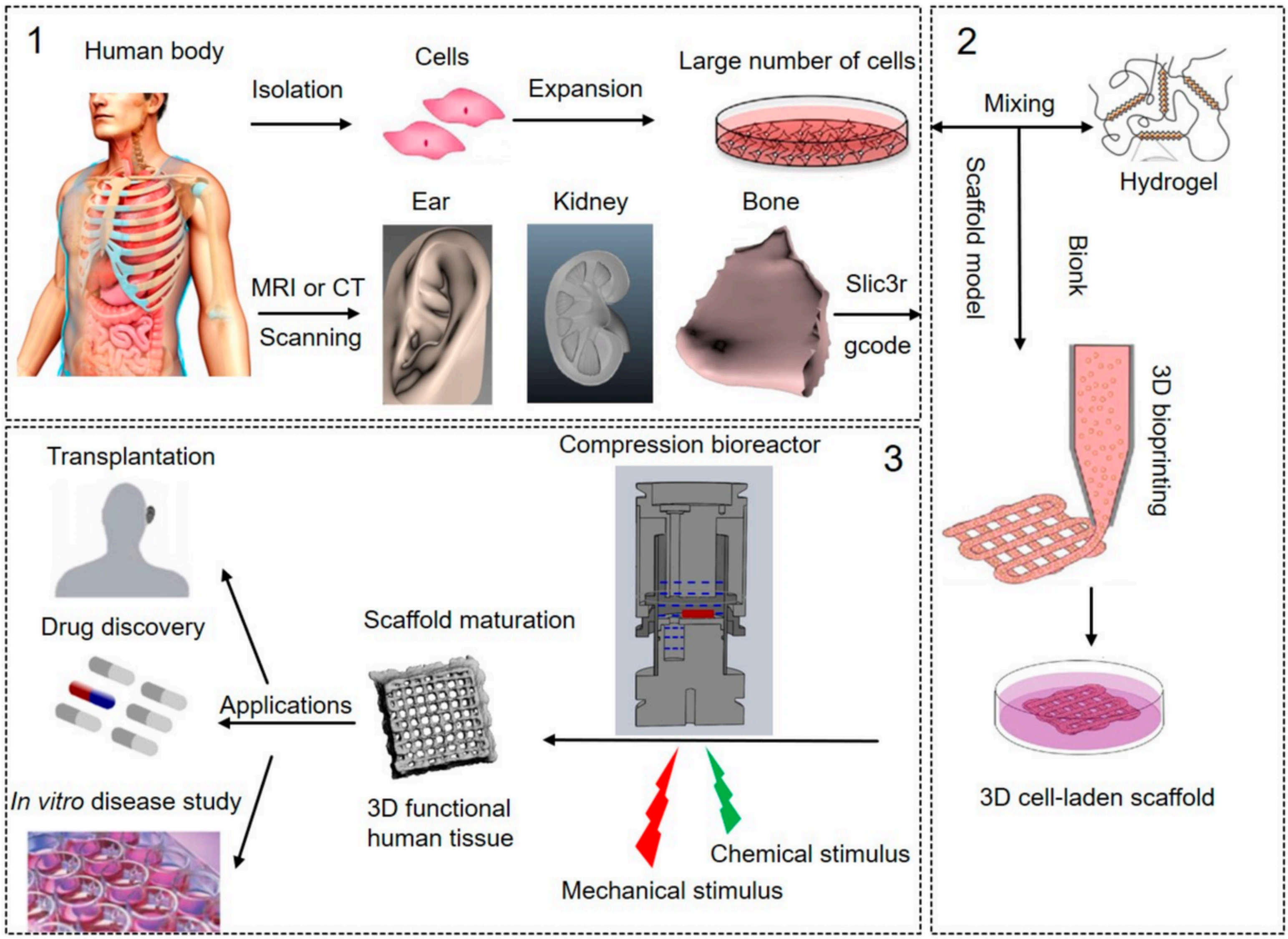
Editor-in-Chief

3D Bioprints Medicine Breakthrough

The field of printing, are now more developed. The first human capability to create printing was priorly from Einstein Nobel worth work in the field of wavelength of colour and image invert based on the wavelengths. His work then opens wide possibility of many kind of printing modes. Currently, we are observing how the printing technology are heading to 3 dimensional sructures, and the ink was subtitute with bio ink such as hydrogels or other type of biogels.

In the field of medicinal purposes, we are using the 3d bioprint results for many areas of tissue and nerves impairment or damages. There ah re also the Stem cells technology, when the stem cells usage was the pluripotent cells, then we can create many type of cells, because the pluripotent cells can developed into many kind of cells, and not only one type of cells based on the biogels that is using.

3D Bioprints Areas of Medicine Applications



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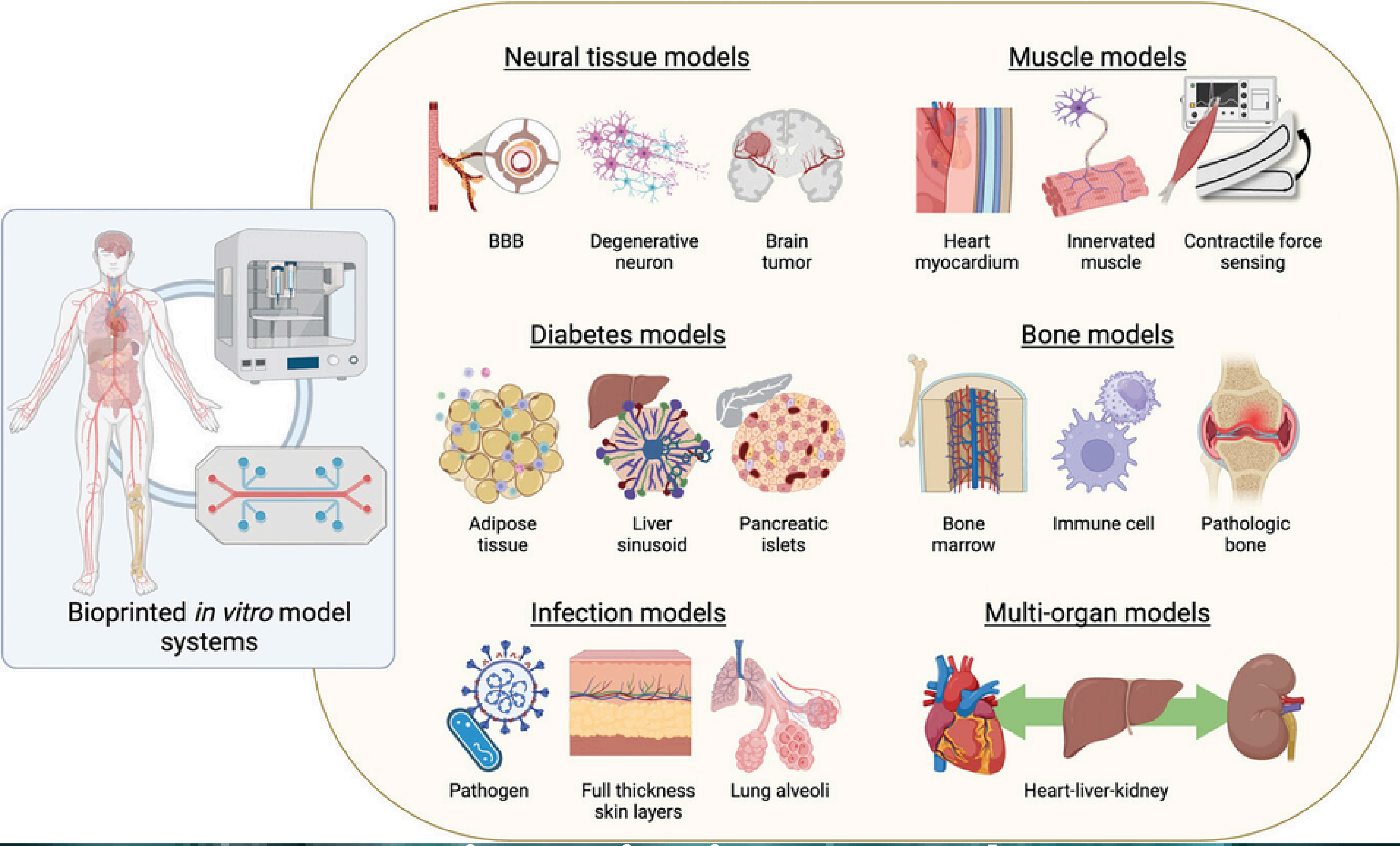
With the help of Scaffold to creates certain structures of the 3D cell-laden, the bio-gels will formed organ-like structures, and can also combine with other nano cells of bio-conductor to make sure the organ will be working properly in each of the placement and supports the subjects organ and enabling new hope and new future of the patient health conditions.



3D & 4D Bio-printing Development

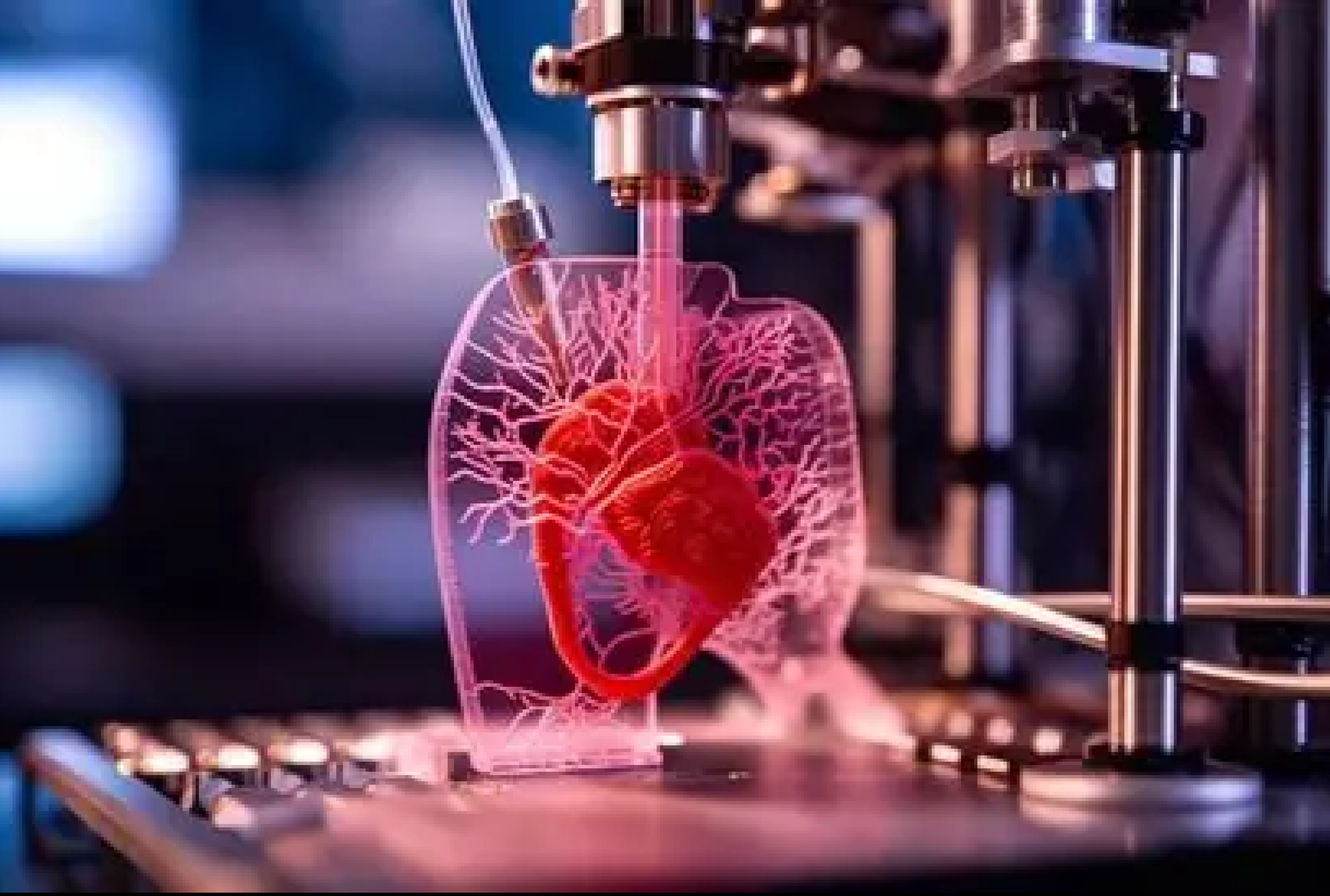
Wounded and dysfunctional Organs are now can be treated with 3D bioprint technology. Starting from basic additive manufacturing (AM) to precise biomaterial and cell deposition for skin reconstruction. Special focus is given to bioinks, including natural polymers, synthetic hydrogels, decellularized extracellular matrix (dECM), and composite formulations, all designed to mimic native skin properties.

These different kind of 3D bio printing model are in line on development, whether it is the infection models, multi organ models, the multipose of diabetes models, the muscle models and the neural tissue models. All these 3D bio printing models of application, can generally increase the chance for every patient to be cured from many of what priorly can't be cured. Imagine the new world when we don't have to wait for organ donors, and the immense health derived from the DNA specific bio-printing technology.

The emerging field of 4D bioprinting is highlighted, incorporating smart, stimuli-responsive materials capable of dynamic structural and functional adaptation to complex wound environments. Key cellular components and bioprinting techniques for multilayered constructs are reviewed, along with personalized approaches such as in situ handheld bioprinting and artificial intelligence (AI) assisted bio-fabrication.

Still, many challenges are faced in clinical translation, manufacturing, and scalability are addressed, with future perspectives on the normatic and frontier of 4D usage of robotics, AI, and innovative biomaterials in regenerative wound care.

The applications are also still in wait for many parts of LMIC parts of the worlds. The technology has emerging at different places at the same time, making sure that there will be large acceptance in various parts of the globe when the real 3D and 4D development will currently lead and replacing all the severe illness effects to patient with organ failure, severe wound, oncology severity, and cancer patients.



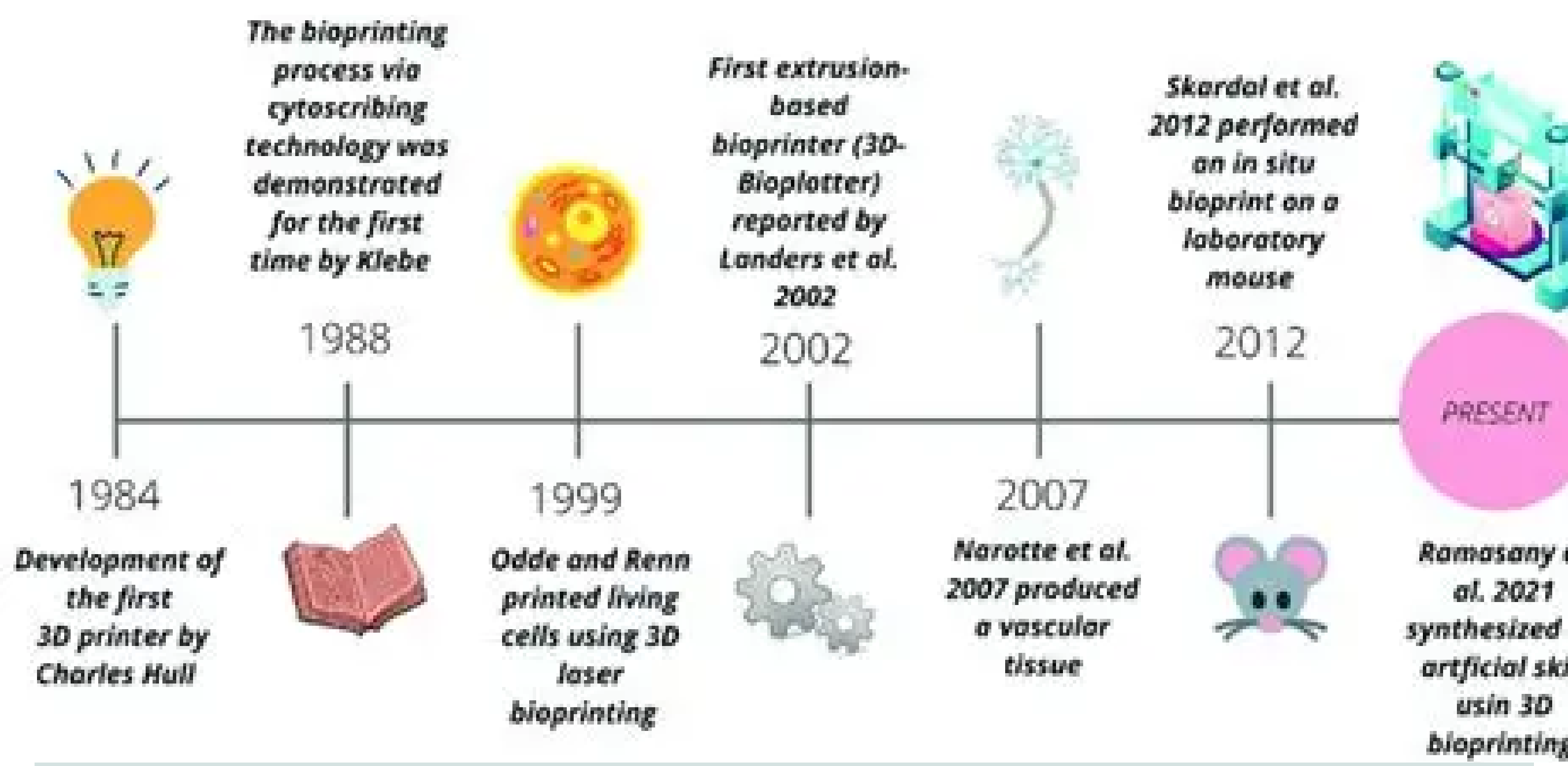
Revarcularization Therapies / Operations

Revascularization therapy is a vital part of modern cardiology, offering hope and treatment options for patients with ischemic conditions. Coronary artery malfunction in our heart are causing the heart attack to emerge. This disease usually trated with creating valve in the Y shape heart artery, to make sure the blood pumped by the heart can fill the ischemic region (parts of body where oxygen can flow).

Revascularization therapy is a crucial procedure for restoring blood flow to ischemic areas of the heart or limbs. It is essential for treating conditions like coronary artery disease (CAD) and peripheral artery disease (PAD). The therapy aims to relieve pain, prevent amputation, and improve the quality of life for patients. The procedure can be performed using minimally invasive techniques or traditional surgeries, depending on the severity of the condition and the patient's overall health.

Revascularization therapy is recommended for patients with coronary artery blockages or narrowing, such as those with CAD or unstable angina. The timing and modality of the procedure depend on the acute coronary syndrome (ACS) present, the extent and location of the anatomical lesions, and the availability of personnel and facilities. Immediate reperfusion is not as urgent in patients with uncomplicated non–ST-segment elevation myocardial infarction (NSTEMI) or unstable angina who respond to medical therapy.

The DEFINE-FLAIR randomized clinical trial found no significant differences in major adverse cardiac events between the use of instantaneous wave-free ratio (iFR) and fractional flow reserve (FFR) as a pressure index to guide revascularization. However, higher mortality was observed in the iFR study arm.



The Evolution of 3D Bioprint

Bioprinting is an emerging and multidisciplinary technology that originated from 3D printing. The first milestone, in 1984, was provided by Charles W. Hull, through the development of three-dimensional printing objects (3D), via stereolithography (SLA).

In 1988, the researcher Robert J. Klebe used cytoscribing technology to demonstrate the potential of positioning biological products, using a Hewlett Packard (HP) inkjet printer and a graphic plotter. Years later (1999), David J. Odde and Michael J. Renn printed living cells using 3D laser bioprinting, thus, demonstrating the feasibility of synthesizing tissues with complex three-dimensional anatomies.

In the 2000s, Rolf Muelhaupt and his group reported the first three-dimensional plotting of thermosensitive gels in a liquid medium, using the additive manufacturing technique. Later, in 2002, the first extrusion-based bioprinter was reported by Landers et al., being marketed under the name “3D-Bioplotter”. In 2003, Boland et al. adapted an HP inkjet printer and were able to successfully print living cells. In 2006, Suwan N. Jayasinghe and his team added an electro-hydrodynamic jet to deposit living cells. In 2009, Narotte et al. synthesized vascular tissue based on free scaffolds.

In 2012, Skardal and colleagues performed in situ bioprinting in laboratory mice using cells derived from amniotic fluids to stimulate the healing process. The results indicated that the bioprinting of these cells could be used to treat wounds and burns. Several types of research have been developed to generate new products for society and overcome the challenges of 3D bioprinting.

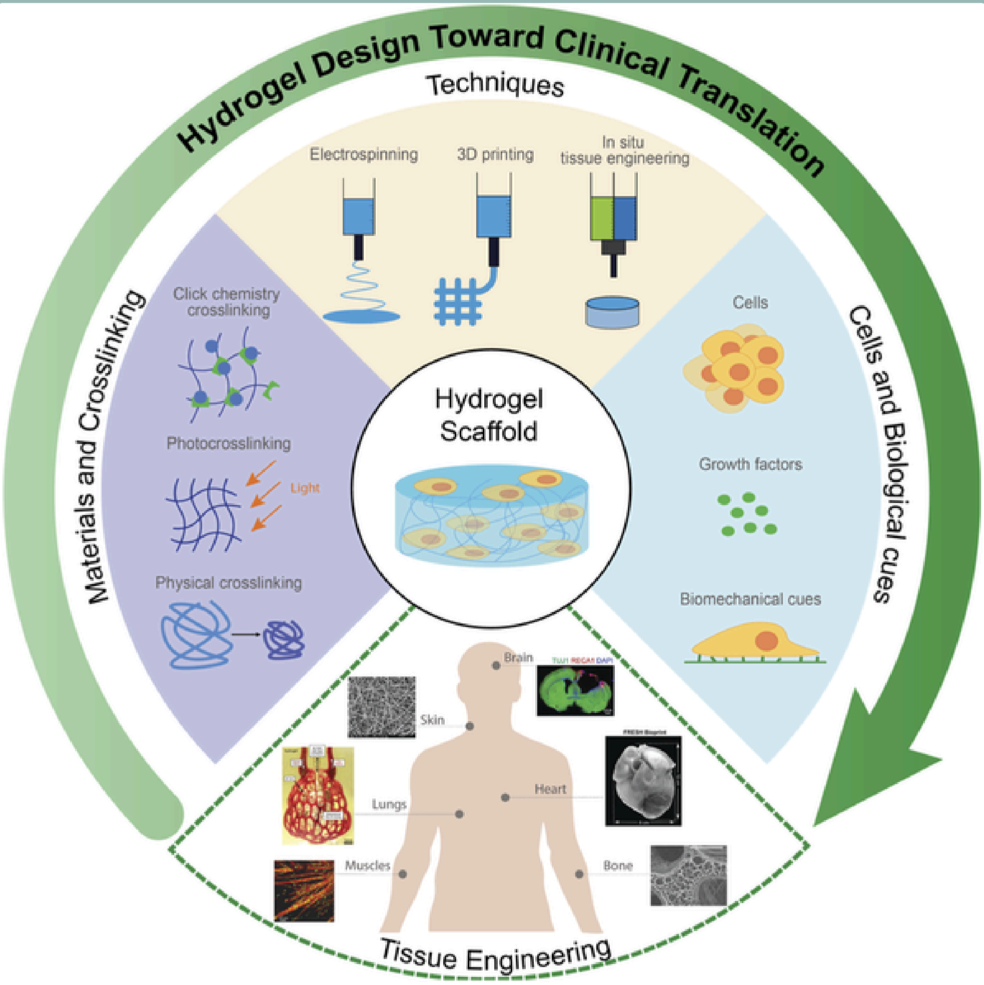
Zhou et al. (2021), for example, used 3D bioprinting technology to add chondrogenic progenitor cells (CPCs) and fibronectin (FN) to a hydrogel composed of alginate/gelatin/hyaluronic acid (Alg/Gel/HA), intending to optimize the cartilage regeneration process. Nulty et al. (2021) developed a new bioprinting method for manipulating pre-vascularized tissues in vitro to analyze vascularization and bone regeneration in vivo. Ramasamy et al. (2021) synthesized an artificial skin using an extrusion-based 3D bioprinter. This identify an opportunity to provide full-thickness reconstructed human skin in a reproducible and potentially scalable manner. Noor et al. (2019) synthesized a custom hydrogel for printing autonomous cellular structures, such as whole hearts with blood vessels

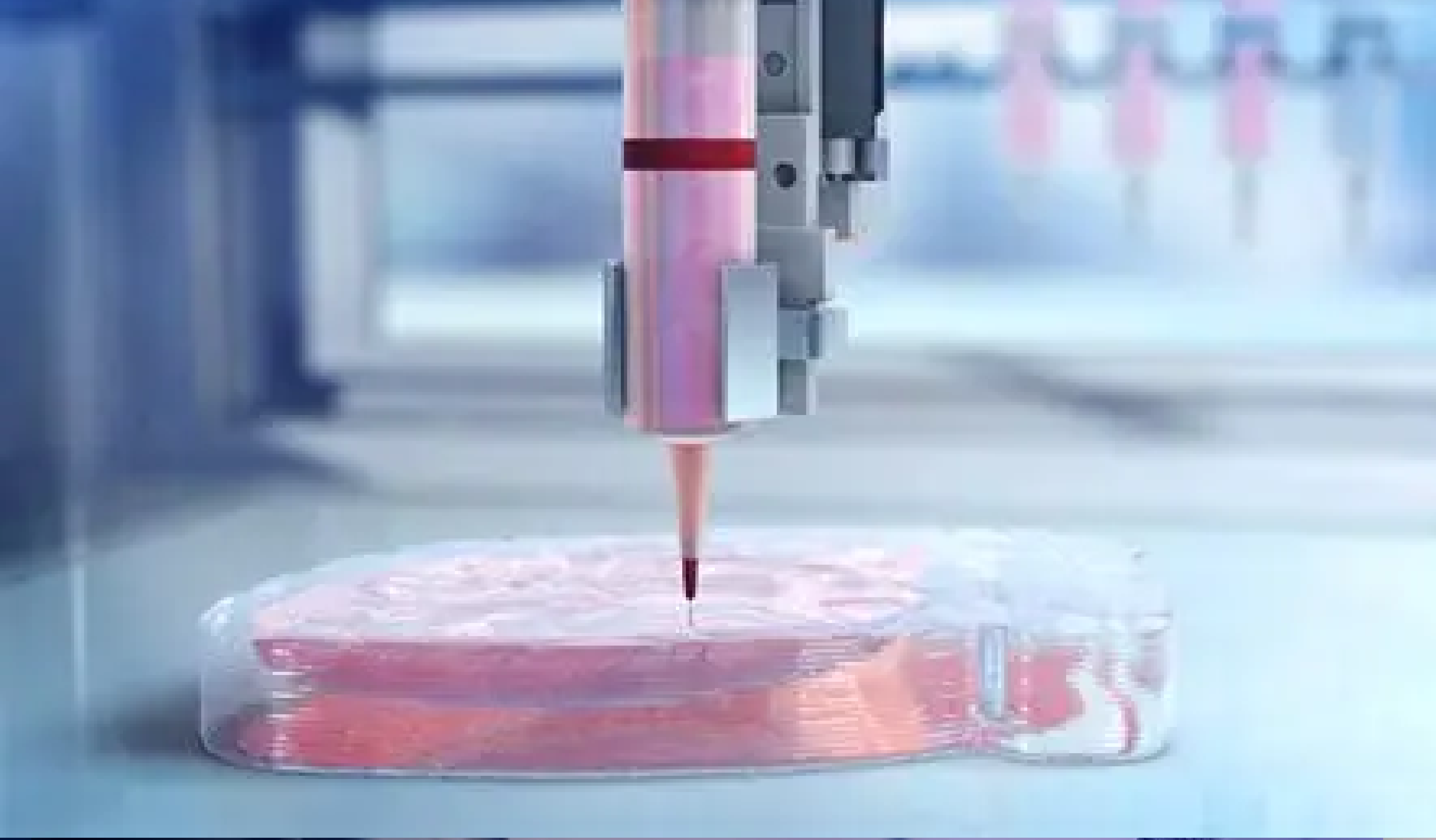
Neural Tissue Engineering with CNHydrogels

Bio-tissue engineering has evolved greatly and can now producing the needed conductive nano parts in our nerves, intra organ, and also for outer layer tissues repairment. The conductivity resulting the new bio-tissue can transmit the electricity and makes our organ can functions accordingly. The Conductive nanocomposite hydrogels (CNHs) represent a promising tool in neural tissue engineering, offering tailored electroactive microenvironments to address the complex challenges of neural repair.

This systematic scoping review, conducted in accordance with PRISMA-ScR guidelines, synthesizes recent advancements in CNH design, functionality, and therapeutic efficacy for central and peripheral nervous system (CNS and PNS) applications. The analysis of 125 studies reveals a growing emphasis on multifunctional materials, with carbon-based nanomaterials (CNTs, graphene derivatives; 36.8%), metals (Iron oxides, gold, etc.; 24.0%), conductive polymers (PEDOT, PPy, etc.; 16.0%), and hybrid systems dominating due to their synergistic electrical, mechanical, and bioactive properties. For CNS repair, spinal cord injury models (n = 42) leverage antioxidant-conductive hybrids and immunomodulatory systems to mitigate oxidative stress and neuroinflammation.

For Peripheral Nerves System repair—particularly sciatic nerve regeneration (n = 20)—CNHs demonstrate efficacy through stimuli-responsive strategies (including wireless and self-powered piezoelectric and magnetic systems) and biomimetic scaffold design to guide axonal regeneration. Tailored hydrogel designs also address traumatic brain injury, stroke, and Parkinson's disease. Beyond these, CNHs show promise in diverse neural tissue engineering contexts, including neurovascular niche reconstruction for diabetic wound healing, coordinated neurogenic and osteogenic differentiation in bone and muscle repair, and auditory neurogenesis in cochlear applications. This review highlights the potential of CNHs by elucidating recent applications across various neural tissue engineering contexts.





3D Bioprint Tech & Hydrogels Usage in The Process

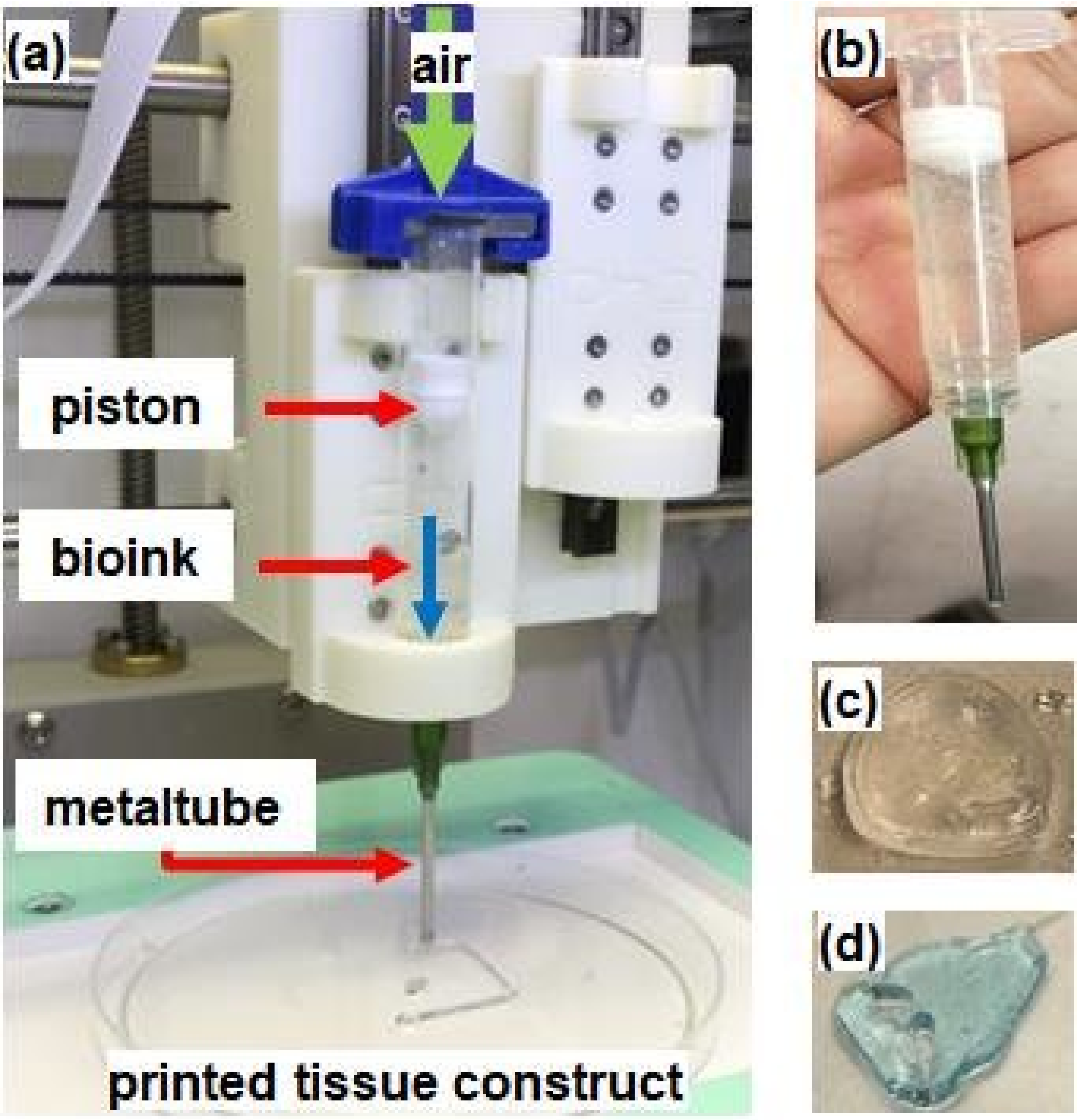
In the field of Regenerative medicine, the choose of materials for the bio-gels or bio ink, are facing very essentials considerations, one of the factors are the compatibilities of the biogels with the intended targeted organs, mechanical nature of the bio-gels to make sure it can gives the same functions with the prior healthy organs.

For organ repairment and the intra or outer organ tissue layer repairment, even inside the bone cartilages the use of cells or cell aggregates as bioinks, in 3D bioprinting technologies, especially in extrusion-based printing, must deal with the challenge of the low cellular viability of the constructs, due to cells finding it difficult to resist the shear stress caused by the material's deposition process, layer by layer.

Alternatively, hydrogels act as vehicles for encapsulating and delivering cells, maintaining high shape fidelity, and mimicking the native extracellular matrix. Furthermore, these materials have good biodegradability and biocompatibility. Designed as porous structures, they present a promising microenvironment for gas exchange and nutrient diffusion for 3D bioprinting of cells.

The swelling capacity provided by the three-dimensional network of hydrogels becomes fundamental for cell migration, proliferation, and adhesion, enhancing the development of complex tissues and organs. Thus, several efforts have been devoted to formulating hydrogel-based bioinks for a 3D microenvironment suitable for cell seeding and encapsulation.

The selection of hydrogel (synthetic or natural) as a bioink is intimately related to the bioprinting technique, tissue type and selected cells. Furthermore, its formulation must satisfy rheological and biological criteria. The viscosity, concentration and crosslink density must also be optimized, with three main types of crosslinking used in the post-printing procedure: thermal, chemical or physical (UV light, among others). Other parameters, such as cytotoxicity, printability, physical strength, in vitro or in vivo degradation capacity and the effects of by-products in the culture medium are also important for the reproduction of good materials. Among the most used hydrogels as bioinks or bioprinting inks are the following: hyaluronic acid, alginate, silk-fibroin, collagen, agarose, and gelatin.



Extrusion based & Laser Assisted Bio Print

Extrusion-based bioprinting is one of the most used bioprinting techniques today, as it prints bioinks with high viscosity. In this process, the bioinks are extruded as a thread through the nozzle, using two methods: pneumatic (air) and mechanical (piston and screw).

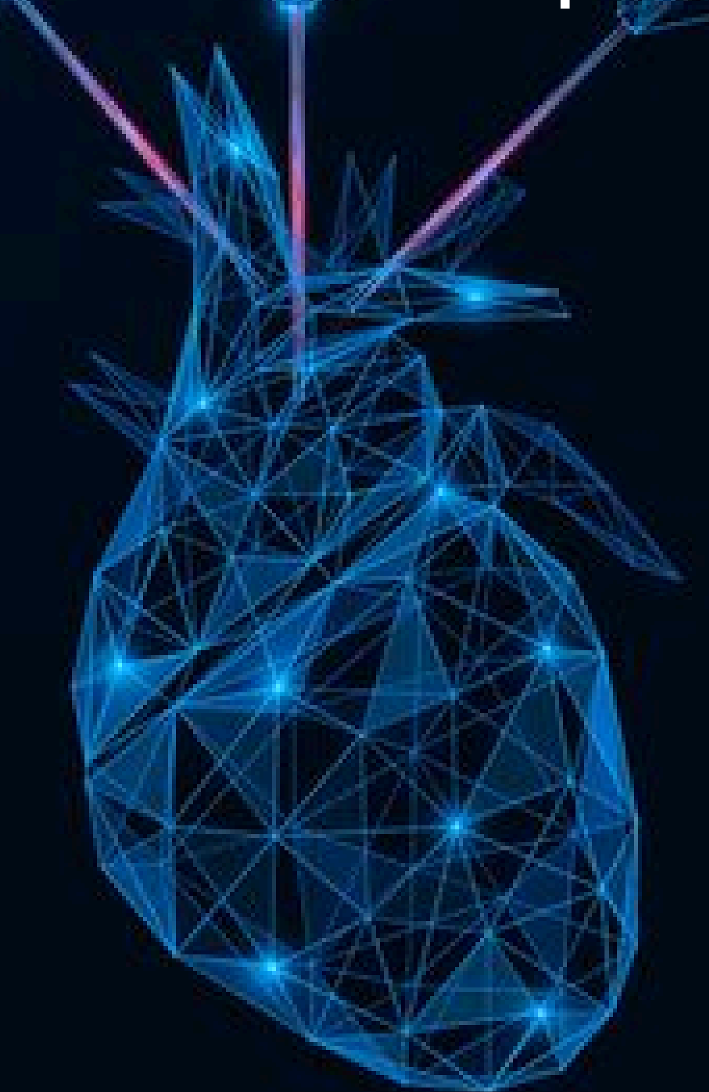
In the pneumatic method, the air pressure provides the force to eject the bioink with pre-established speed and quantity. However, even though it is a simple procedure, there is a lack of control in bioinks with low viscosity. The mechanical method determines the printing process through the vertical and rotational forces .

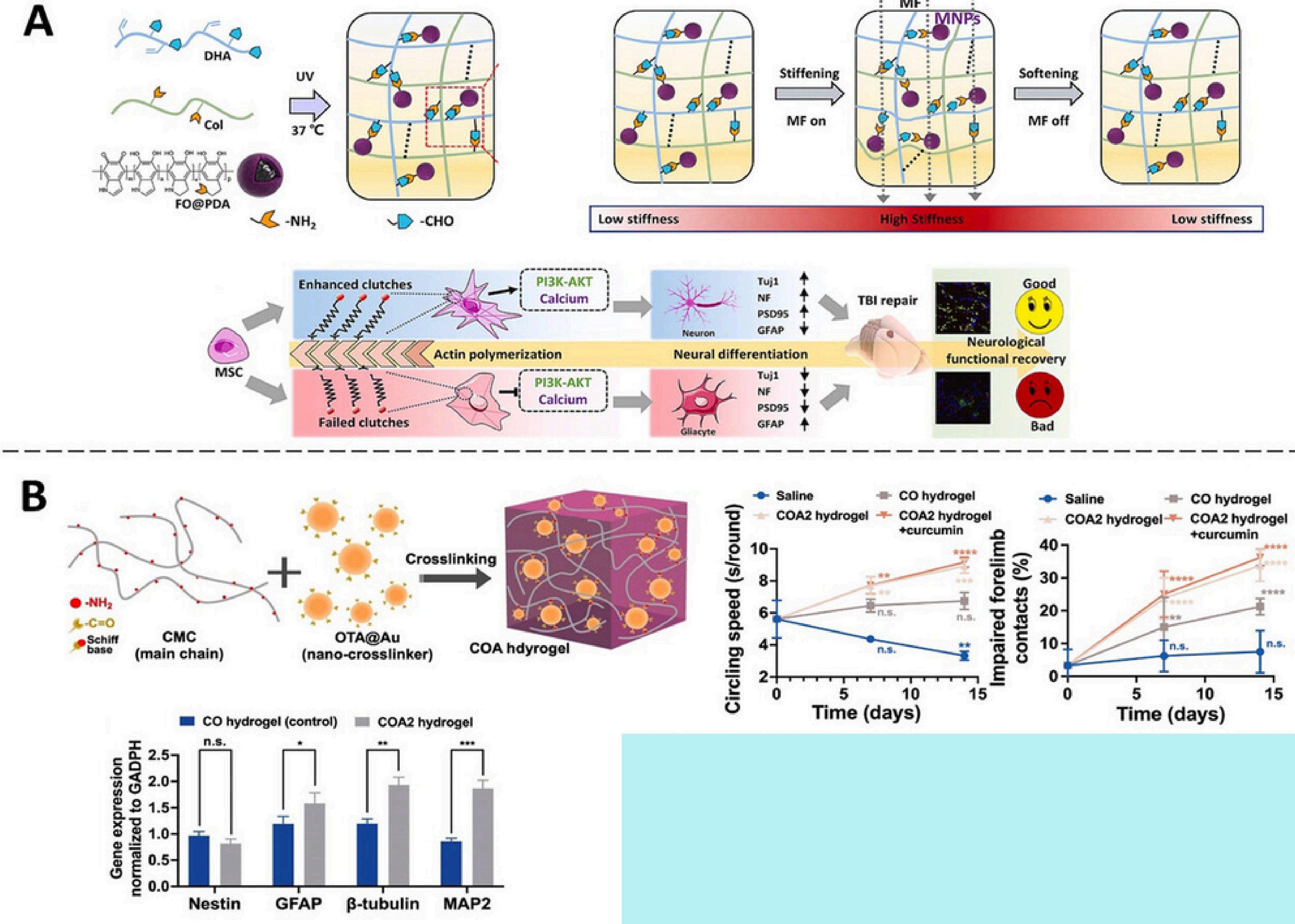
In the piston process, the flow is favored over the bioink during printing. For very viscous materials, however, failures occur in the bioink deposition. On the other hand, in screw-based extrusion, bioink is distributed in a microliter range, which can be interesting for materials with low viscosity.

Although extrusion bioprinting is one of the most required for artificial tissues and organs, it has some disadvantages, such as shear stress, which can cause death and/or loss of cell viability, and a low quantity of materials. It is recommended to use more robust hydrogels and improve-ments in the nozzle and syringe, which would contribute to better cell viability after printing. In work by Cleymand et al. (2021), a bioink based on chitosan (CH) and guar gum (GG) was synthesized to be used in extrusion-based bioprinters.

3D bioprinting has significantly advanced this field by enabling the fabrication of complex, patient-specific tissue models that more accurately mimic human physiology compared to traditional animal models. These bioprinted tissues can be used for various applications, including skin grafts, cartilage repair, and even the creation of functional organoids (in Schimdt, 2025), (Spirito et al., 2024) (Kim et al., n.d.). The demand for organ transplantation far exceeds the available supply of donor organs, leading to a critical need for alternative solutions. 3D bioprinting offers a promising approach to address this shortage by enabling the fabrication of functional organs on demand. While the bioprinting of complete, transplantable organs remains a distant goal, significant progress has been made in the development of bioprinted tissues and organs for regenerative medicine (in Schmidt 2025) (Wang et al., 2024) (Wu et al., 2023) (Jones, n.d.) (Persaud et al., 2022). Recent advancements in bioprinting technologies have enabled the creation of solid organs such as hearts, livers, kidneys, and pancreas. These bioprinted organs are being tested for their potential to address organ shortages and improve patient outcomes in transplantation, with future hopes these technology can be applied to clinical settings and to be disseminated and globally applied.

The Fabrication of Patient Specific Tissue Models in 3D Bioprinting





Anti-inflammatory bioactive injectable Hydrogels for Parkinson Disease

Parkinson disease are among the dominant illness that can be found in many geriatric patients. Not only it has impact to our mental conditions, each of the simptoms are also derives from the nerves inflammations that happening in our brain, with many brain areas affected.

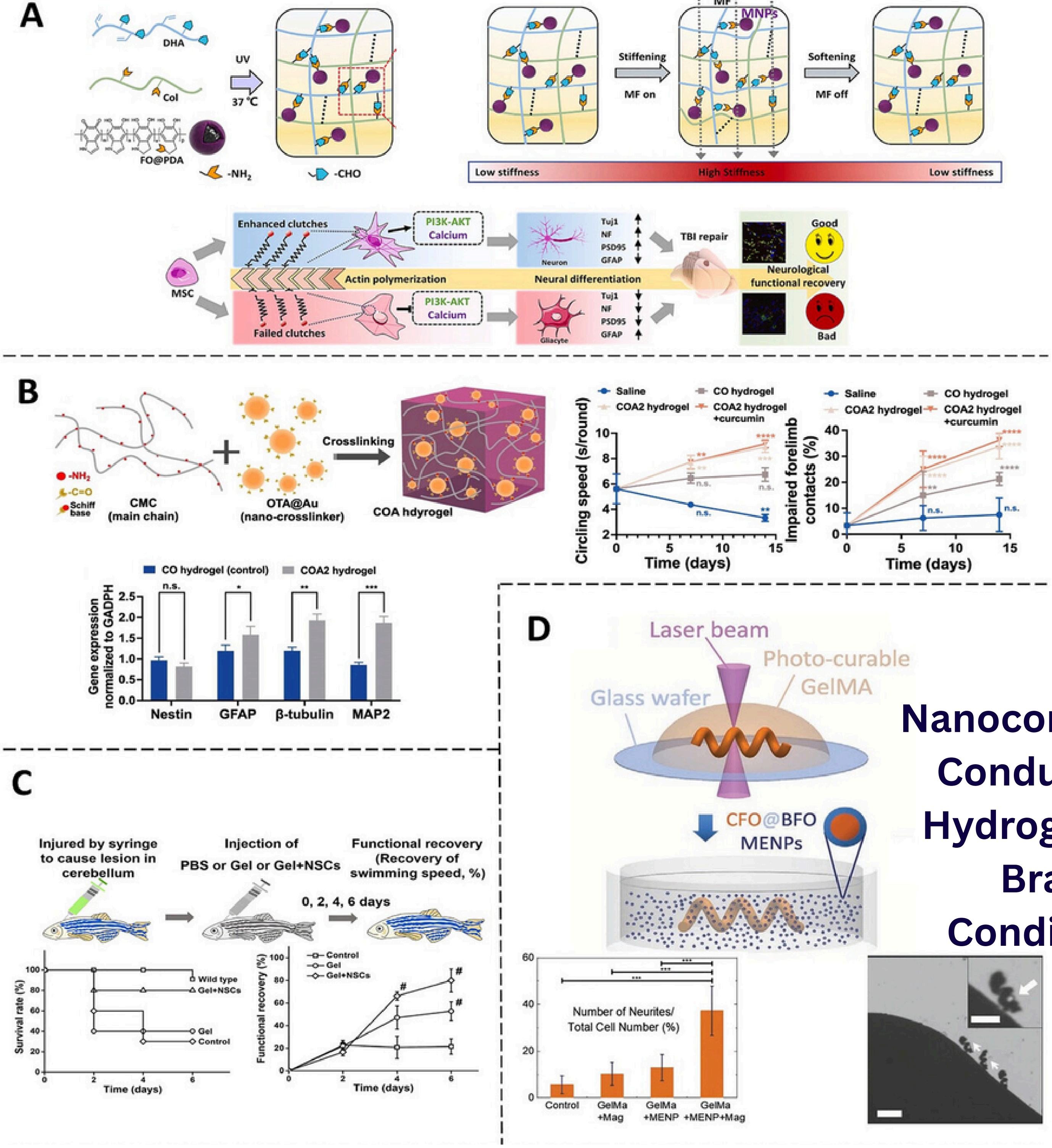
Two studies aimed to incorporate anti-inflammatory features into hydrogels to reduce neuroinflammation in Parkinson's disease (PD), Xu et al, created bioactive injectable hydrogel to relieve the functions of the affected nerves, and initiate rapid self-healing, and as conductive cells that initiates the anti-oxidative functions and anti inflammatory effects.

In vivo studies in a rat PD model indicated that the stereotactic implantation of the COA2 hydrogel successfully restored normal electrophysiological functions. In another study led by the same author, a comparable formulation produced similar results, except that the negatively charged dialdehyde polyurethane nanoparticulate (DAPU) in the hydrogel played a key role in promoting the anti-inflammatory effect.

Application of Nanocomposite Conductive Hydrogels for Brain-related Conditions;

A) DHAC-F hydrogels, with varying cross-linking bonds, enable reversible matrix regulation of neural differentiation in BMSCs through magnetic on-off mechanisms. This process modulates mechano=transduction via the PI3K-AKT and calcium signaling pathways.

B) The gelation mechanism of COA hydrogel and its effect on neural-related gene expression after 14 days. Functional recovery in PD rats treated with or without COA hydrogel containing curcumin was assessed by comparing left-side circling speeds.



Nanocomposite Conductive Hydrogels for Brain Conditions

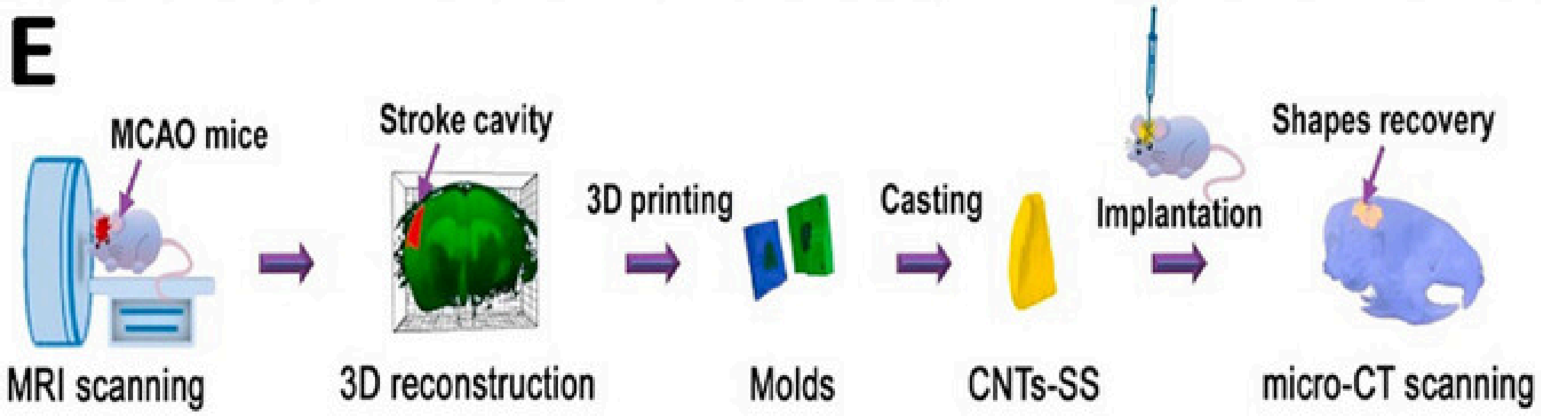
DHAC-F hydrogels, with varying cross-linking bonds, enable reversible matrix regulation of neural differentiation in BMSCs through

A) magnetic on-off mechanisms. This process modulates mechanotransduction via the PI3K-AKT and calcium signaling pathways.

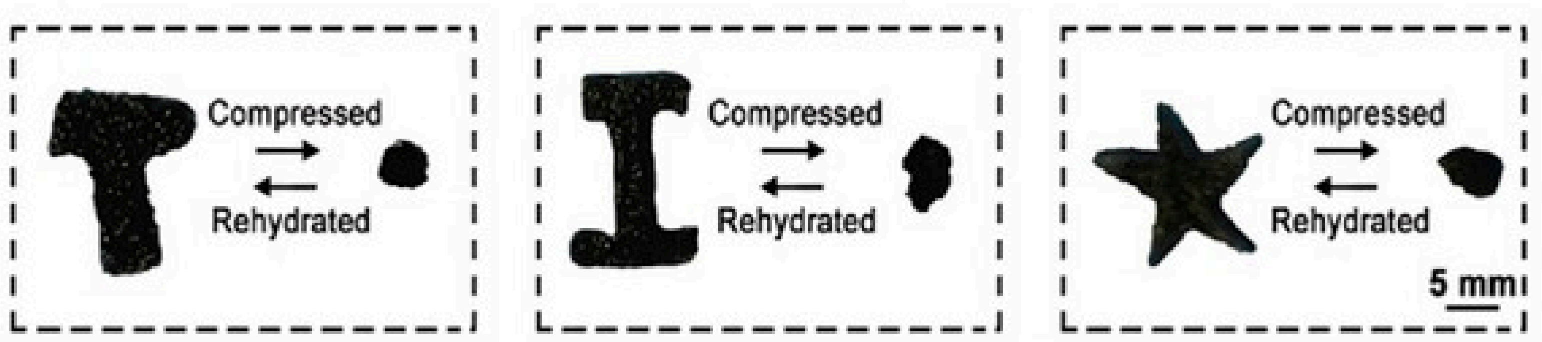
B) The gelation mechanism of COA hydrogel and its effect on neural-related gene expression after 14 days. Functional recovery in PD rats treated with or without COA hydrogel containing curcumin was assessed by comparing left-side circling speeds.

C) Functional recovery of adult zebrafish after CNS injury assessed with PBS, CDD hydrogel ("Gel"), and NSC-laden CDD hydrogel ("Gel + NSCs"). Recovery was measured by survival rate and swimming speed over 6 days.

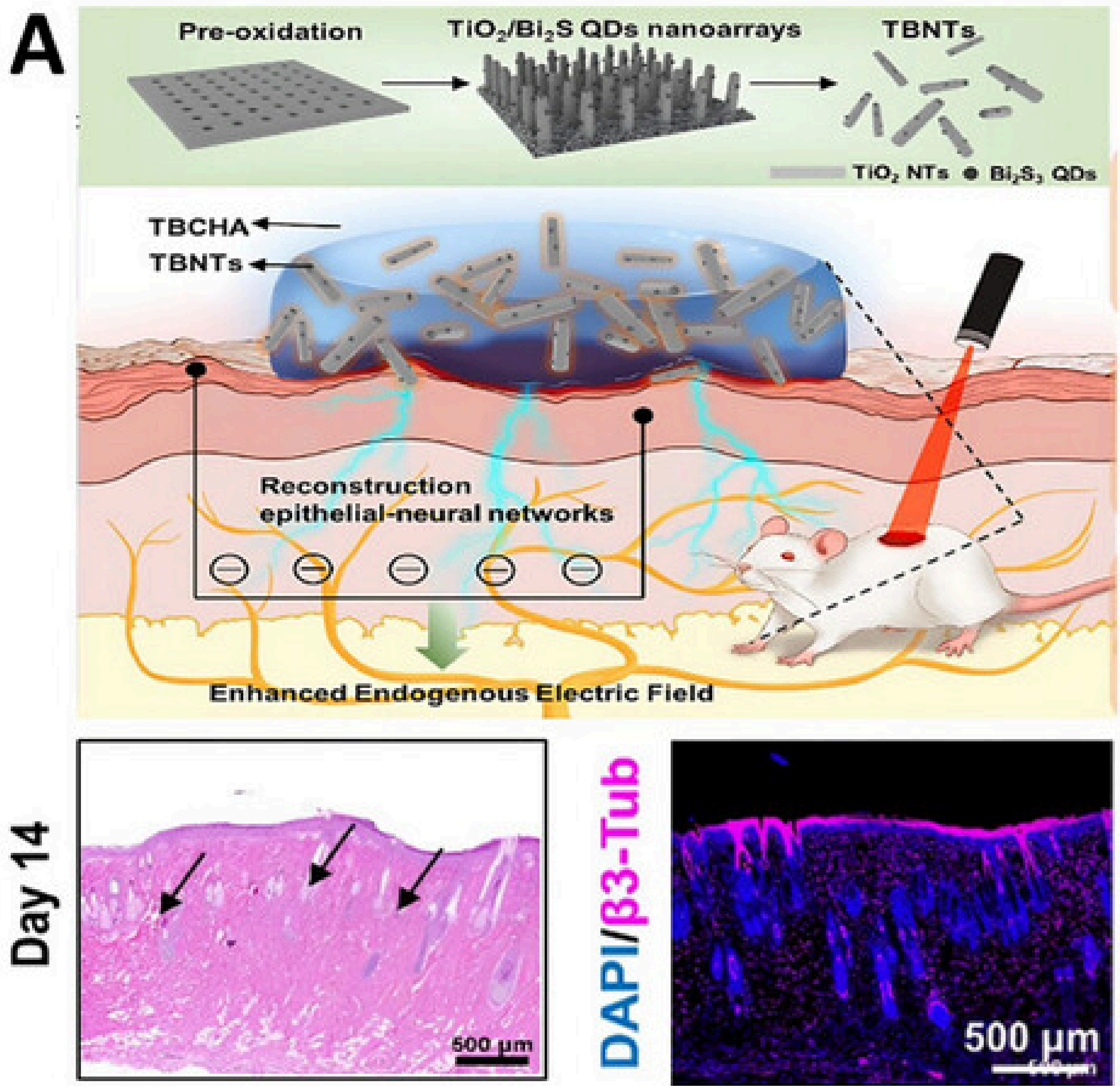
D) Two-photon polymerization (TPP) of GelMA helical microstructures, followed by incubation in core-shell magnetoelectric nanoparticles (MENPs). The image on the right shows time-lapse of a cell-laden helical microswimmer actuated by a rotating magnetic field, and the one on the left displays neurite count relative to the total cell number after 10 days.



Conductive Nanocomposites Hydrogels (CNHs) for Brain Conditions

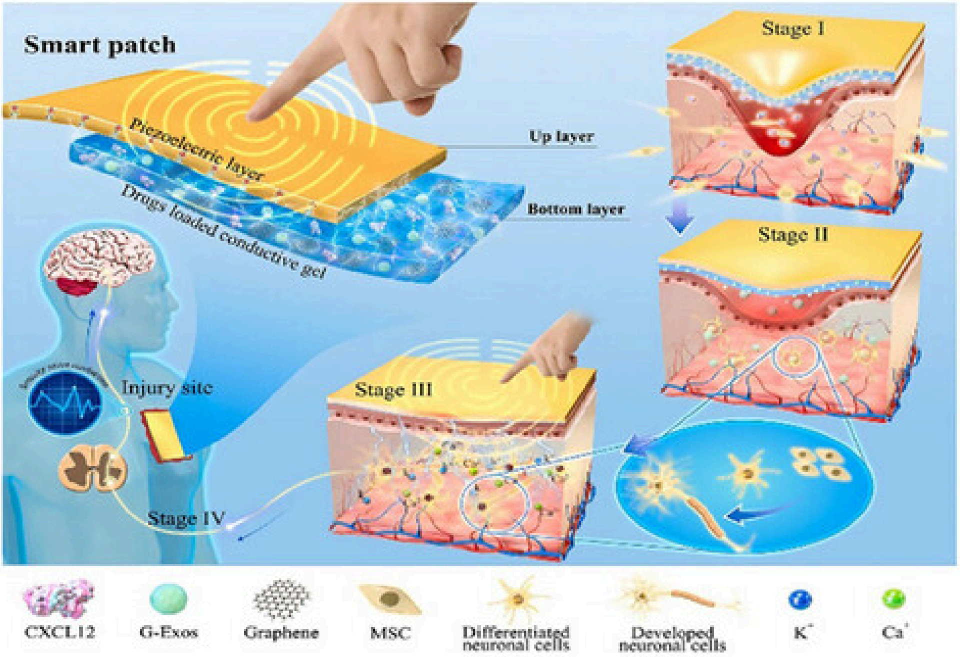


CNH-based stroke therapies aim to provide neuroprotective niches for transplanted cells and enable structural repair of ischemic cavities. In one study, Zhang et al. developed a GelMA/PEDOT:PSS hybrid hydrogel serving as a niche for NSCs to facilitate recovery in a rat cerebral ischemia-reperfusion model. The hydrogel demonstrated mechanical properties analogous to brain tissue and critical electrical conductivity for neural communication. Encapsulated NSCs in the GelMA/PEDOT:PSS100 hydrogel exhibited neuroprotection against oxygen-glucose deprivation, notably decreasing neuronal apoptosis. In vivo studies in middle cerebral artery occlusion rats indicated excellent histocompatibility and markedly diminished inflammatory responses at the injury site.[79] Additionally, Wang et al. designed an injectable silk sericin scaffold infused with CNTs for targeted repair of ischemic stroke cavities.

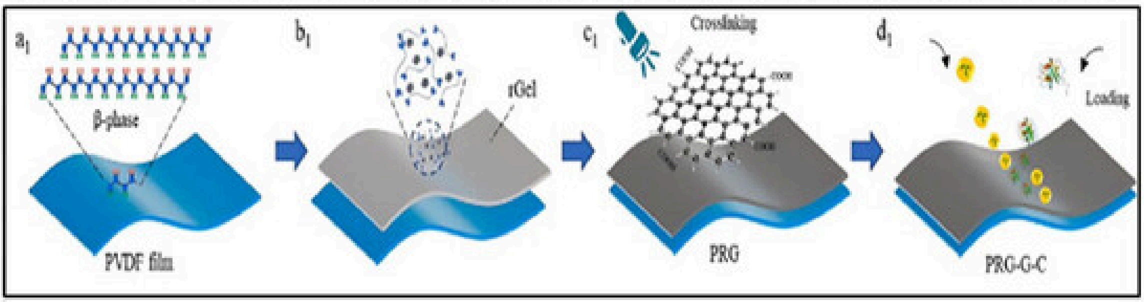


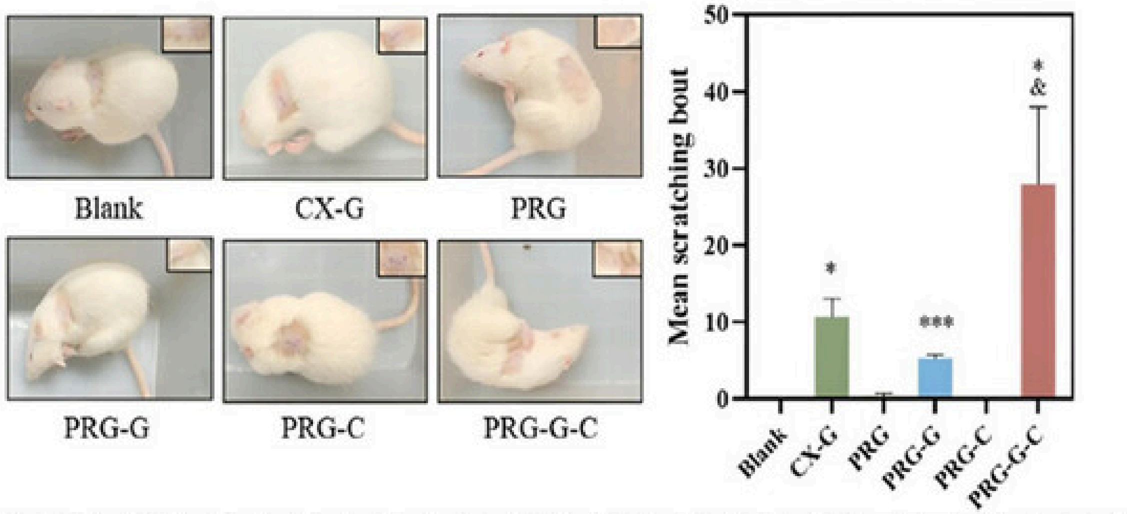
Reconstruction of Epithelial-neural networks

Recent studies have leveraged multifunctional nanocomposite hydrogels, integrating conductive nanomaterials and stimuli-responsive mechanisms such as photothermal, photoelectrical, and piezoelectric effects, to synergistically promote neurovascular niche reconstruction and sensory recovery in diabetic wound healing models. Jiang et al. synthesized a photothermally responsive nanocomposite hydrogel with conductive polydopamine-reduced graphene oxide (pGO), achieving notable success in restoring neural networks and mechanical nociception in infectious diabetic ulcers (IDUs). This hydrogel utilized pGO's conductivity and photothermal properties for NIR-mediated controlled antibiotic delivery. Additionally, pGO attracted $Trem2^+$ macrophages, facilitating collagen remodeling and enhancing angiogenesis through the VEGF-eNOS pathway, thereby establishing a mature vascular network. Furthermore, 3D imaging illustrated dense $PGP9.5^+$ nerve fibers in close association with regenerated blood vessels in the MpGel-NIR cohort, indicating the reconstruction of the neurovascular niche. This structural regeneration resulted in functional recovery, as MpGel-NIR reinstated mechanical nociception (verified by behavioral pain thresholds) and upregulated the mechanosensitive ion channel PIEZO2 in regenerated nerves, essential for protective sensation. Similarly, Qiao et al. demonstrated that TiO_2/Bi_2S_3 quantum dot nanotubes (TBNTs) enhance photocurrent generation when integrated into a dual-crosslinked collagen/hyaluronic acid hydrogel (TBCHA) for a photoelectrically active wound dressing In vitro, photostimulation of TBCHA increased NIH-3T3 and PC12 cell metabolic activity, enhancing ATP production and Ca_2 influx. This stimulation further promoted fibroblast contractility and neural differentiation, indicated by increased β3-tubulin. Additionally, it polarized macrophages towards an anti-inflammatory phenotype.



Piezoelectric biofilm with Conductive Graphene oxide-Gelatine Metacryloyl Matrix for programmed biological-electrical signals for enhanced nerve regeneration

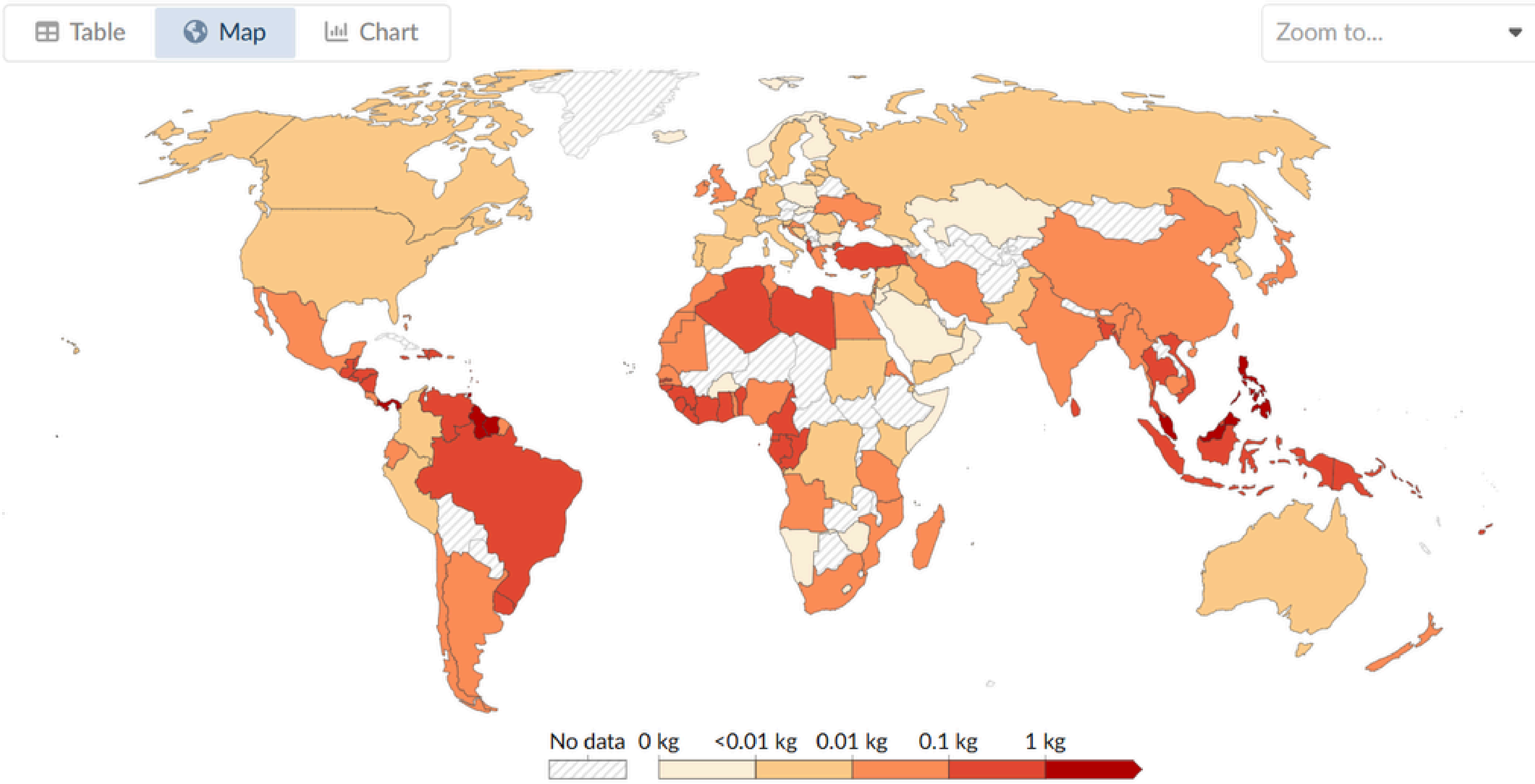




Tan et al. demonstrated a self-powered smart patch (PRG-G-C) that combined a piezoelectric polarized β-phase PVDF film with a conductive reduced graphene oxide-gelatin methacryloyl matrix, providing programmed biological-electrical signals for enhanced nerve regeneration. The patch produced endogenous electrical stimulation through piezoelectric transduction resulting from mechanical deformation. As a result, CXCL12 was rapidly released to recruit BMSCs to the wound site, while gingival mesenchymal stem cell-derived exosomes (G-Exos) were released in a sustained manner to promote neural differentiation. In vivo, PRG-G-C restored functional sensation, evidenced by restored scratching behavior in an itching model. Lastly, an ECM-based conductive interpenetrating network hydrogel, incorporating an oxidized chondroitin sulfate (OCS)/gelatin methacryloyl (GM) network with polypyrrole nanoparticles, was established by Fan et al., demonstrating notable effectiveness in diabetic wound healing and neurovascular regeneration. The hydrogel displayed robust tissue adhesion through aldehyde-amino group crosslinking and exhibited enhanced hemostatic capabilities in a liver injury model, enabling swift wound closure. Mechanistically, the hydrogel's conductivity facilitated intracellular calcium influx in HUVEC PC12 cells, thus activating the MEK/ERK and PI3K/AKT signaling pathways, which are critical for angiogenesis and neurogenesis.

Plastic waste emitted to the ocean per capita, 2019

This is an annual estimate of plastic emissions. A country's total does not include waste that is exported overseas, which may be at higher risk of entering the ocean.



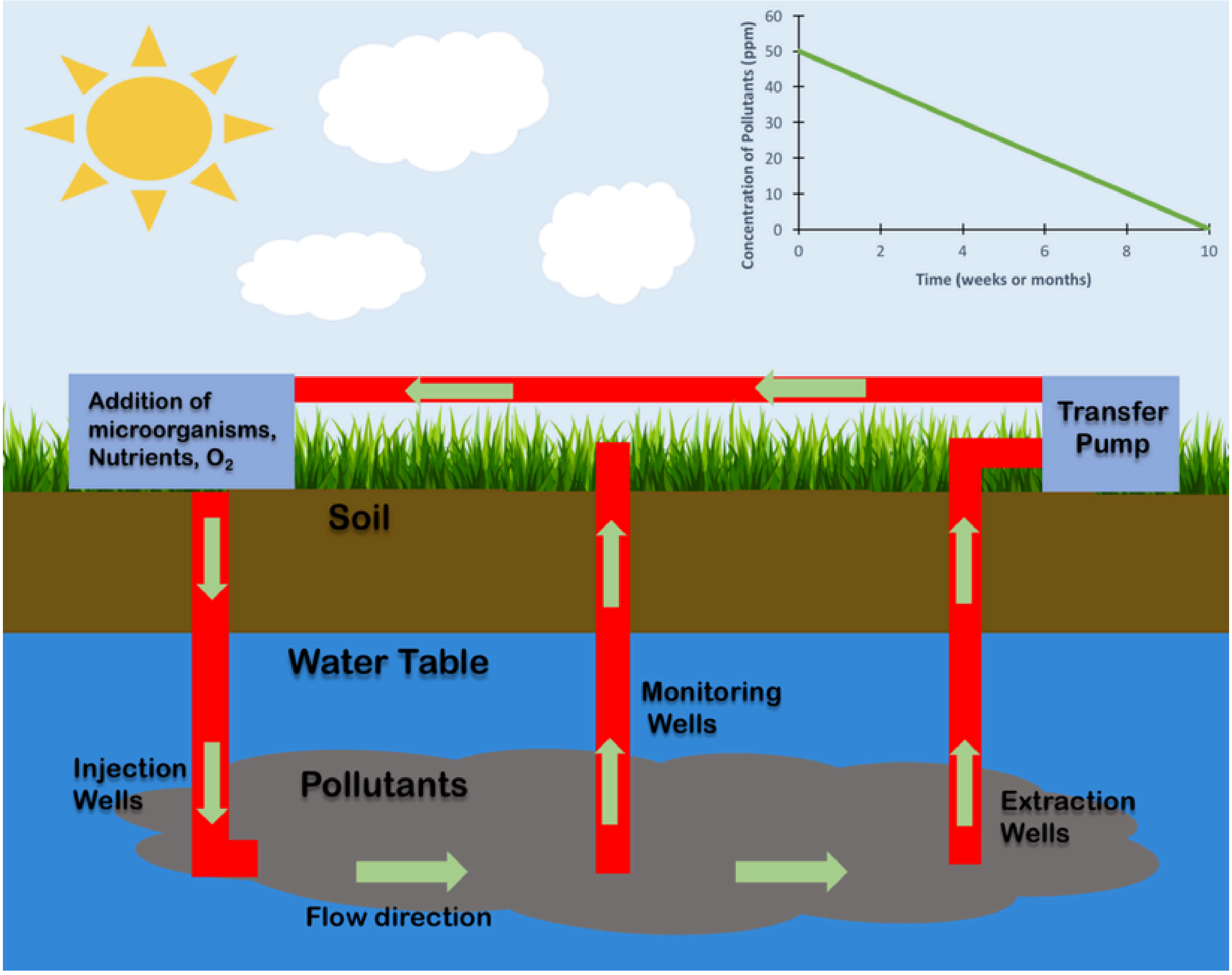
Microbial Usage to Ends The Plastic Floods

Global plastic production now exceeds 460 million tonnes annually. Up to half of this is estimated to be single-use items, often used for only a few moments before being discarded.While diligent users of recycling facilities might assume that most of our plastic is indeed recycled, the reality is sobering: the global recycling rate for plastics is only 9%.

Around half ends up in landfills, while around one-fifth is incinerated, and another fifth is mismanaged so it's not recycled, incinerated or securely contained. That means it can end up in rivers, lakes and oceans. The result: a planet drowning in synthetic waste.

Arthrobacter, a kind of microbe, has bioremediation usage. Arthrobacter Crystallopoietes and Arthrobacter Chlorophenolicus have been shown to reduce hexavalent chromium (a carcinogenic substance, can cause cancer in human and animals) and 4-chlorophenol (microbe that dissolves easily in water) levels in contaminated soil, suggesting they may be useful for bioremediation.

Gordonia species are able to degrade various environmental pollutants toxins and other natural compounds that cannot regularly be biodegraded. Two common materials, natural and synthetic isoprene rubber (cis-1,4-polyisoprene), can be biodegraded and used as a carbon and energy source by Gordonia. Gordonia are commonly detected in activated sludge wastewater treatment plants, where they along with other mycolic acid containing actinomycetes are well known contributors to sludge foaming issues that impede biomass settling and process performance. Some pathogenic instances of Gordonia have been reported to cause skin and soft tissue infections, including bacteremia and cutaneous infections. Though infections are generally treated with antibiotics, surgical procedures are sometimes used to contain infections. Some investigations have found that 28 °C is the ideal temperature for the growth of Gordonia bacteria. Gordonia species often have high G-C base pair contents in DNA, ranging from 63% to 69%.

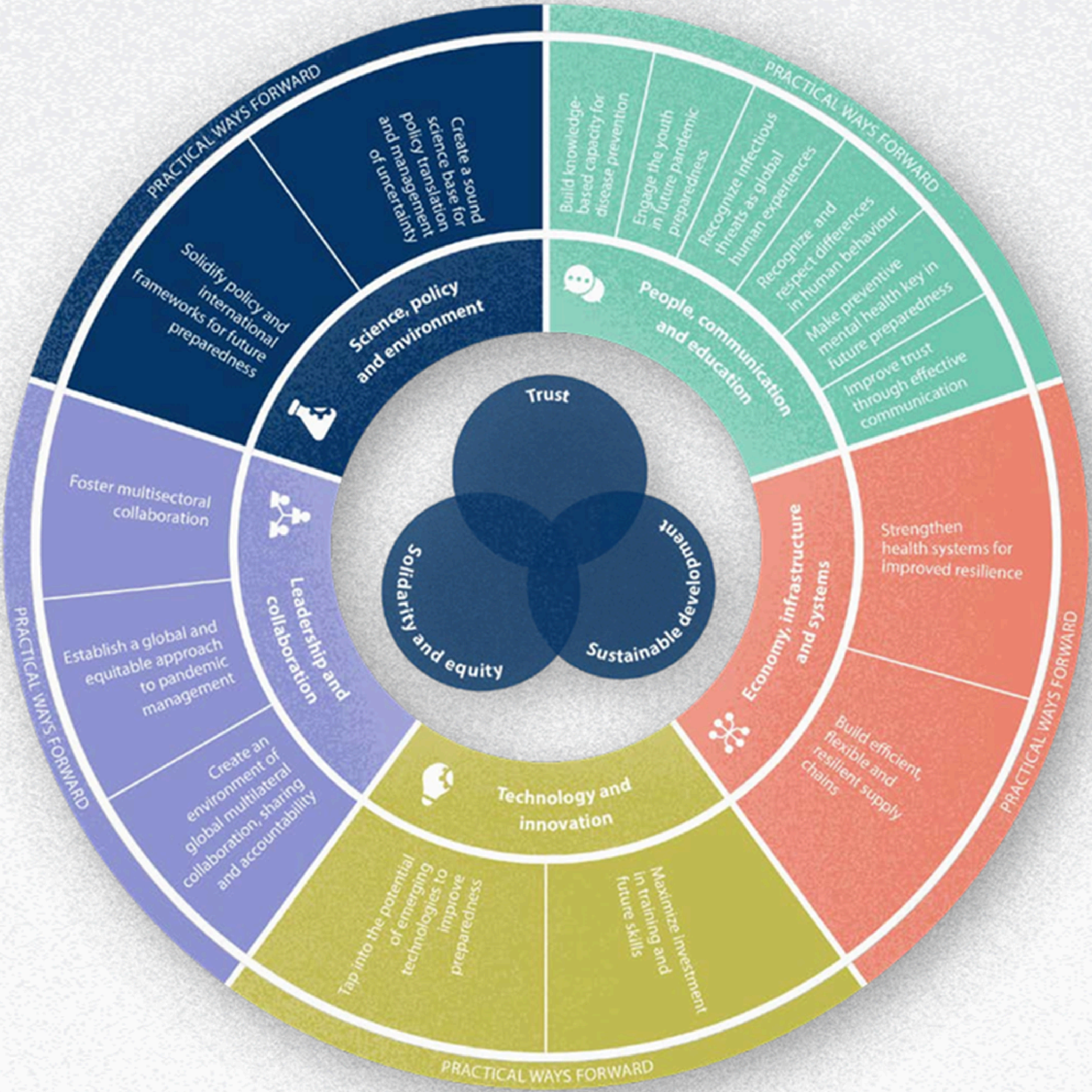


Bioremediation, The Remedy for Waste Dissaster

Bioremediation techniques can be classified as (i) in situ techniques, which treat polluted sites directly, vs (ii) ex situ techniques which are applied to excavated materials.[8] In both these approaches, additional nutrients, vitamins, minerals, and pH buffers are added to enhance the growth and metabolism of the microorganisms. In some cases, specialized microbial cultures are added (biostimulation). Some examples of bioremediation related technologies are phytoremediation, bioventing, bioattenuation, biosparging, composting (biopiles and windrows), and landfarming. Other remediation techniques include thermal desorption, vitrification, air stripping, bioleaching, rhizofiltration, and soil washing. Biological treatment, bioremediation, is a similar approach used to treat wastes including wastewater, industrial waste and solid waste. The end goal of bioremediation is to remove harmful compounds to improve soil and water quality.[9]

Some bacteria think plastic is fantastic

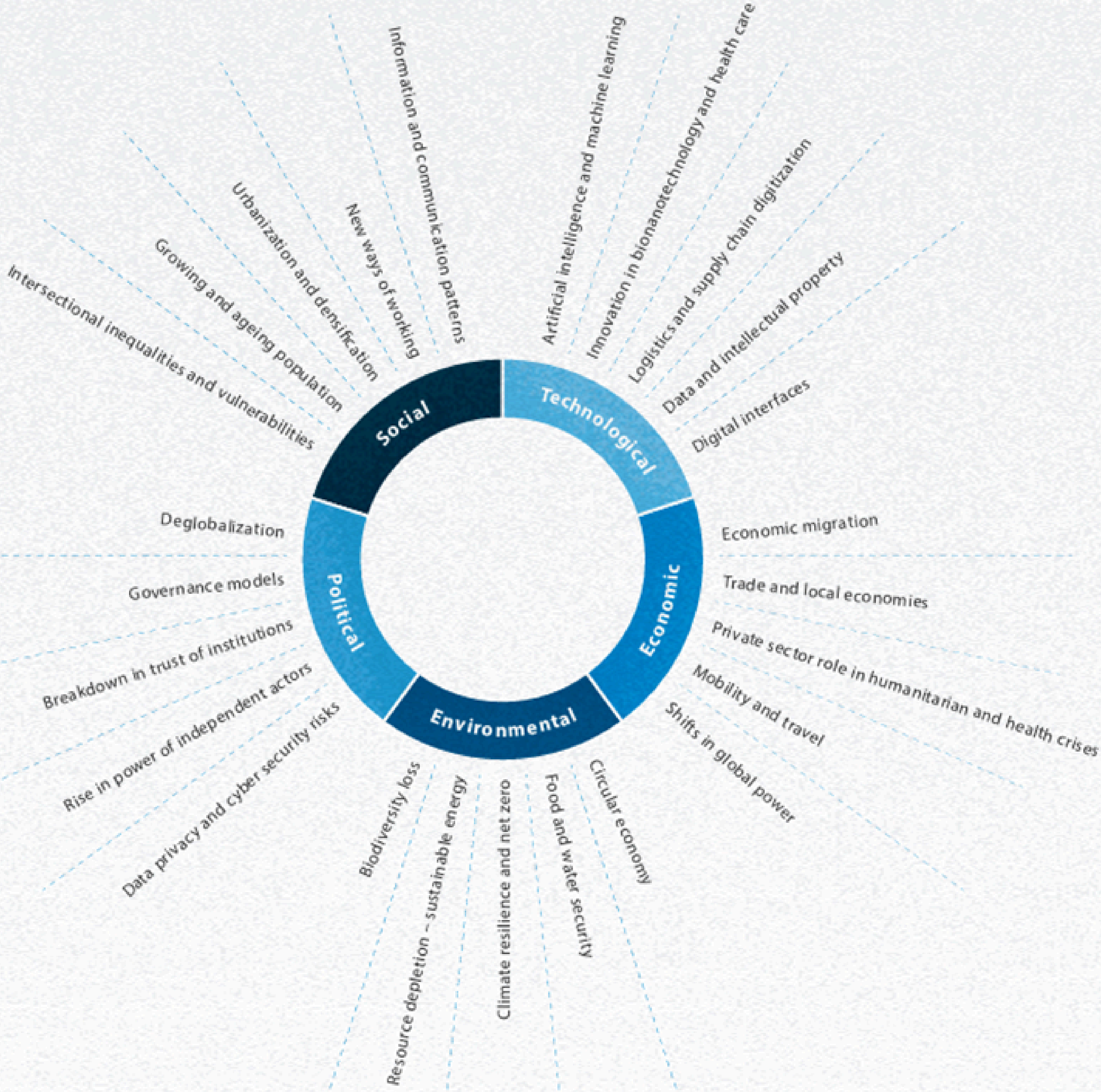
Bacteria isolated from outside a bottle-recycling facility can break down and metabolize plastic. The proliferation of plastics in consumer products, from bottles to clothing, has resulted in the release of countless tons of plastics into the environment. Yoshida et al. show how the biodegradation of plastics by specialized bacteria could be a viable bioremediation strategy (see the Perspective by Bornscheuer). The new species, Ideonella sakaiensis, breaks down the plastic by using two enzymes to hydrolyze PET and a primary reaction intermediate, eventually yielding basic building blocks for growth. Bioremediation broadly refers to any process wherein a biological system (typically bacteria, microalgae, fungi in mycoremediation, and plants in phytoremediation), living or dead, is employed for removing environmental pollutants from air, water, soil, fuel gasses, industrial effluents etc., in natural or artificial settings.



Guiding Principles for Future Pandemic Preparedness

The 2019 Covid pandemic has taken so many life. The velocity of spreading disease, with tthe unseen symptom, was very dangerous for people who has prior chronic ailment organ conditions, especially in the lungs and heart. The Sytokin storm that then build up in the body of the person with this condition, being more acute and threaten one's life.

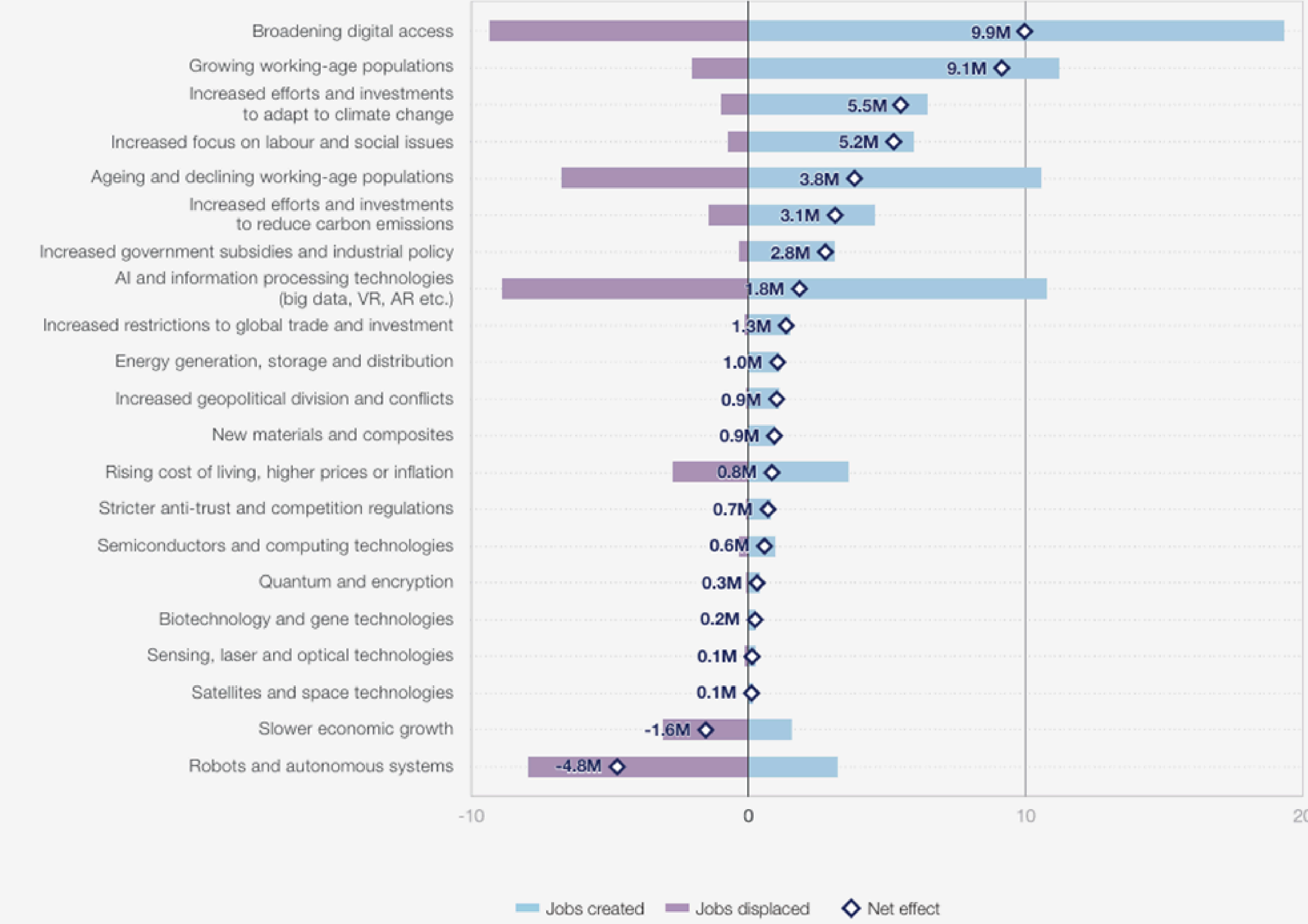
The Sytokin storms is the condition when the medicine that being given was not working as should be, and it was then atttacking the human immunology systems, making the conditions of one's illness more severe because the drugs that being given are making the cytokine, a part of our immune system that suppose to heal us, was then attacking our leukocyte blood platelete. The immune system then being the one that attacking our own organs. The destructive effects was happen in one's various organ that has prior severe ailments conditions, and death then happened in just few days.



Guiding Principles for Future Preparedness

International Policy of many nations currently are facing multidimensional threats. Various pathways of international policy are starting to show direct inclinations from prior polarized regional cooperations, into more independent averse-awareness each country has to has more balance formulation onto taking forward politics, economy, and technologies which have more future-readiness onward, in facing fast changing towards any global policies.

One of the steps that being taken by many countries is doing Deglobalization. Means that it one or more countries depolarized from prior international treaties, and creating policy for nations internal focusing. In various aspects or politic and economy such as supply chain, using own currencies, and many more international policies done by several countries, in the focus of creating internal economy dynamics. Its also can be happen for international policy reasons, such as respect towards violation against human rights, equality of humanism, and as ways for negating several international of regional political views.



Source

World Economic Forum, Future of Jobs Survey 2024;

EXPECTED IMPACT OF MACROTRENDS AND TECHNOLOGY TRENDS ON JOBS, 2025-2030

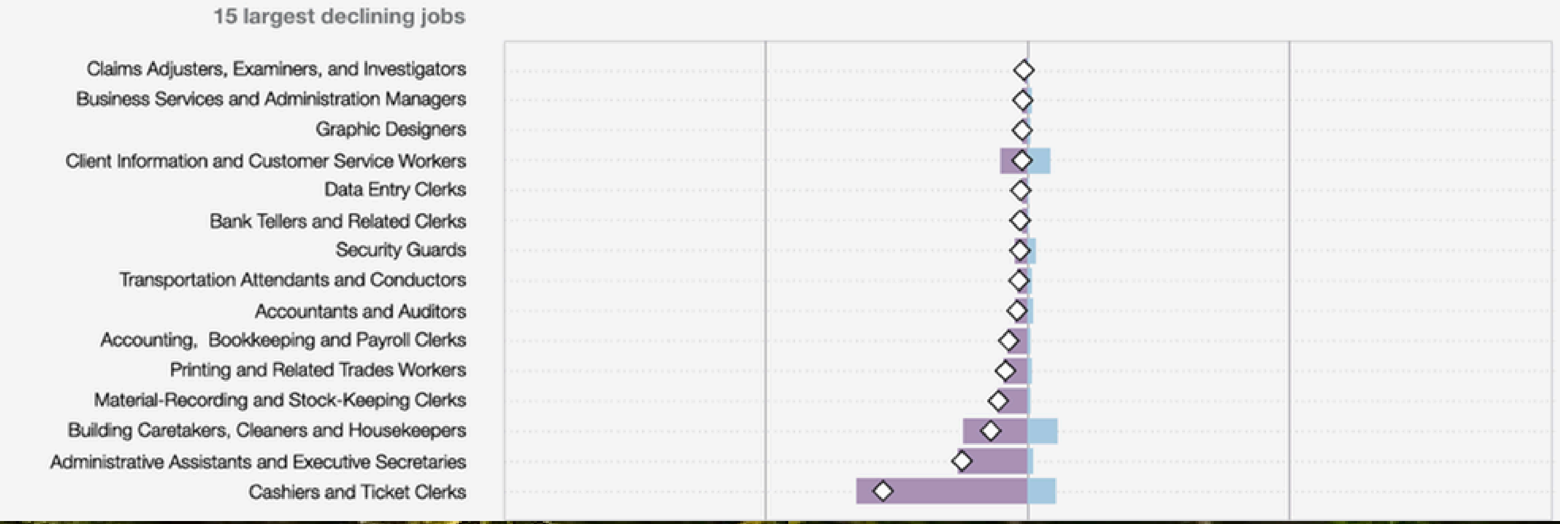
With AI as disruptor, many jobs at information processing can be reduced. Instead of avoiding the current trends, lets try to ride the wave. People with bachelor from Information technology can now focus on jobs to broadening digital access, big data structurizing, virtual reality devices development, and augmented reality holographical images, all on the pursuit of excellence in many crucial fields such as Medicine and Technology Device Development for Health, Manufacturing, and Distribution Fields.

As the world has now facing AI dan robotic development with positive manners, we can now innovate more on the development of Robotics devices in the field of biologi, medicine, health and even for military, arts, and even innovation in creating new forms of vehicle development and new forms of aeronautics sensors and earth monitoring, and aerospace spatial imaging. Anything and in any place where are risky and dangerous, we can give the task to Frontier AI Robotics.

Our current workforce also has higher respect for the geriatric people and promoting them to continue their works on various fields. Especially to the Gen X and the Baby Boomers, that are still having higher motivation on works, more prone to office dramas, not having toxic behavior, and avoiding office politics.

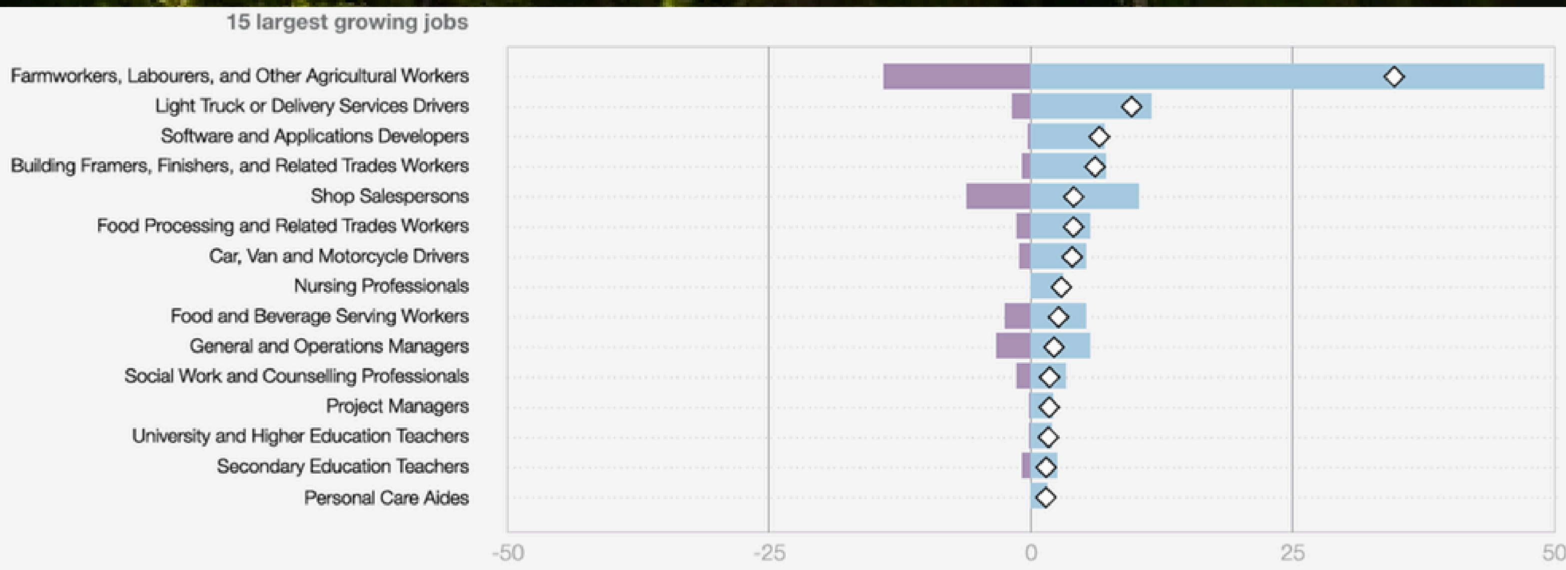
The pension age are now various. Many of people who wants to build business take early pension, while they who have vivid dreams are now re-entering various fields of works.

Expected impact of macrotrends and technology trends on jobs, 2025-2030



In this economy many jobs of ticket clerks has now replaced with barcodes, also the same with building caretakers that now are replaced by using application in hour smartphones. Material recording and stock keeping are also has been replaced by distribution robotics with path nodes.

Even for the role of investigator and examiner now can be replaced by AI at data information processing. Several sector of business and administration managers, and graphic designer has also less required now. Transportation attendants, bank tellers, cooks, chefs, data entry clerks, customer service workers, accountants and auditors, has and will be largely replaced by AI and robotics developments.

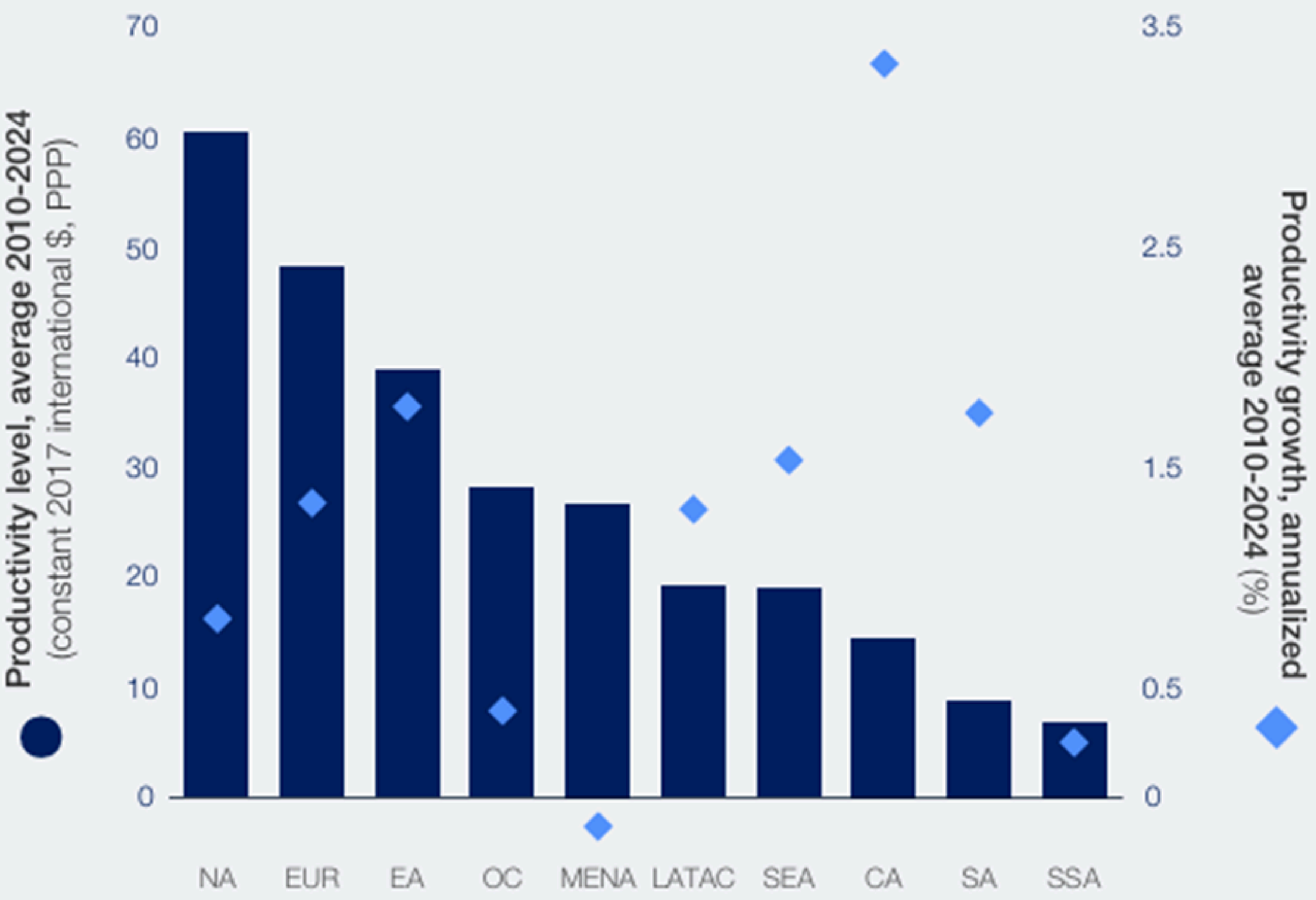


At the higher and middle income country, jobs in the field of agriculture are the new focus for human capital development, as the sectors with abundance of demands. Also for the field of Delivery services, Food processing and Food trades. High Demand are also found at the field of building designers, building finishers and building trader workers.

With the rise of IT sectors, big data processing experts also in high demand, along with the rising demand for full-stack developers, software developers, and software project managers. To handle the work stress, demand for social workers and counseling professionals, education teachers, psychologists, psychiatrists, nursing professionals, we still need human workers.

We are also still have to count on to human as general director and operations managers, food and beverage serving workers, teachers, university lecturer, because there always the need to discuss and analyse every aspects and every corners, with humanistic communications.

Figure 2.1 Labour productivity 2010-2024 (level and growth), by region



Note: NA = Northern America, EUR = Europe, EA = Eastern Asia, OC = Oceania, MENA = Middle East and Northern Africa, LATAC = Latin America and the Caribbean, SEA = South-eastern Asia, CA = Central Asia, SA = Southern Asia, SSA = Sub-Saharan Africa.

Source: World Economic Forum and Accenture based on International Labour Organization (ILO) modelled estimates, output per hour worked (GDP, constant 2017 international $, purchasing power parity).

Global Workforce Productivity 2010-2024

The visual between productivity from purchasing power parity in the north america are the highest among other regions including europe. while for he productivity growth are surpassed by the Central Asia with scores above 60. Followed by the productivity growth annualized since 2010-2024, for Eastern Asia and Southern Asia. The score of growth also above 300% developmen, seen in the number at the right blue diamond shapes.