APSLD NEWSLETTER

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Association of Plastic Surgeons of Lebanese Descent

A Lebanese-American Pioneer in Regenerative Medicine

Dr. Atala is a pediatric urologist, researcher, professor, and mentor who is renowned for developing foundational principles for regenerative medicine research, which holds great promise for people who require tissue substitution and reconstruction. Dr. Atala and his team successfully implanted the world's first laboratory-grown bladder in 1999.

Dr. Anthony ATALA

LEBANESE CONTRIBUSTION TO REGENERATIVE MEDICINE

New body parts – the shape of things to come?

Dr. ANTHONY ATALA leads an interdisciplinary team that has developed 15 clinically used tissue applications and is working on more than 40 tissues and organs

Dr. Atala was born in Lima, Peru, and moved to the United States with his family when he was a young boy. He earned a Bachelor of Arts degree from the University of Miami before attending medical school at the University of Louisville, where he also completed his surgical residency training. Near the end of his residency, he applied for a pediatric urology fellowship at Boston Children's Hospital, which was transitioning from a one-year to a two-year program to include a year of research prior to the clinical year. He embarked on a fellowship there in its new form with encouragement from Alan B. Retik, MD, FACS, founder of Boston Children's first department of urology. Dr. Atala arrived in Boston and began attending seminars, which led him to explore whether uroepithelial cells could be grown and expanded ex vivo, comparable to skin. This additional year of research sparked what has become his career of transformational research, discovery, and innovation with his work focused on growing human cells, tissues, and organs.

Dr. Atala spent the first portion of his academic career at Harvard Medical School before being recruited in 2004 as professor and chair of the department of urology at Wake Forest School of Medicine. After moving his laboratory from Boston, he became the founding Director of the Wake Forest Institute for Regenerative Medicine, where his research and work has produced extraordinary results for nearly two decades.

Dr. Atala is a pediatric urologist, researcher, professor, and mentor who is renowned for developing foundational principles for regenerative medicine research, which holds great promise for people who require tissue substitution and reconstruction. Dr. Atala and his team successfully implanted the world's first laboratory-grown bladder in 1999.

Dr. Atala's remarkable work has expanded, and today, WFIRM is a leader in translating scientific discovery into regenerative medicine clinical therapies. He currently leads an interdisciplinary team of more than 450 researchers and physicians. Beyond many other world firsts, WFIRM has also developed 15 clinically used technology-based applications, including muscle, urethra, cartilage, reproductive tissues, and skin. Currently, the Institute is working on more than 40 tissues and organs.

Through Dr. Atala's vision, ingenuity, and leadership, the WFIRM team has developed specialized 3- D printers to engineer tissues. This work is accomplished by using cells to create various tissues and organs, including miniature organs called organoids to create body-on-a-chip systems. Dr. Atala and his team also discovered a stem cell population derived from both the amniotic fluid and the placenta, which are currently being used for clinically relevant research applications.

Dr. Atala's theory is that every cell within the human body should be capable of regeneration. What reproduces naturally inside the body should also have the same capabilities of reproduction outside of the body. According to Dr. Atala, "the key benefit to the approach of cell and tissue regeneration is that a patient will not reject their own cells or tissue, which is always a

Dr. Atala is currently the George Link, Jr. Professor and Director of the Wake Forest Institute for Regenerative Medicine (WFIRM) and the W. H. Boyce Professor and Chair of Urology at the Wake Forest University School of Medicine.

concern related to traditional organ match transplantation."

Honors and Awards

Dr. Atala's innovative work has been recognized as one of *Time* magazine's Top 10 Medical Breakthroughs in 2007, *Smithsonian*'s 2010 Top Science Story of the Year, and *U.S. News & World Report*'s honor as one of 14 top Pioneers of Medical Progress in the 21st Century. He has been named by *Scientific American* as one of the world's most influential people in biotechnology, by *Life Sciences Intellectual Property Review* as one of 50 Key Influencers in the Life Sciences Intellectual Property arena, and by *Nature Biotechnology* as one of the top 10 Translational Researchers in the World.

Dr. Atala was elected to the Institute of Medicine of the National Academies of Sciences (now the National Academy of Medicine) in 2011 and inducted into the American Institute for Medical and Biological Engineering. In 2014, he was inducted into the National Academy of Inventors as a Charter Fellow and has been a strong and thoughtful contributor to the ACS Surgical Forum and Surgical Research Committee. He presented the prestigious Martin Memorial Named Lecture during the ACS Clinical Congress in 2010 entitled, *Regenerative Medicine: New Approaches to Health Care*.

Other honors include being the recipient of the U.S. Congress-funded Christopher Columbus Foundation Award, which is bestowed on a living American that currently is working on a discovery that will significantly affect society; the World Technology Award in Health and Medicine for achieving significant and lasting progress; the Edison Science/Medical Award; and the Smithsonian Ingenuity Award.

A Leader in Regenerative Medicine

Throughout his distinguished career, Dr. Atala has led or served on several national professional and government committees, including the National Institutes of Health Working Group on Cells and Developmental Biology, the National Institutes of Health Bioengineering Consortium, and the National Cancer Institute's Advisory Board. He is a founder of the Tissue Engineering Society, the Regenerative Medicine Society, the Regenerative Medicine Foundation, the Alliance for Regenerative Medicine, the Regenerative Medicine Development Organization, the Regenerative Medicine Manufacturing Society, and the Regenerative Medicine Manufacturing Consortium.

A Prolific Author and Inventor

Dr. Atala is the editor in chief of *Stem Cells-Translational Medicine* and *BioPrinting*. He is an author or coauthor of more than 800 journal articles and has applied for or received over 250 national and international patents.

In 2022, he was presented with the 2022 Jacobson Innovation Award of the American College of Surgeons (ACS). The international surgical award from the ACS honors living surgeons who are innovators of a new development or technique in any field of surgery

BLADDER GROWN FROM 3D BIOPRINTED TISSUE CONTINUES TO FUNCTION AFTER 14 YEARS

BRIAN LORD - 2018-09-12 1:41 PM 0

After more than a decade, a 3D bioprinted bladder, created by Dr. Anthony Atala at Boston Children's Hospital, is sustaining the live of a patient. The 3D bioprinted organ was made to replace patient Luke Massella's defective bladder in 2004. Since then, Massella has not required any further surgery.

Recalling the transplant to BBC News, Massella stated "It was pretty much like getting a bladder transplant, but from my own cells, so you don't have to deal with rejection. […] I was able to live a normal life after"

Massella was born with spina bifida, which left a gap in his spine, and led him to undergo several surgeries at a young age. Unfortunately, a defective bladder caused his kidneys to fail, leaving him the possibility of being on dialysis for the remainder of his life. Thankfully, Dr. Atala came up with an alternative solution.

The bladder was made using a sample of Massella' bladder tissue, and modified inkjet printer, presumably used to build a sort of scaffold/host for the cells. Incubated in lab condition, the new bladder was grown in 2 months, and then successfully transplanted into the patient.

Massella is 1 of 10 people with a bioprinted bladder grown from his own cells. According to Dr. Atala, flat structures like skin are easiest to print, whereas tubular structures like blood vessels and hollow non-tubular organs like bladders are more complex. Solid organs like hearts, lungs, and kidneys, are the most difficult to bioprint as they have more cells per centimeter, though some researchers have had small successes in this field.

Editor of the Month

Anthony Atala, MD

WHAT IS YOUR ACADEMIC BACKGROUND/ RESEARCH TRAINING?

I attended medical school and completed my residency at the University of Louisville, and had superb mentors, including Drs Hiram Polk, Moe Amin, Arnold Belker, and Jim Harty. I trained in pediatric urology at Boston Children's Hospital and Harvard Medical School with Drs Alan Retik and Hardy Hendren, where I stayed as faculty for 12 years. In 2004 I moved to Wake Forest University in North Carolina to serve as the W. Boyce Professor and Chair of the Department of Urology, and as the G. Link Professor and Director of WFIRM (Wake Forest Institute for Regenerative Medicine), which we established by moving our laboratory and team. Over time, both efforts grew from 6 to 30 physicians in urology and from 20 to over 500 faculty and staff currently at WFIRM. This growth led to new opportunities in clinical care, research, and education, and to more exposure and experience in publishing.

WHAT WAS YOUR PATHWAY TO SERVING AS AN EDITORIAL LEADER FOR PEER-REVIEWED JOURNALS?

I first became involved with peer review through publishing our own work and then being a reviewer. Unexpectedly, the peer review process taught me how to be a better author. Over time I was asked to serve on numerous editorial boards and became editor in chief of 3 journals. My first role in *The Journal of Urology®* was as a member of the editorial board of Investigative Urology, and 3 years later I was appointed its section editor. I thereafter served as an editorial board member for Urological Survey and now serve as the section editor. The Survey has typically been one of the most read sections of The Journal, mainly due to the superb editorial board members' efforts to survey articles and then summarize the most important urology literature worldwide that can be shared with the readership.

IN YOUR OPINION, WHAT MAKES RESEARCH NOVEL?

Novel research starts with a good hypothesis, but the hypothesis must also be meaningful to the field and its future advances. An effective launch pad to achieve novel research involves several factors, such as investing the time needed to know the established fund of knowledge well, to understand the current gaps and challenges, and to determine the potential ways to achieve meaningful outcomes.

WHAT ARE YOUR TIPS FOR AUTHORS HOPING TO GET THEIR RESEARCH PUBLISHED FOR THE FIRST TIME?

After following the principles delineated above, it is important to compose a manuscript that has a good narrative by clearly explaining the purpose of study, citing prior relevant work, presenting the results precisely, and interpreting the significance accurately. Having the manuscript reviewed by several mentors before submission is also helpful.

WHAT SUBJECT MATTER OR RESEARCH QUESTION SHOULD BE STUDIED MORE THOROUGHLY?

We need to keep advancing our field in all areas, so all topics should be considered. It really depends on what interests the investigator the most in terms of inquiry—that is when research truly becomes a passion rather than just a job.

Anthony Atala[1,2]
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APSLD participation at the 9th Ziyalan International Medicine of Anti-Aging and Aesthetic Congress. July 17-19, 2026, Shenzhen, China

At the 3rd Anti-Aging Medical Aesthetic Book "Oscar" Awards Ceremony, held during the 9th Ziyalan International Medicine of Anti-Aging and Aesthetic Congress. July 17-19, 2026, Shenzhen, China, ASPSLD president was awarded the Best Contribution Award for Original Work in Medical Aesthetic Publications in recognition for exceptional contribution in the development of the Aesthetic Medicine Industry.


第三届全球抗衰老医美图书"奥斯卡"

The 3rd Global Anti-Aging Medical Aesthetics Book "Oscar" Awards Ceremony

兹授予 黎巴嫩裔整形外科医师协会会长(APSLD) Prof. Dr. Bechara Atieh 医美图书

最佳著作贡献奖

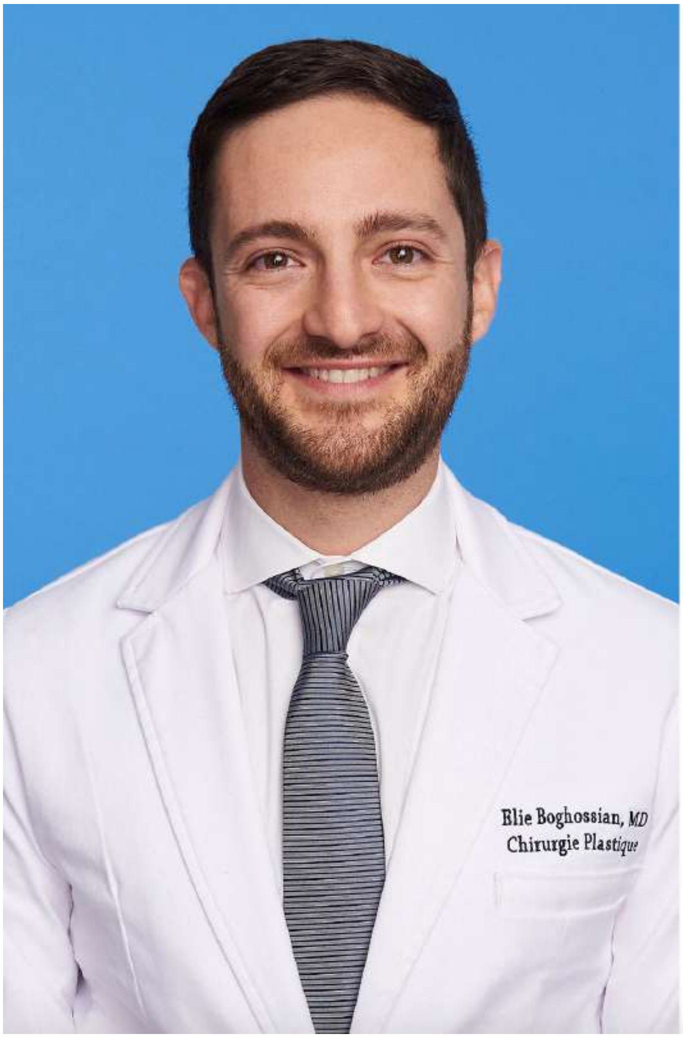
以感谢其对医美行业发展做出的卓越贡献，特发此证，以资鼓励。

This certificate is presented to
Prof. Dr. Bechara Atieh, President of the Association of Plastic Surgeons of Lebanese Descent
for the Best Contribution Award for Original Work
in Medical Aesthetic Publications, in recognition of their exceptional contributions to the development of the Medical Aesthetics Industry.

紫亚兰国际抗衰老医美大会组委会

Welcoming
APSLD Member from CANADA

Dr Elie BOGHOSSIAN



"La vision de notre programme est de former des résidents avec un niveau d'expertise exceptionnel, un sens du leadership développé, une éthique de travail et un professionnalisme exemplaire, et tout simplement de bons médecins. Nous souhaitons qu'ils deviennent chacun dans leur milieu respectif des leaders du futur et des défenseurs de leurs patients."

Elie Boghossian
MD, MSc, FRCSC
Directeur de programme

Département de chirurgie –
Chirurgie plastique
Faculté de médecine
Université de Montréal

Dr. Elie Boghossian is a plastic surgeon of Lebanese and Armenian origin, born in Beirut and based in Montreal, Canada, since 2000. He completed medical school and Plastic Surgery residency at Université de Montréal, followed by a Hand Surgery fellowship at Royal North Shore Hospital in Sydney, Australia, in 2018.

Since 2019, he practices as a hand surgeon and microsurgeon at Maisonneuve-Rosemont Academic Hospital in Montreal, combining clinical care with academic responsibilities. He currently serves as Assistant Professor and Plastic Surgery Residency Program Director at Université de Montréal since 2022. He also acts as Hand Surgery Fellowship Director at his institution. His clinical and research interests include wrist surgery and arthroscopy, nerve transfers and reconstruction for spinal cord injury, sarcoma and skin cancer reconstruction, and perforator flaps.

Emerging 3D bioprinting applications in plastic surgery

Biomaterials Research
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Biomaterials Research

REVIEW Open Access

Emerging 3D bioprinting applications in plastic surgery

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Abstract

Plastic surgery is a discipline that uses surgical methods or tissue transplantation to repair, reconstruct and beautify the defects and deformities of human tissues and organs. Three-dimensional (3D) bioprinting has gained widespread attention because it enables fine customization of the implants in the patient's surgical area preoperatively while avoiding some of the adverse reactions and complications of traditional surgical approaches. In this paper, we review the recent research advances in the application of 3D bioprinting in plastic surgery. We first introduce the printing process and basic principles of 3D bioprinting technology, revealing the advantages and disadvantages of different bioprinting technologies. Then, we describe the currently available bioprinting materials, and dissect the rationale for special dynamic 3D bioprinting (4D bioprinting) that is achieved by varying the combination strategy of bioprinting materials. Later, we focus on the viable clinical applications and effects of 3D bioprinting in plastic surgery. Finally, we summarize and discuss the challenges and prospects for the application of 3D bioprinting in plastic surgery. We believe that this review can contribute to further development of 3D bioprinting in plastic surgery and provide lessons for related research.

Keywords: Plastic surgery, Biomaterials, 3D bioprinting, Tissue engineering, Tissue regeneration

3D BIOPRINTING: TRANSFORMING MEDICAL IMAGES INTO HUMAN TISSUE

https://newsnetwork.mayoclinic.org/discussion/3d-bioprinting-transforming-medical-images-into-human-tissue/

3D bioprinters are just like the 3D printers that print small plastic toys or parts. Instead of using hard plastics or metals to construct a part or prototype, 3D bioprinters use biocompatible materials containing living cells to print three dimensional structures of tissue that could be used to improve human health. Bioprinters are tools to accelerate research in the field of tissue engineering.

3D bioprinting holds intrigue among researchers for its potential to study disease progression and screen new treatments for conditions such as end-stage organ failure, cartilage defects and atopic dermatitis, a skin disease also known as eczema. Researchers are working to establish standard operating procedures for biomanufacturing tissue for testing in early-stage clinical trials. This pioneering work is aimed at integrating tissue engineering into clinically relevant therapies that could be studied in clinical trials.

Bioprinting with Living Cells

The 3D bioprinter utilizes a digital blueprint of a design from medical imaging, such as MRI or CT scans, and then gets to work. This powerful, high-tech tool precisely places bioinks composed of living cells, hydrogels, biomaterials and growth factors in a layer-by- layer fashion. The final 3D tissue model it produces can mimic the structure, mechanics and physiology of human organs, muscle or cartilage.

A bioink composed of gelatin-like materials can be formulated and can be printed into into a desired shape. In addition, living cells can be encapsulated into that gelatin-like bioink. This type of tissue engineering is an emerging technology in regenerative medicine that has the potential to transform laboratory research and clinical practice by bioengineering replacements for damaged or diseased tissue.

The complex tissue structures that come from the 3D bioprinter have allowed researchers to study ways to bioprint human organs. Mayo Clinic has developed the capability of bioprinting skin to mimic inflammatory skin disease. This first-in-kind human bioprinted skin model with functional epidermis and dermis accurately recreates patient-specific disease. It is being studied to test treatments and understand disease progression for conditions such as atopic dermatitis (eczema).

Besides its use for disease models, this emerging technology is being explored for manufacturing human tissue and organs. The ultimate goal is to someday be able to print organs and tissue on demand.

Bioprinting Implants

In Arizona, the research team of David Lott, M.D., is developing 3D bioprinted implants for the larynx or trachea. The implants could be used to replace damaged or diseased portions of the organ while maintaining the healthy tissue.

The 3D bioprinter has the ability to construct complex tissue which has both stiff cartilage and soft tissue regions. This enables to print vocal folds and the surrounding cartilage within the larynx.

Challenges to Bioprinting

While 3D Bioprinting holds a high potential, research institutions still have challenges to overcome. In order for a bioprinted organ to function, it must have a connection to blood, oxygen and nutrients. Researchers have struggled to grow a network of capillaries and blood vessels in the bioprinted structures at scale that would deliver those vital elements. Another challenge is how to integrate the bioprinted tissues with the human body while preventing rejection of the implant.

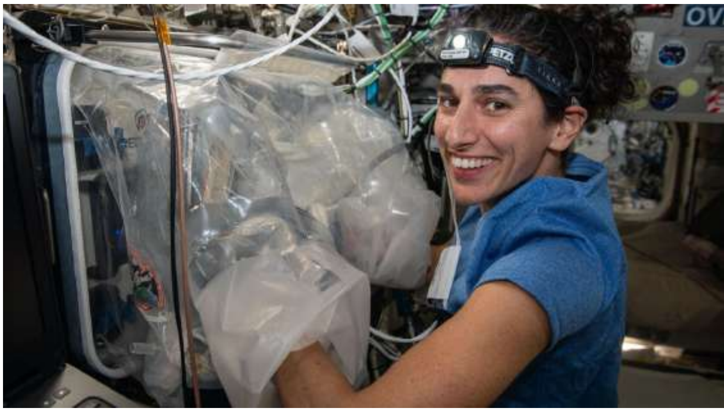
3D bioprinting has the potential to transform healthcare, but more years of research are needed to fully understand and apply this technology.

3D Bioprinting: Science in Space

https://www.nasa.gov/missions/station/iss-research/3d-bioprinting/

The process of 3D printing (also known as additive manufacturing) enables the design and production of one-of-a-kind items made of plastic, metal, and other materials, including tools, equipment, and even buildings. Biological printing or bioprinting uses living cells, proteins, and nutrients as raw materials and has the potential to produce human tissues for treating injury and disease and to create entire organs for transplants.

In Earth's gravity, bioprinting requires a scaffold or other type of structure to support tissues, but in the near-weightlessness of the space station's orbit, tissues grow in three dimensions without such support. Redwire Corporation developed the BioFabrication Facility (BFF) as a part of the larger goal of using microgravity to bioprint human organs. Popular Science magazine recently awarded the BFF a 2023 Best of What's New Award in the Health Category. These awards, handed out since 1988, recognize "groundbreaking innovations changing our world," according to Popular Science, and "radical ideas that are improving our everyday lives and our futures."



NASA astronaut Jasmin Moghbeli swaps components inside the BioFabrication Facility (BFF)

A current investigation, BFF-Cardiac, uses the BFF to evaluate the printing and processing of cardiac tissue samples. Cardiovascular disease is the number one cause of death in the United States. Adult heart tissue is unable to regenerate, so damaged heart tissue is mostly replaced with scar tissue, which can block electrical signals and prevent proper cardiac contractions. This investigation could support the development of patches to replace damaged tissue –and eventually the creation of replacement hearts. The work represents a big step toward addressing the significant gap between the number of transplant organs needed and available donors.

The first human knee meniscus successfully 3D bioprinted in orbit using the BioFabrication Facility

The BFF-Meniscus investigation and the follow-up BFF-Meniscus-2 investigation resulted in the first successful bioprinting of a human knee meniscus in orbit using the space station's BioFabrication Facility, announced in September 2023. Musculoskeletal injuries, including tears in the meniscus, are one of the most common injuries for the U.S. military and this milestone is a step toward developing improved treatments on the ground and for crew members who experience musculoskeletal injuries on future space missions. After initial printing and a period of growth in microgravity, the tissues returned to Earth for additional analysis and testing.

The Russian state space agency ROSCOSMOS launched equipment in 2018, 3D MBP, that included a magnetic printer called Organ.Aut. A series of experiments from 2018 through 2020 showed that this approach could create tissue constructs, helping to pave the way for additional research on producing artificial organs.

Bioprinting technology also could create artificial retinas to help restore sight for the 30 million people worldwide who suffer from degenerative retinal diseases. One way to manufacture artificial retinas is a technique that alternates layers of a light-activated protein and a binder on a film. On Earth, gravity affects the quality of these films, but researchers suspected that films created in microgravity would be more stable and have higher optical clarity. Protein-Based Artificial Retina Manufacturing is one of several investigations by LambdaVision Inc. in partnership with developer Space Tango Inc. to develop and validate space-based manufacturing methods for artificial retinas. The company has consistently manufactured multiple 200-layer artificial retina films in microgravity and now is working to commercialize its hardware and strategies for development of other therapies and drugs.

The Protein-Based Artificial Retina Manufacturing experiment hardware on the space station

Bioprint FirstAid, a study from ESA (European Space Agency) and the German Space Agency (DLR), demonstrated the function of a prototype for a portable handheld bioprinter that creates a patch from a patient's own skin cells. Space causes changes in the wound healing process, and such customized bandages could accelerate healing on future missions to the Moon and Mars. Using cultured cells from the patient reduces the risk of rejection by the immune system, and the device offers greater flexibility to address wound size and position. Because the device is small and portable, health care workers could take it almost anywhere on Earth. The investigation showed that the device works as intended in microgravity, and researchers are studying the space-printed patches and comparing them with samples printed on the ground before taking the next step.

Bioprinting in microgravity also could make it possible to produce food and medicine on demand on future space missions. Such capabilities would reduce the mass and cost of materials needed at launch and help maintain the health and safety of crew members throughout a mission.

The 3D Printing In Zero-G investigation, which started in 2014, demonstrated that the process of 3D printing with inorganic materials such as plastic worked normally in microgravity. 3D printing could reduce the need to pack costly spare parts on future long-term missions and help solve the problem of trying to predict every tool or object that might be needed on a mission. With the addition of bioprinting capabilities, crews eventually may be able to 3D print almost anything they need –from a replacement screwdriver to a replacement knee.

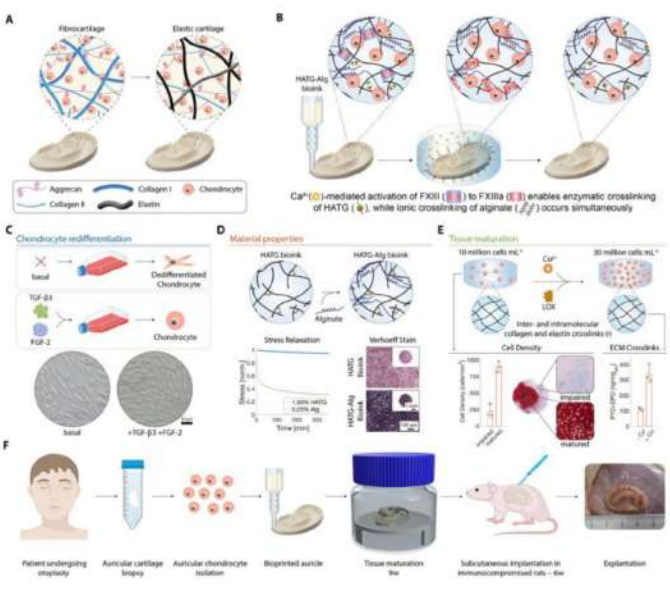
Sample patches printed using simulant inks and the hand-held tool for Bioprint FirstAid

ETH Zurich lab produces 3D printed ear cartilage with properties close to natural tissue

Joseph Caron-Dawe • February 27, 2026
https://www.voxelmatters.com/eth-zurich-lab-produces-3d-printed-ear-cartilage-with-properties-close-to-natural-tissue/

A team made up of researchers from ETH Zurich, the Friedrich Miescher Institute in Basel, and the Cantonal Hospital of Lucerne has produced elastic ear cartilage from human cells in a laboratory setting, which achieved mechanical properties comparable to natural tissue.

The engineered cartilage retained its shape and elasticity after six weeks in a rat model. The development marks a significant step forward in the search for a viable alternative to current reconstruction methods, with patients who've lost ears or have been born with congenital conditions such as microtia potential beneficiaries of such advances.



Engineered, lab-grown cartilage retains shape and elasticity in animal models for six weeks

Currently, the standard treatment for ear reconstruction relies on rib cartilage harvested from the patient, a procedure that is painful and can cause scarring and deformation in the thoracic region. The reconstructed ear also tends to be stiffer than a natural ear.

The research team set out to engineer laboratory-grown tissue that replicates the mechanical properties of an ear's real structure, before any implantation takes place.

The team extracted cells from small cartilage remnants removed during corrective ear surgeries, and from a piece of tissue approximately 3mm in diameter, around 100,000 cells could initially be isolated. This is significantly fewer than the several hundred million required to print a full ear.

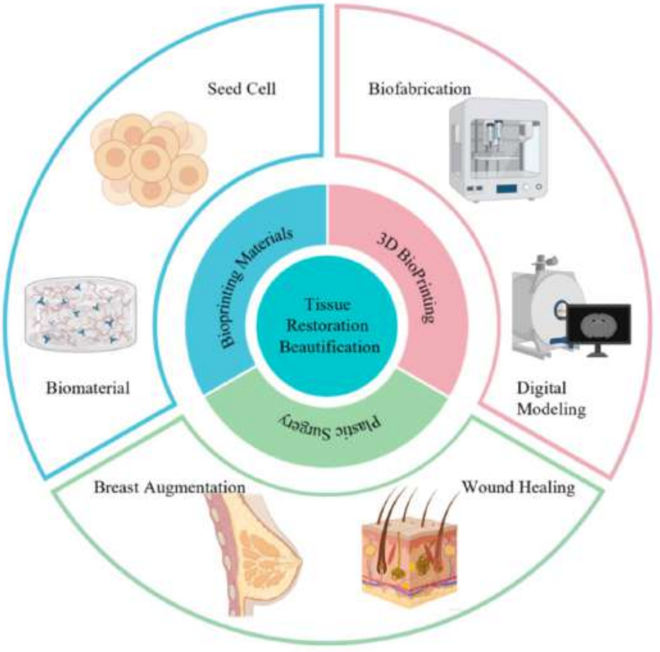
The cells were then expanded in a specialized nutrient solution before being embedded in a bioink and printed into ear structures using a 3D printer. The printed constructs then matured in an incubator for several weeks, receiving a continuous nutrient supply to promote the formation of type II collagen, elastin, and glycosaminoglycans. Despite this major success, elastin remained a challenge, as That clearly showed that it needed to stabilized further.

Elastic ear cartilage experiments take roughly three to four months to complete, and only a small number of research groups worldwide are working on the subject. The current study provides a good guide to the current state of research. It shows how close researchers already are to recreating the human ear — and what's still missing.

3D Bioprinting for Tissue Engineering in Plastic Surgery: Reshaping Beauty

Dr. Anjali, Dr. A.k. Tiwari
Written and Medically reviewed by February 12, 2024
https://www.icliniq.com/articles/skin-care/3d-bioprinting-for-tissue-engineering-in-plastic-surgery

The formation of modern technology has resulted in a dramatic development in plastic surgery in recent times. 3D bioprinting is one such ground-breaking innovation that has great potential for tissue engineering in plastic surgery. This new technique opens the door to precisely constructing three-dimensional structures out of biological components, allowing for personalized solutions in reconstructive surgeries.



What Are the Basics of 3D Bioprinting?

Redefining the fundamentals of reconstructive treatments, 3D bioprinting for tissue engineering in plastic surgery is based on a revolutionary method. This cutting-edge technique builds complex, living structures with unmatched accuracy by carefully depositing biomaterials layer by layer. By precisely arranging cells, growth hormones, and biomaterials to replicate the natural architecture of tissues, bioprinting provides a revolutionary solution to traditional plastic surgery techniques that rely on donor tissues or artificial implants. This accuracy represents a turning point in the development of plastic surgery by bringing an extent of personalization beyond what can be achieved with conventional methods. Through the use of the patient's own cells, 3D bioprinting reduces the possibility of rejection, improving biocompatibility and promoting better long-term outcomes. 3D bioprinting, which combines biology and technology, is an exceptional instance of the area's possibilities and marks a new age in plastic surgery where patient- specific, customized solutions will rule the forefront.

What Are the Biomaterials in 3D Bioprinting?

The foundation of 3D bioprinting is the role that various biomaterials play in rebuilding tissues. Hydrogels, which are composed of biocompatible polymers and water, act as a supporting matrix that is essential to promoting the growth and differentiation of cells. Bioinks, which are biomaterials combined with cells, enable the creation of printed living tissues. The choice of biomaterials is carefully considered, depending on the type of tissue that is being engineered and the desired end properties. Scientists investigate a wide range of biomaterial possibilities, examining those that provide elasticity, strength, and biocompatibility to meet the particular requirements of each tissue. This thorough examination illustrates the dynamic relationship between biomaterial science and the cutting-edge 3D bioprinting method, paving the way for customized and cutting-edge tissue engineering methods in the field of plastic surgery.

What Are the Applications of 3D Bioprinting in Plastic Surgery?

Skin Tissue Engineering: One of the main uses of 3D bioprinting in plastic surgery is in the field of skin tissue engineering, where bioprinted skin grafts provide a revolutionary substitute for conventional grafts, removing problems associated with donor site availability and lowering the likelihood of rejection. Researchers are investigating the use of patient-specific cells to create customized skin grafts that correspond to the individual's unique skin characteristics, improving wound healing and scar reduction outcomes.

Cartilage and Bone Reconstruction: The potential of 3D bioprinting in the reconstruction of cartilage and bone tissues is promising. Conventional approaches typically rely on synthetic implants or autologous grafts, which may face challenges related to their shape and size. Bioprinting offers the ability to produce intricate structures that closely resemble the natural architecture of bone and cartilage, fostering improved integration and functionality. This holds particular significance in facial reconstruction surgeries, where precise anatomical alignment is of utmost importance.

Breast Reconstruction: For individuals with breast cancer, breast reconstruction following a mastectomy is an essential component of plastic surgery. By implementing the patient's cells, 3D bioprinting provides a customized method that enables doctors to make breast implants. With a more natural appearance and better long-term results, this customized technique can improve the practical and aesthetic elements of breast reconstruction.

What Are the Advantages of 3D Bioprinting in Plastic Surgery?

Personalized Solutions: The capacity of 3D bioprinting to offer patients individualized treatments is one of its main benefits. Bioprinted tissues can closely mimic an individual's anatomy by employing the patient's cells, which lowers the risk of problems and improves overall results. This personalization is especially helpful in plastic surgery, where appearance and utility are crucial considerations.

Reduced Risk of Rejection: Conventional plastic surgery methods frequently incorporate foreign materials, such as synthetic implants, which can be susceptible to rejection by the body's immune system. In contrast, 3D bioprinting relies on the patient's own cells, reducing the likelihood of immune reactions. This not only improves the safety of the procedure but also fosters superior tissue integration and long-term success.

Precision and Complexity: 3D bioprinting's layer-by-layer method enables unmatched precision in the replication of intricate tissue structures. In plastic surgery, where details are critical to both functional and cosmetic results, this precision is essential. By creating tissues with complex vascular networks, surgeons can ensure sufficient blood flow and improve the healing process.

Limitless Design Possibilities: 3D bioprinting offers endless design possibilities and creates new opportunities for innovation, unlike traditional plastic surgery techniques that could be limited by availability of donor tissues or prefabricated implants. Whether implants for breast augmentation, face reconstruction, or other operations, surgeons can design personalized implants to meet unique demands.

What Are the Future Perspectives?

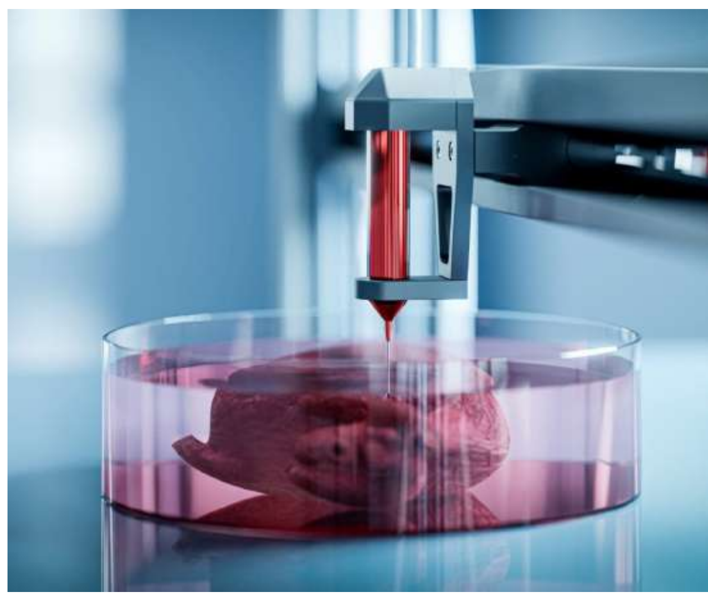
Integration of Bioprinting with Other Technologies: The integration of 3D bioprinting with other cutting-edge technologies holds the key to the future of plastic surgery. By merging bioprinting with advanced imaging methods like 3D scanning and virtual reality, surgical planning can be significantly refined for greater precision. Furthermore, the integration of bioinformatics and artificial intelligence has the potential to optimize the design of bio-printed tissues, considering factors such as genetic information, patient history, and desired outcomes.

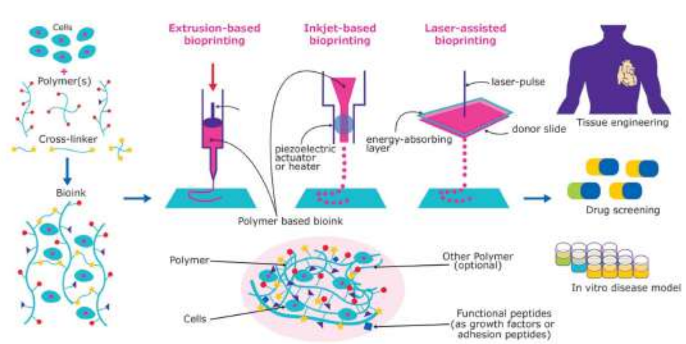
Expanded Range of Tissue Types: Advancements in 3D bioprinting research are anticipated to broaden the range of successfully engineered tissues, extending from nerves to intricate organs. The extensive potential applications in plastic surgery present novel opportunities for comprehensive reconstruction, providing patients with customized solutions that surpass the limitations of existing surgical techniques.

Patient-Specific Drug Testing: Bioprinted tissues can be helpful to platforms for customized medical care and drug testing. This could entail determining if cosmetics or medications are compatible with the tissues of certain patients in the context of plastic surgery. These kinds of applications benefit not just the specialty of plastic surgery but also the entire medical field.

Conclusion

3D bioprinting is leading the way in revolutionary developments in tissue engineering for plastic surgery, thereby bringing in a new era of customized and regenerative medicine. This cutting-edge technology has proven to have exceptional promise in precisely reconstructing intricate tissue structures, providing customized solutions for both reconstructive and cosmetic surgeries. 3D bioprinting not only solves the problems associated with tissue grafting and transplantation but also creates opportunities for the production of functioning and vascularized tissues by seamlessly integrating biomimetic materials and patient-specific data. As we learn more about bioprinting, it becomes clear that its use in plastic surgery has the potential to revolutionize current practices and usher in a day when the complexities of tissue regeneration are handled with never-before-seen precision and effectiveness.





3D Bioprinting and Stem Cells in Plastic Syrgery

Adapted from: Lars Kölby
https://www.gu.se/en/research/3d-bioprinting-and-stem-cells-in-plastic-surgery

Stem cells are found in every bodily organ, in several forms. Their function is to ensure that a certain type of tissue can be continuously replaced during our lives, and to assist healing of an injury to the tissue concerned.

The largest and most readily available source of stem cells is adipose (fatty) tissue, from which adipocyte stem cells are derived. These can be induced to form several di!erent tissue types, such as cartilage. In a plastic surgery clinic, there is an ample supply of adipose tissue, for example after liposuction, and adipose tissue is thus an easily accessible source from which stem cells can be extracted.

A basic feature of stem cells is that they can be stimulated to develop into several di!erent tissue types.

Stem cells can either themselves develop into a particular cell type or exert their e!ect by stimulating the growth of other, specific, cells for growth. This is a fundamental principle that helps to produce new tissue. It thereby becomes possible to obtain tissues, such as cartilage or skin, that are used in a plastic surgery clinic. The overall idea in this regard is to produce stem cells from the patient's own adipose tissue.

All regenerative medicine needs to have a source to obtain material from, and since the previous application we have acquired equipment and been able to successfully extract large quantities of patient-specific adipocyte stem cells. We have stimulated these stem cells to turn into cartilage. All in all, we thus have an almost inexhaustible source of patient-specific stem cells that can be used to create patient-specific tissues, and also to influence immune responses.

Background

One overall problem in all reconstructive plastic surgery is lack of tissue. Traditional techniques include such methods as removing cartilage from ribs, for example, to use in reconstructing ears, expanding skin mechanically, transplanting skin from one body area to another, and so on.

New technology means that cultured tissue may become an option for remedying the lack of suitable tissue.

Another development for creating tissue is 3D bioprinting, in which a 3D printer, loaded with bioinks and living cells, prints out the required tissue. Technological development has come a long way, with bioinks that have extremely specialized properties. The inks are shear-thinning, which means that they are relatively viscous in their resting state while becoming more fluid when they are subjected to pressure in the printer needle. The inks provide an environment in which cells thrive and grow. The components of the inks can be made resorbable or nonresorbable, depending on what the operator wants to achieve. The maximum resolution of the best printers is in the order of 10 micrometers — that is, in principle, the diameter of one cell.

Analogously to the fact that tissues are in short supply, the specific cells (such as cartilage cells) that are mixed in the ink are also scarce. The established method to remedy this is to mix specific cells with stem cells. The stem cells can either themselves develop into the desired cell type or stimulate growth of the specific cells that have been added.

For some years, a collaboration has been established between the University of Gothenburg Department of Plastic Surgery and Chalmers' BBV Laboratory. We have conducted a series of experiments in which we 3D-bioprinted cartilage and skin. Using stem cells in combination with cartilage cells, we showed that the stem cells boost cartilage cells' growth. In the past, we have had to rely on purchased, cultured stem cells from either bone marrow or fat. These commercial stem cells are not, of course, individual-specific; moreover, they are difficult to grow, availability can be a limiting factor, and the stem cells' quality is difficult to control. Now, with our own ability to extract stem cells from fat, we have paved the way for almost unlimited access to fat stem cells. The research group's overall goal is to create tissue that is specific to a given patient. Then, if the 3D-bioprinted tissue is of sufficiently high quality, we get no immunological rejection problems when the tissue is inserted in the patient.

3D-Bioprinted Cartilage

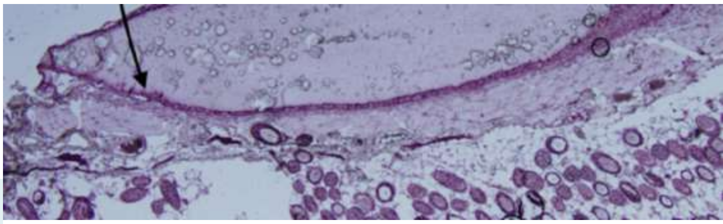
There are three kinds of cartilage in the body:
1- Hyaline cartilage, in weight-bearing joints, contains about 80% water, relatively few cartilage cells (chondrocytes), and thin Type II collagen fibrils.
2- Fibrous cartilage, in the intervertebral discs, contains thicker fibrils of Type II collagen.
3- Elastic cartilage, in the outer ears, contains a relatively high density of chondrocytes, and fibers of the protein elastin.

Cartilage lacks blood vessels and nerves, and has a very limited ability to heal. If cartilage is damaged, there is a loss of shape and function.

3D bioprinting of cartilage means that cartilage can be printed in the desired shape with high resolution. In the long run, the goal is to be able to print an outer ear that is covered with skin and can be transplanted. The idea is that the patient gains a very lifelike ear, built out of the patient's own cells, while the painful, protracted surgical process is avoided.

Skin that is transplanted onto a 3D-bioprinted piece of cartilage grows, adheres firmly, and heals edge to edge with the animal's own skin. The printed pieces thus have the potential to be included as the base for a more complex construction.

3D-Bioprinted skin



3D-bioprinted skin

The skin is our largest organ, and two of its most important functions are protecting the body from the surroundings and preventing fluid loss. An injury to the skin that does not heal fast enough can have major consequences for the patient and result in death. Every year, approximately 11 million people around the world su!er from burns severe enough to require hospitalization (according to WHO). The degree (depth) of

The single biggest limitation on the maximum size of constructs that should be printable is the burn plays a major part in the skin's capacity for healing. Burns of a higher degree result in nonfunctioning or nonexistent wound healing. In this case, the patient must rapidly get help to prevent fluid loss and infections that, at worst, may be fatal. Burns are treated by various means, including transplantation of the patient's own skin. When burns cover large parts of the body, the patient's own healthy skin cannot be used for treatment, and this is where new treatment methods are required to facilitate healing for the patient.

3D-bioprinting technology can be used to print "skin" from the patient's own cells, along with supporting material. These constructs are then transplanted onto the patient, whose body acts as the ultimate incubator for optimal cell growth and new skin formation. The innovative aspect of this idea

formation. The innovative aspect of this idea is the ability to design patient-specific grafts (3D-bioprinted constructs) in clinically approved materials without using large areas of the patient's own skin. This would mean less pain for the patient, since there would be no need to remove large pieces of skin but improved healing would nonetheless take place, in that the grafts resemble complete skin.

Blood vessels in 3D-bioprinted constructs

The single biggest limitation on the maximum size of constructs that should be printable is the transport of oxygen and nutrients to the cells in the printed tissue. Without blood vessels, the maximum thickness is about 0.5 mm — that is, twice the diffusion distance.

APSLD Committee for Residents and Trainees

Welcoming Dr. Bachar Chaya

The Association of Plastic Surgeons of Lebanese Descent (APSLD) is pleased to announce the appointment of Dr. Bachar Chaya, MD, as the new leader of the *APSLD Committee for Residents and Trainees (APSLD-CRT)*. Dr. Chaya is an integrated Plastic and Reconstructive Surgery resident at Vanderbilt University Medical Center and an alumnus of the American University of Beirut, where he was inducted into the Alpha Omega Alpha (AΩA) Honor Medical Society. He previously completed a three-year research fellowship at NYU Langone Health, where his work focused on vascularized composite allotransplantation, facial transplantation, craniofacial surgery and microsurgery. His academic work has resulted in an extensive record of peer-reviewed publications, book chapters, national and international presentations, with contributions spanning craniofacial, microsurgical, global health and aesthetic surgery. His journey from Lebanon to leading academic centers in the United States reflects a sustained commitment to academic excellence, innovation, and the advancement of plastic and reconstructive surgery, while embodying the international spirit of the Lebanese surgical community.

Dr. Chaya succeeds Dr. Rami S. Kantar, MD, MPH, PhD, who founded and led the APSLD-CRT and played a pivotal role in establishing it as a platform for connecting Lebanese surgeons-in-training around the world. Dr. Kantar is currently a faculty member at NYU Langone Health, where he has built a distinguished academic and clinical career spanning craniofacial surgery, microsurgery, facial transplantation, surgical education, and global surgery. A graduate of the American University of Beirut and an Alpha Omega Alpha (AΩA) inductee, Dr. Kantar has distinguished himself through a substantial record of peer-reviewed publications, research, clinical innovation, and academic presentations, alongside his contributions as a surgeon and educator. His work in complex craniofacial and reconstructive surgery, combined with his commitment to mentorship and global surgical collaboration, has earned him recognition within the field and made him an important advocate for the advancement of Lebanese surgeons in the international plastic surgery community. His leadership in establishing the APSLD-CRT has provided an enduring foundation for mentorship, collaboration, and professional development among the next generation of Lebanese plastic surgeons.

Building upon the strong foundation established by Dr. Kantar, Dr. Chaya looks forward to further developing the APSLD-CRT as a global network for residents, fellows, and medical students of Lebanese descent interested in plastic and reconstructive surgery. The committee will continue to foster mentorship, collaboration, academic exchange, and professional relationships among trainees while strengthening connections between the next generation of surgeons and established leaders in the field. At its core, the APSLD-CRT represents an opportunity to celebrate our shared Lebanese heritage, support one another across institutions and borders, and help cultivate the next generation of leaders in plastic surgery. This transition represents a continuation of the committee's mission and a new chapter in its commitment to advancing excellence within the Lebanese plastic surgery community.