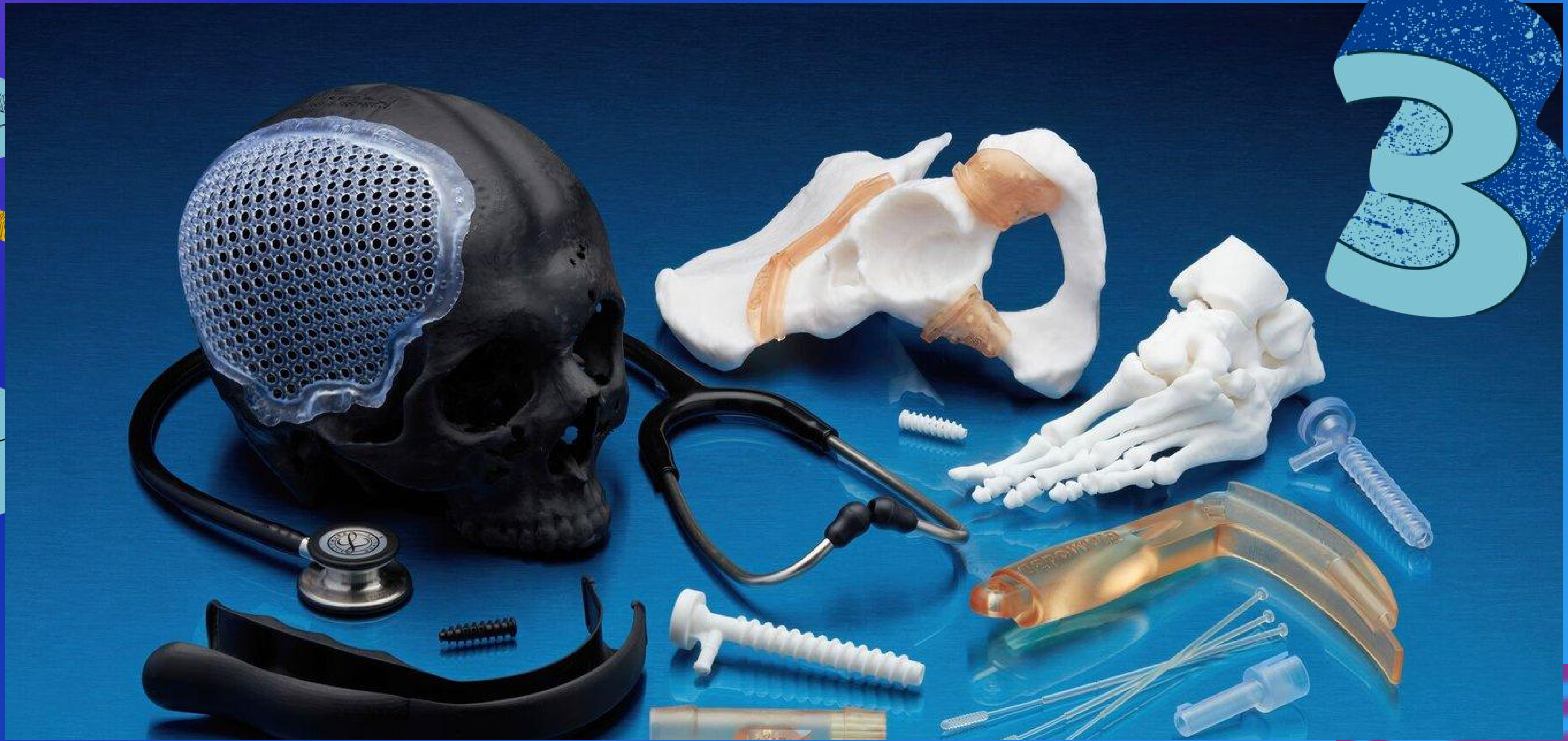
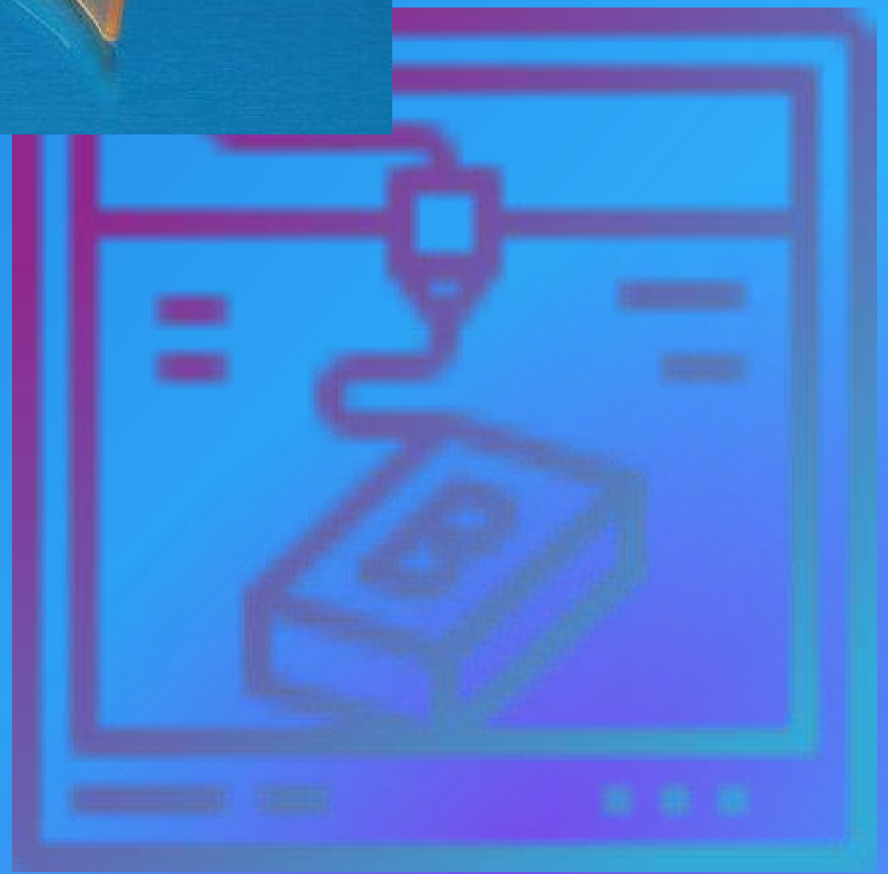


3D



3D Printing in Healthcare

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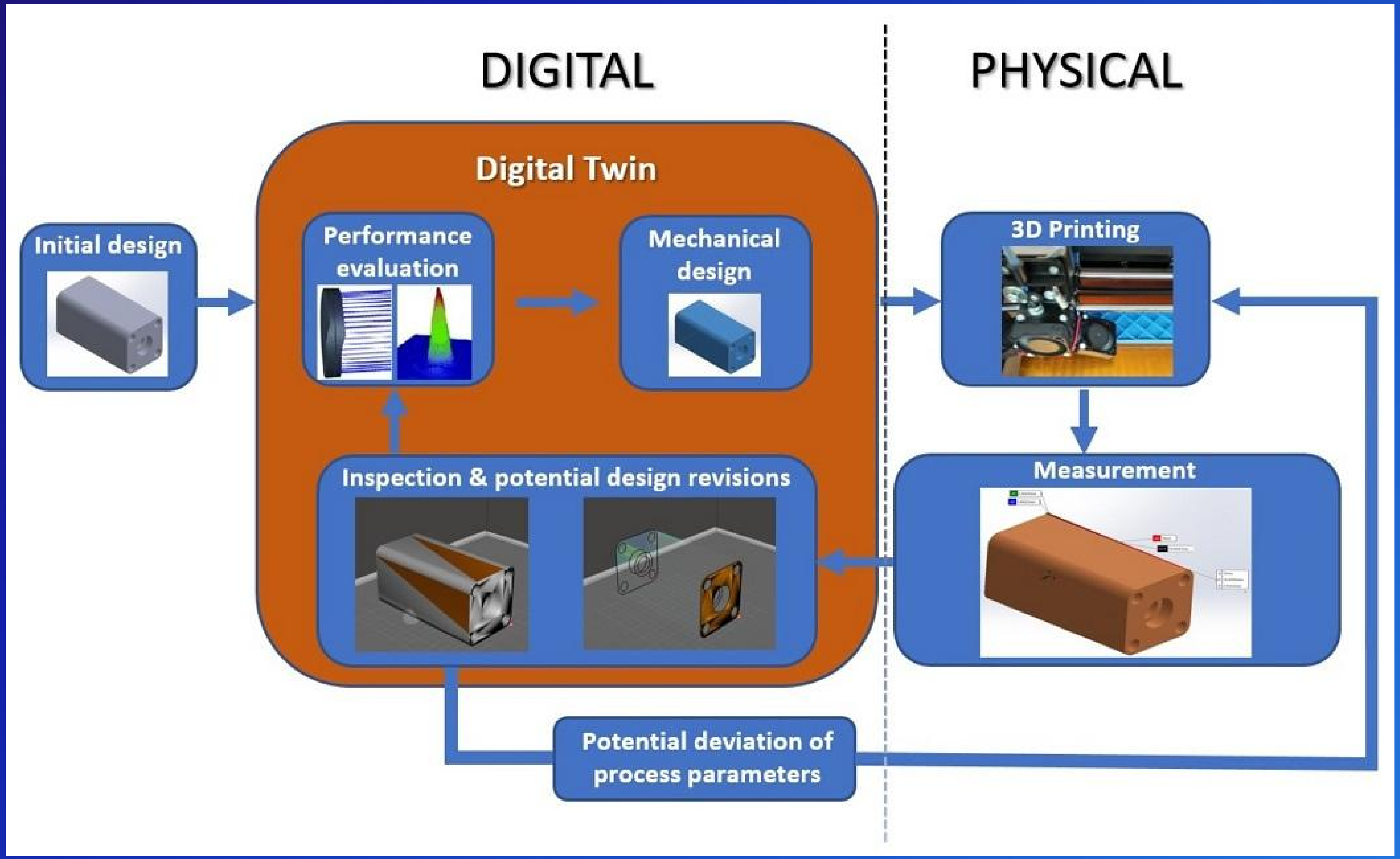
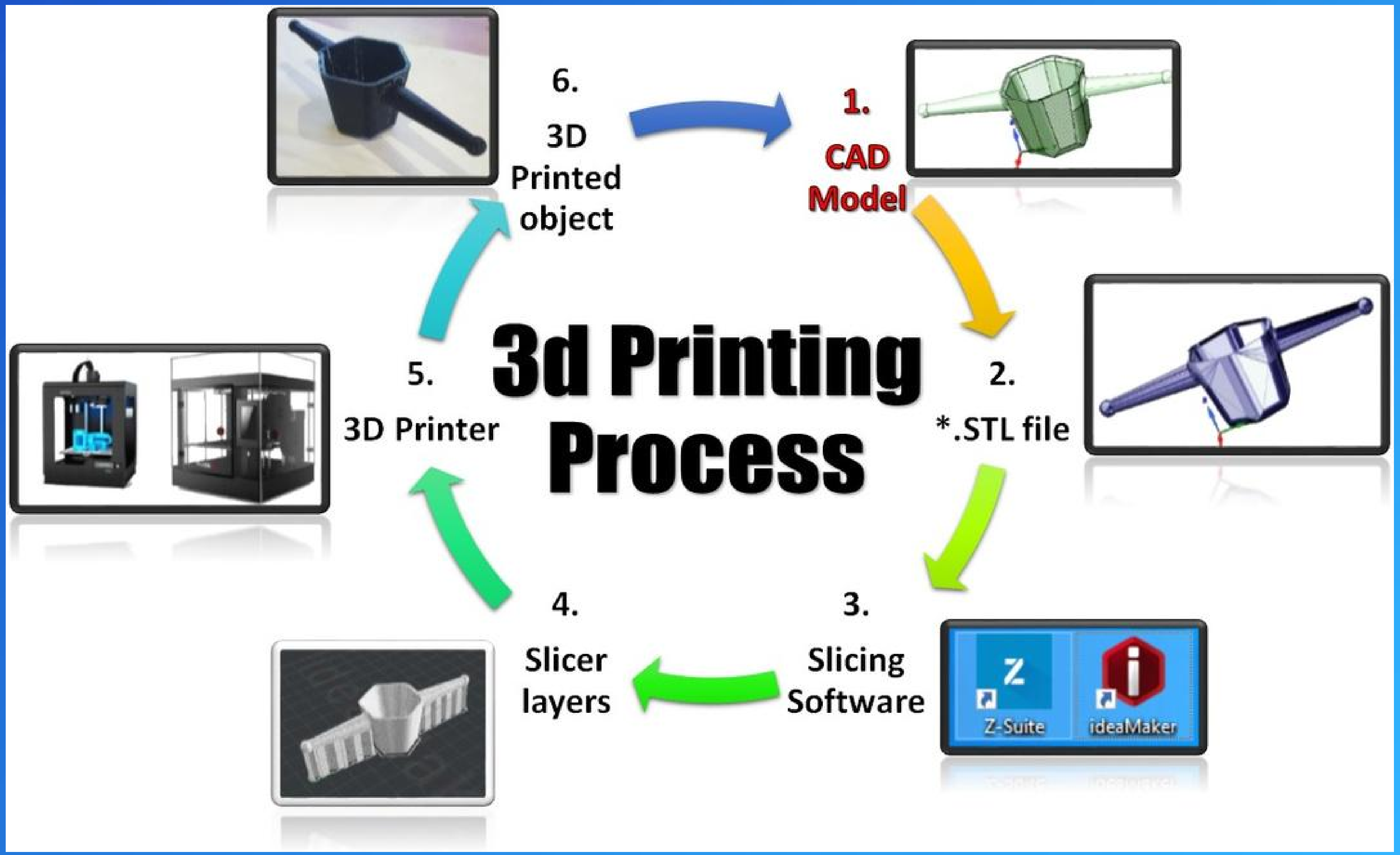
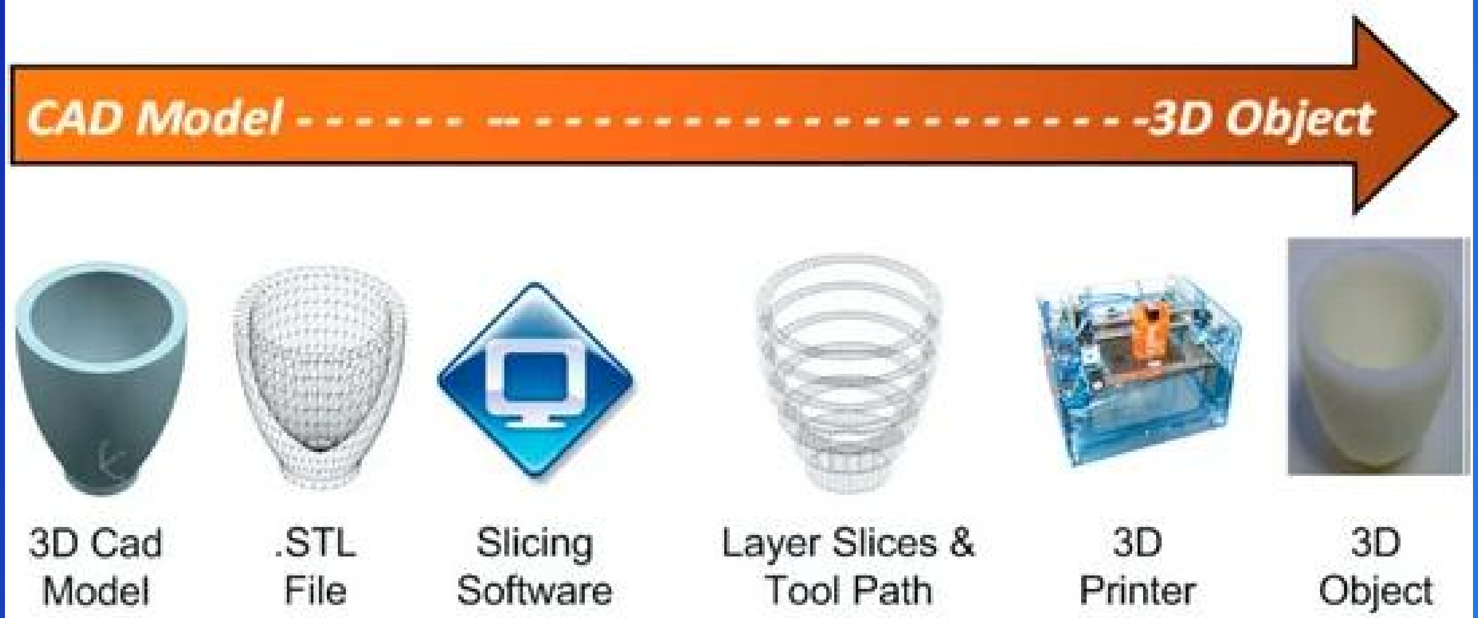
OUTLINES

i. Introduction of 3D Printing
ii. Types of 3D Printing Technologies
iii. Applications of 3D Printing in Healthcare:
iv. Challenges and Considerations
v. Future Trends and Innovations
vi. Case Studies
vii. AI in 3D Printing:
viii. Uses of 3D in Innovating medical device manufacturing in Developing countries

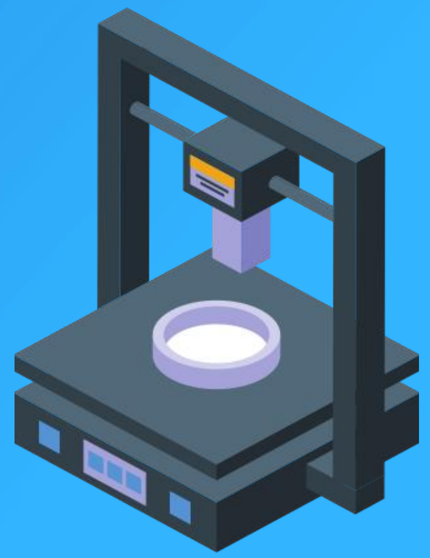
I. INTRODUCTION







It all starts with making a virtual design of the object you want to create. This virtual design is made in a CAD (Computer Aided Design) file using a 3D modeling program (for the creation of a totally new object) or with the use of a 3D scanner (to copy an existing object). A 3D scanner makes a 3D digital copy of an object. There are also lots of online file repositories where you can download existing 3D files that will help get you started.




SIX ADVANTAGES
TO ADDITIVE MANUFACTURING:
ACCELERATED
TIME-TO-MARKET
DISTRIBUTED
MANUFACTURING
SUPPLY CHAIN
CONSOLIDATION
DESIGN
FREEDOM
MASS
CUSTOMIZATION
LOW &
MID-VOLUME
PRODUCTION
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II. TYPES AND MATERIALS OF 3D PRINTING TECHNOLOGIES

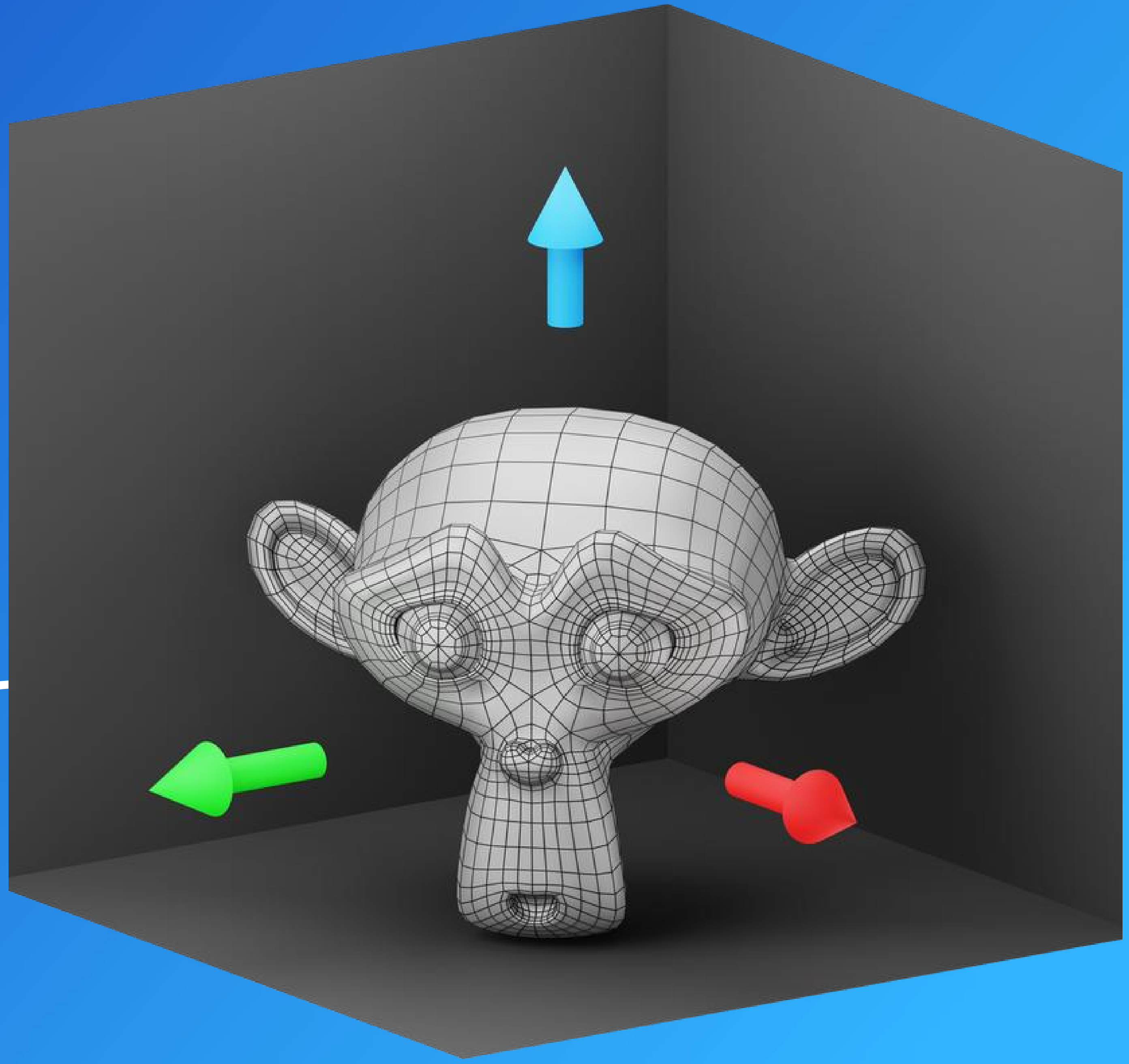
A. Stereolithography (SLA)

B. Fused Deposition Modeling (FDM)

C. Selective Laser Sintering (SL

D. PolyJet Printing

E. Bioprinting

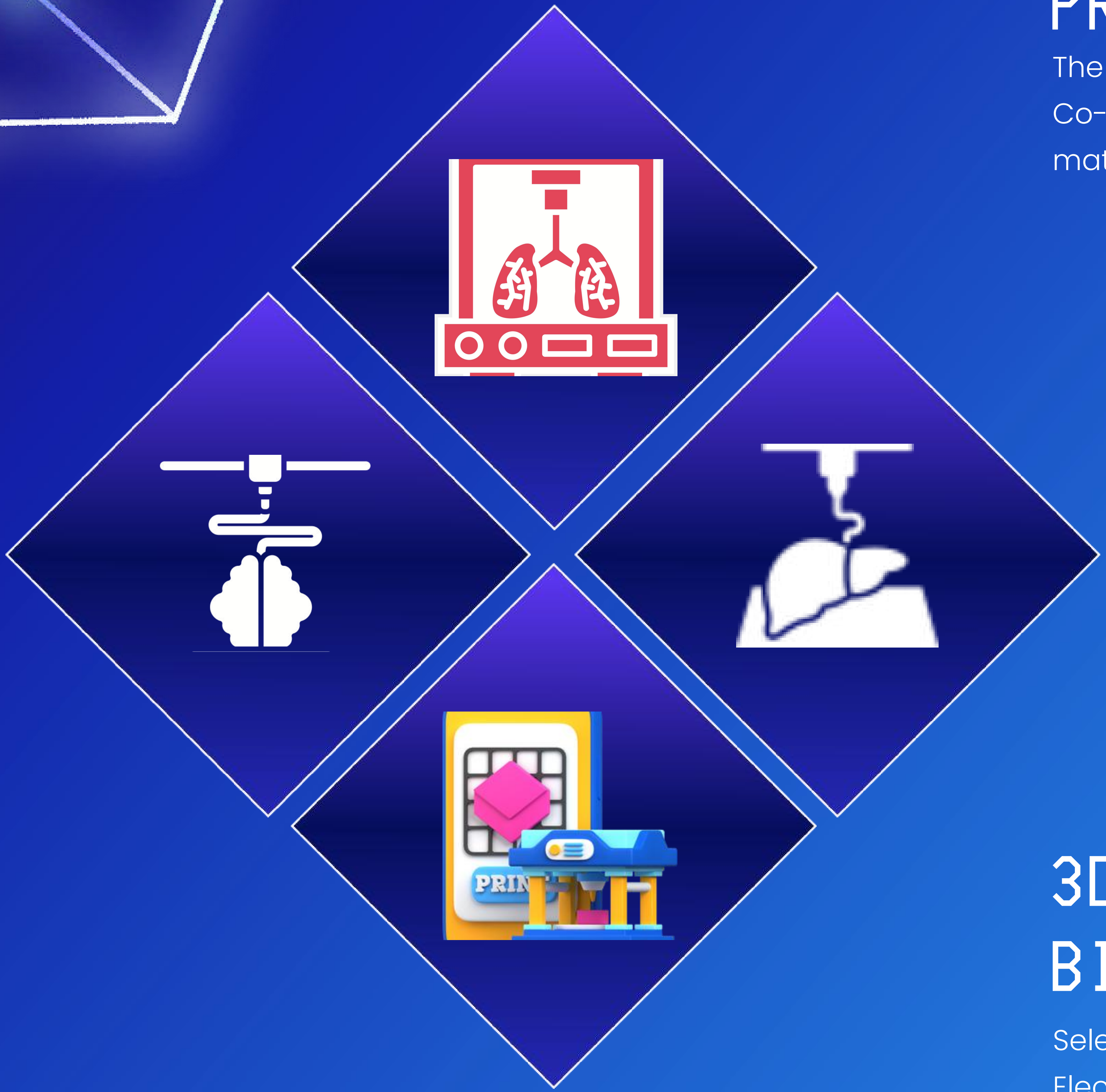


II. Types and Materials of 3D Printing Technologies

1. Types of Filaments

PLA is a thermoplastic. It is more brittle than ABS. However, PLA is easier and quicker to print with making it great for a hobbyist.

ABS is a thermoplastic. It is more pliable than PLA, but it is also more difficult to use. You would use ABS for things you need to be stronger and more heat resistant.



PRINTABLE BIOMEDICAL METALS

The metallic materials frequently utilized in biomedical applications, including titanium, titanium alloys, Co-Cr alloys, stainless steel (SS), tantalum, gold, magnesium, gallium alloys, and iron. Each of these materials can undergo processing through one or more additive manufacturing (AM) methods.

PROPERTIES OF BIODEGRADABLE METALS

These metals, primarily composed of magnesium, iron, and zinc alloys, are engineered to have controlled corrosion rates that match the healing process of the tissue. The degradation products are non-toxic and can be absorbed or excreted by the body.

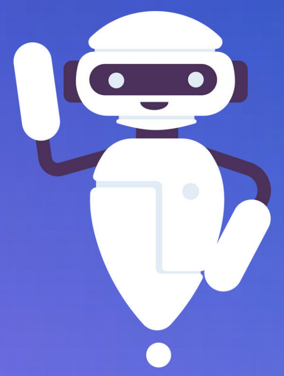
METALS 3D BIOPRINTING APPLICATIONS

These encompass a wide array of applications, spanning dental, maxillofacial, craniofacial, load-bearing, sternocostal, spine fusion implants, and cardiovascular stents.

3D PRINTING TECHNOLOGIES FOR BIODEGRADABLE METALS

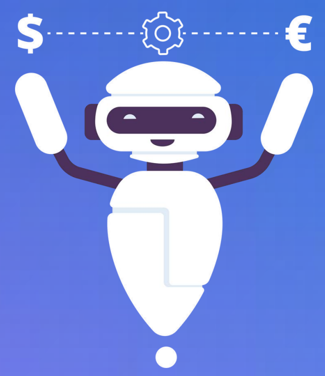
Selective Laser Melting (SLM)
Electron Beam Melting (EBM)
Electron Beam Melting (EBM)

TYPES OF 3D PRINTING TECHNOLOGIES



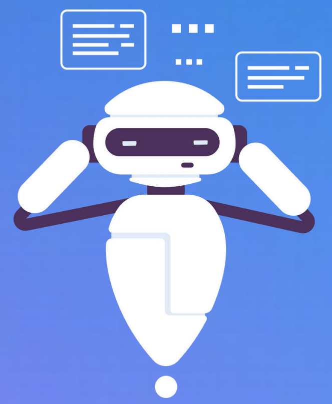
FDM/ FFF

The most prevalent and cost-effective 3D printing technology, suitable for fabricating functional parts and prototypes. This method utilizes strands of plastics as its primary material.



SLA

SLA technology relies on light-sensitive liquid resins that solidify under UV light exposure. SLA 3D printers feature a platform that moves after each layer solidifies, allowing the next layer to adhere. Unlike FFF printers, SLA-produced objects offer superior detail but require longer print times and have smaller print volumes.



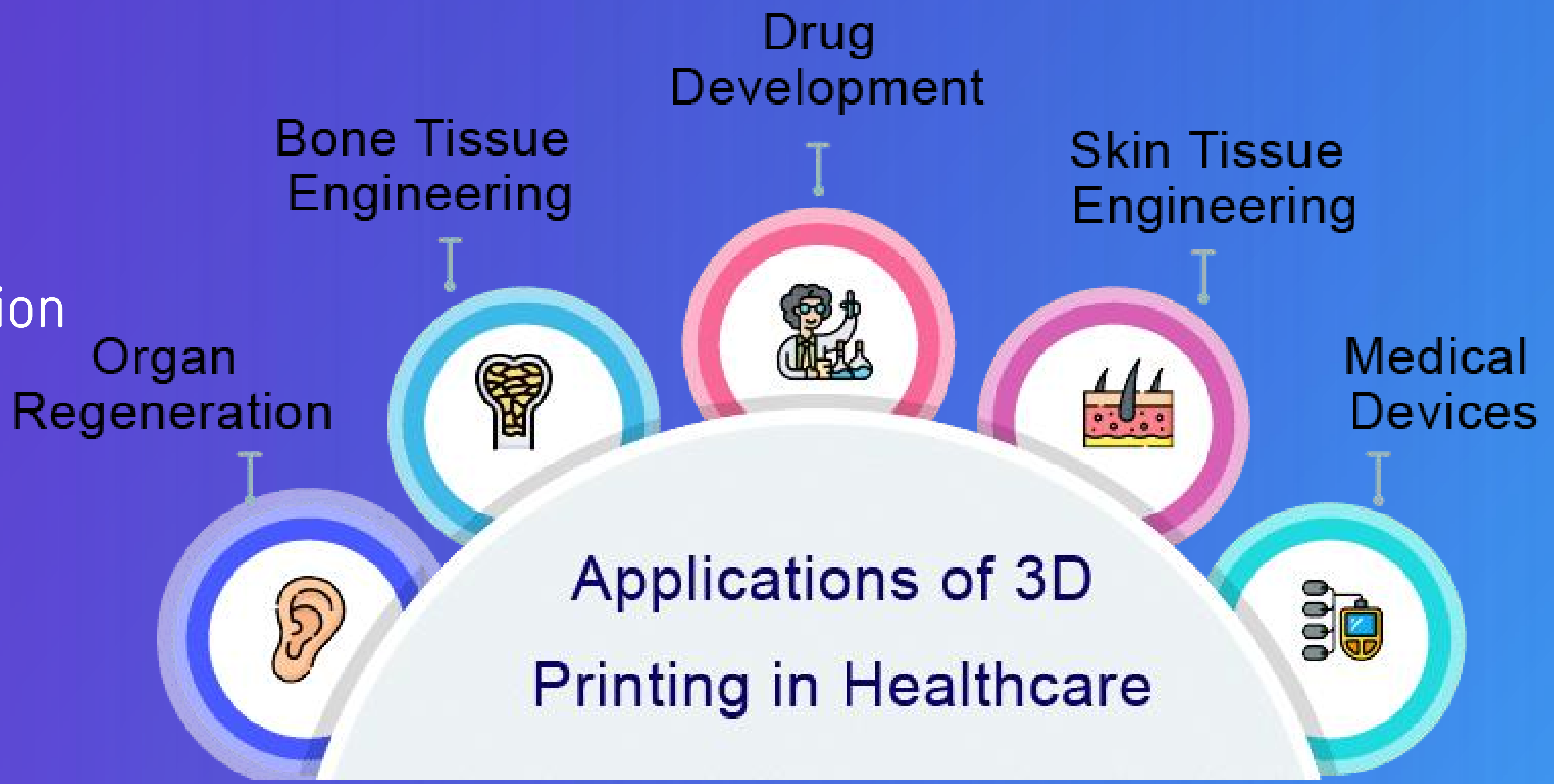
SLS/ DMLS

SLS and DMLS are alternative 3D printing technologies that employ a sintering process. In these methods, a thin layer of fine powder is spread across the platform by a cylinder with each new layer. A laser then sinters the powder to achieve the desired shape. Moreover, this technique produces layers that are almost indistinguishable.

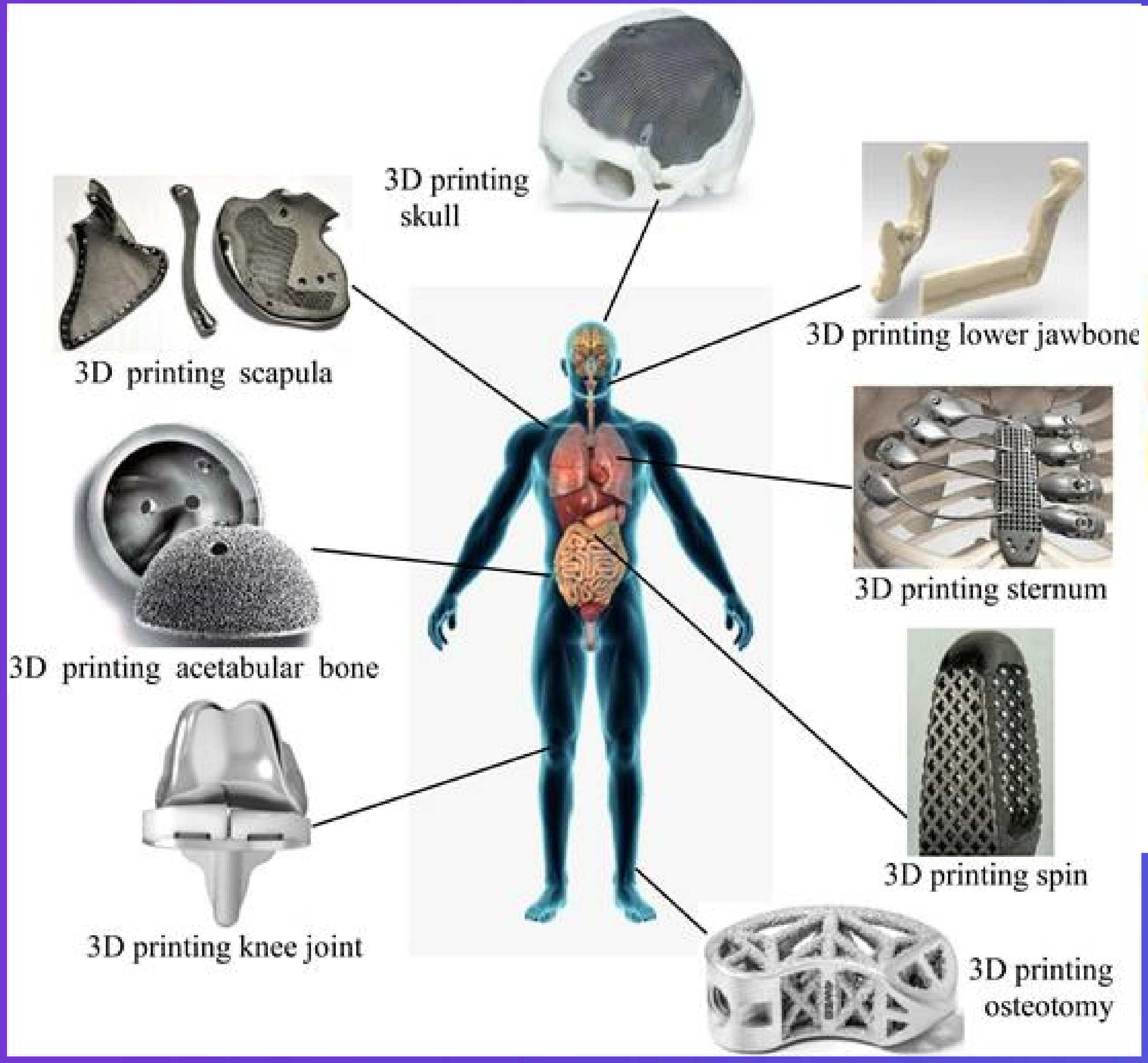
Applications in Healthcare

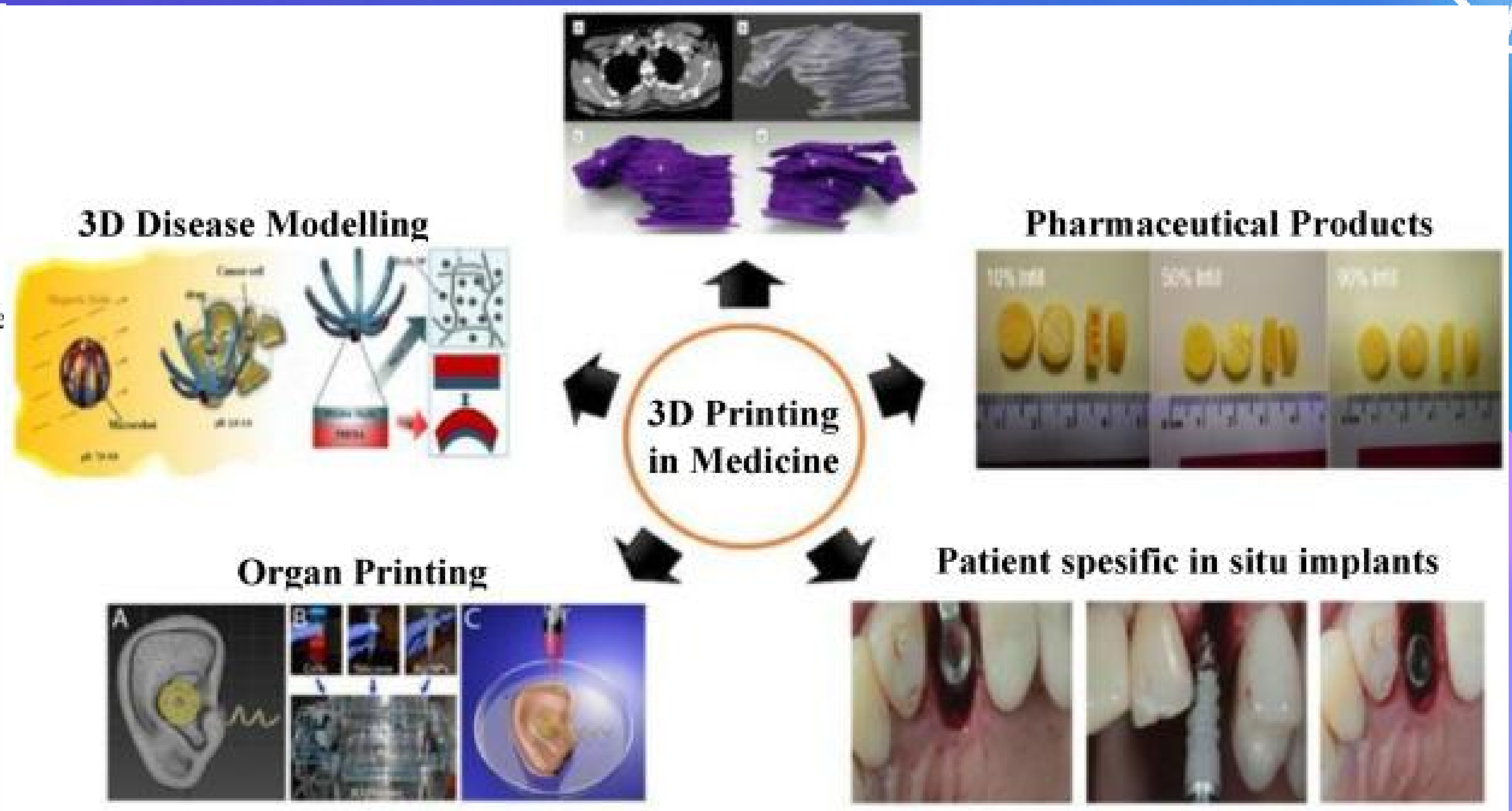
Benefits of 3D printing in Healthcare

1. Patient-Centric Approach
2. Design Optimization
3. Collaborative Innovation
4. Preclinical and Clinical Validation
5. Supply Chain Resilience
6. Data Security and Privacy
7. Environmental Impact
8. Health Equity and Access
9. Education and Training



Applications of 3D printing in Healthcare





Applications of 3D printing in Healthcare


'A worldwide hackathon': Hospitals turn to crowdsourcing and 3D printing amid equipment shortages

The efforts come as supply shortages loom in one of the biggest challenges for health care systems around the world.

Conjoined Twins & 3D Printed Surgical Models

3D Printing

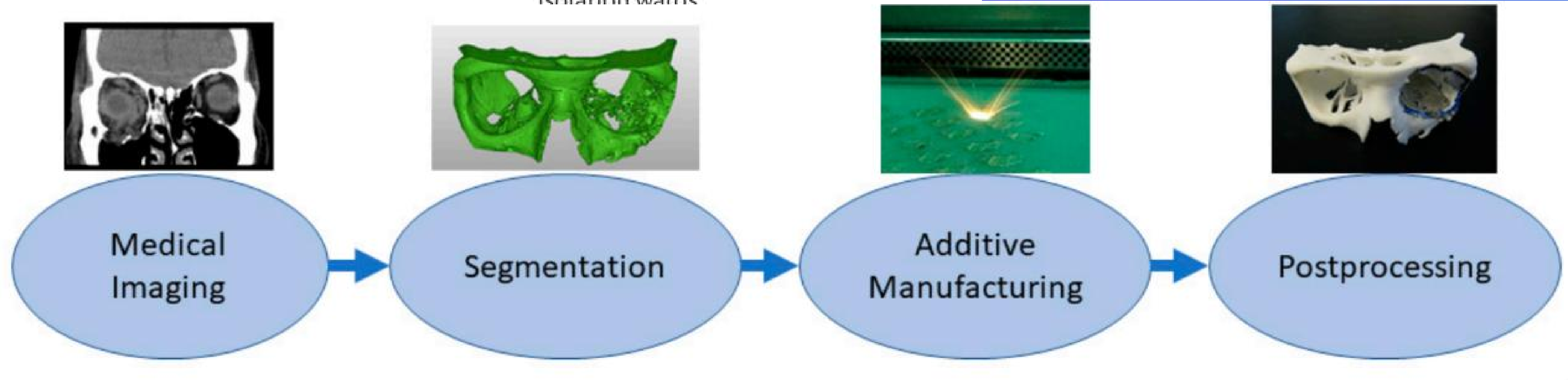
HEALTH AND HEALTHCARE

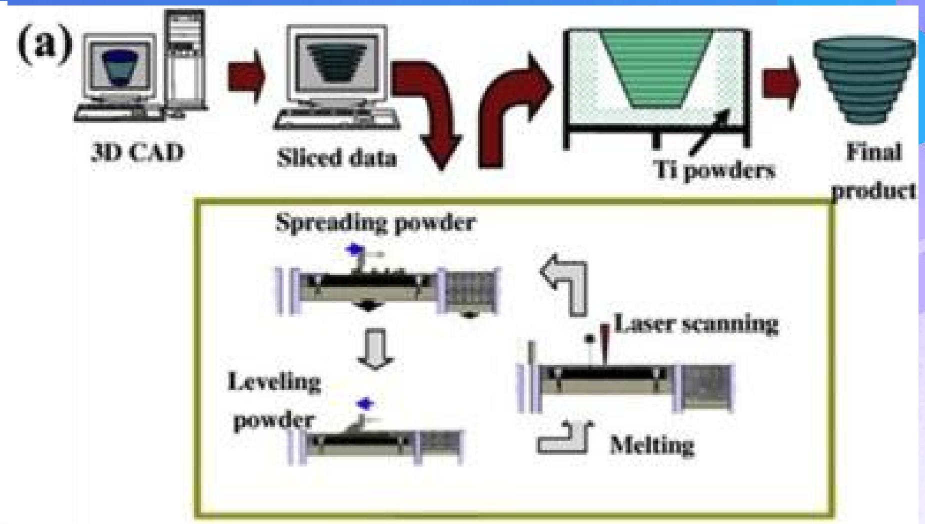
This non-profit is using 3D-printing technology to give refugees the gift of hearing

Aug 9, 2023

3D Printed Infant Masks Are a Success Story for Silicone in the Medical Sector

Published on November 2, 2023 by Michael M.

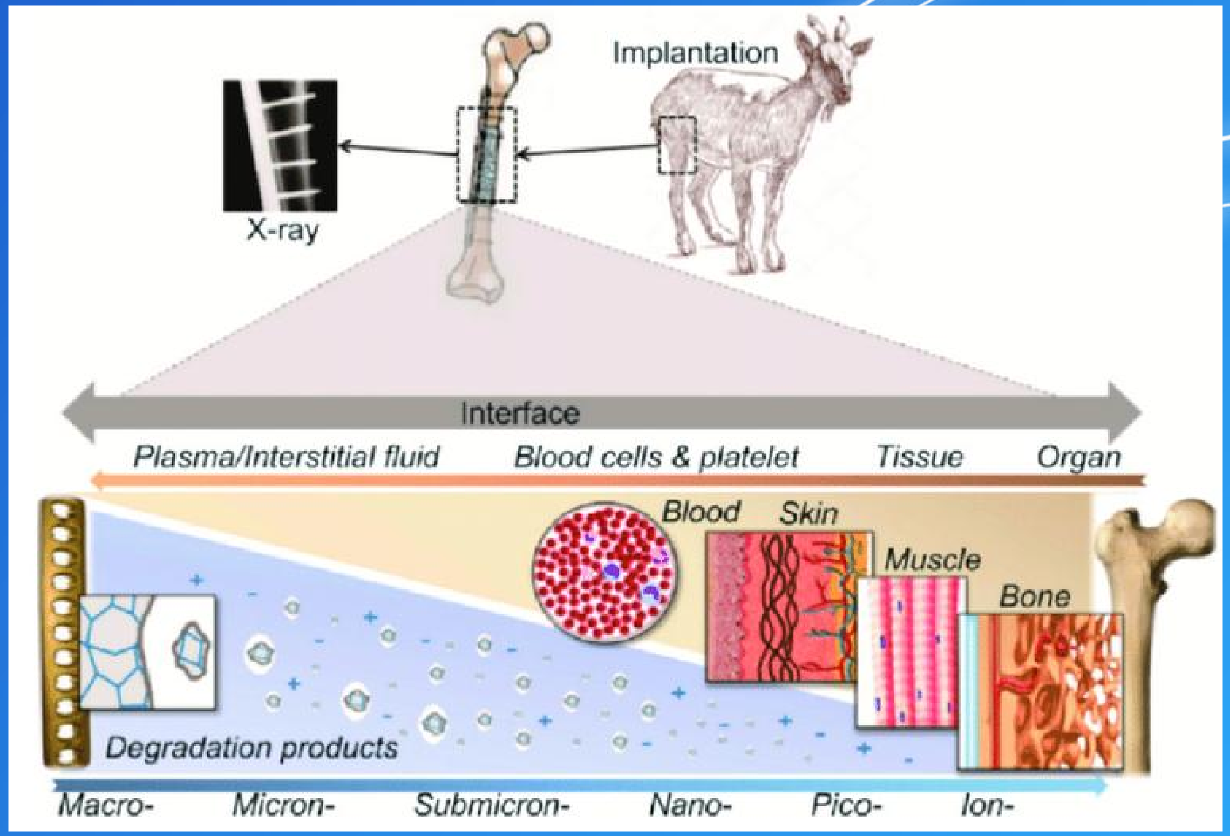


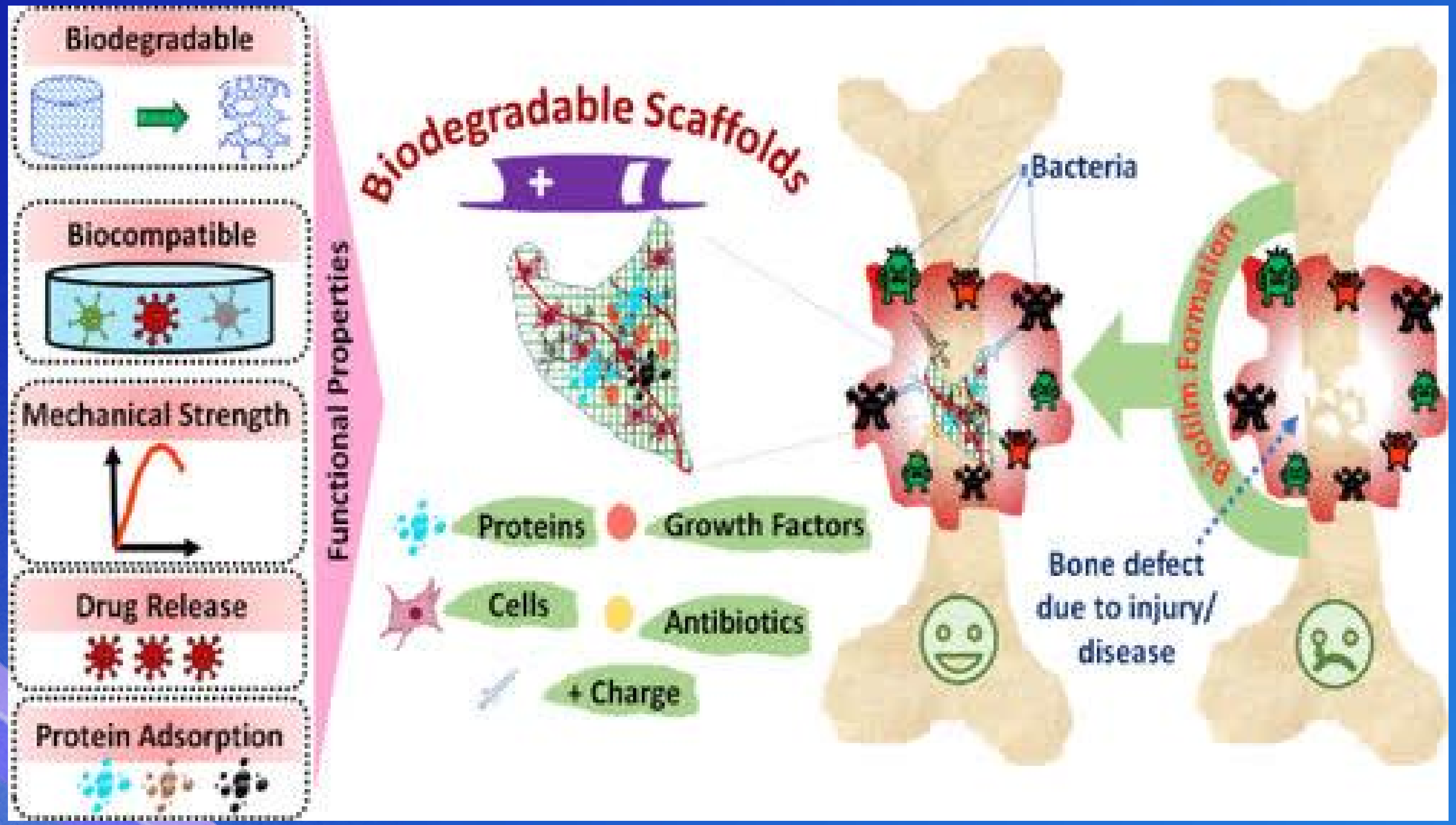


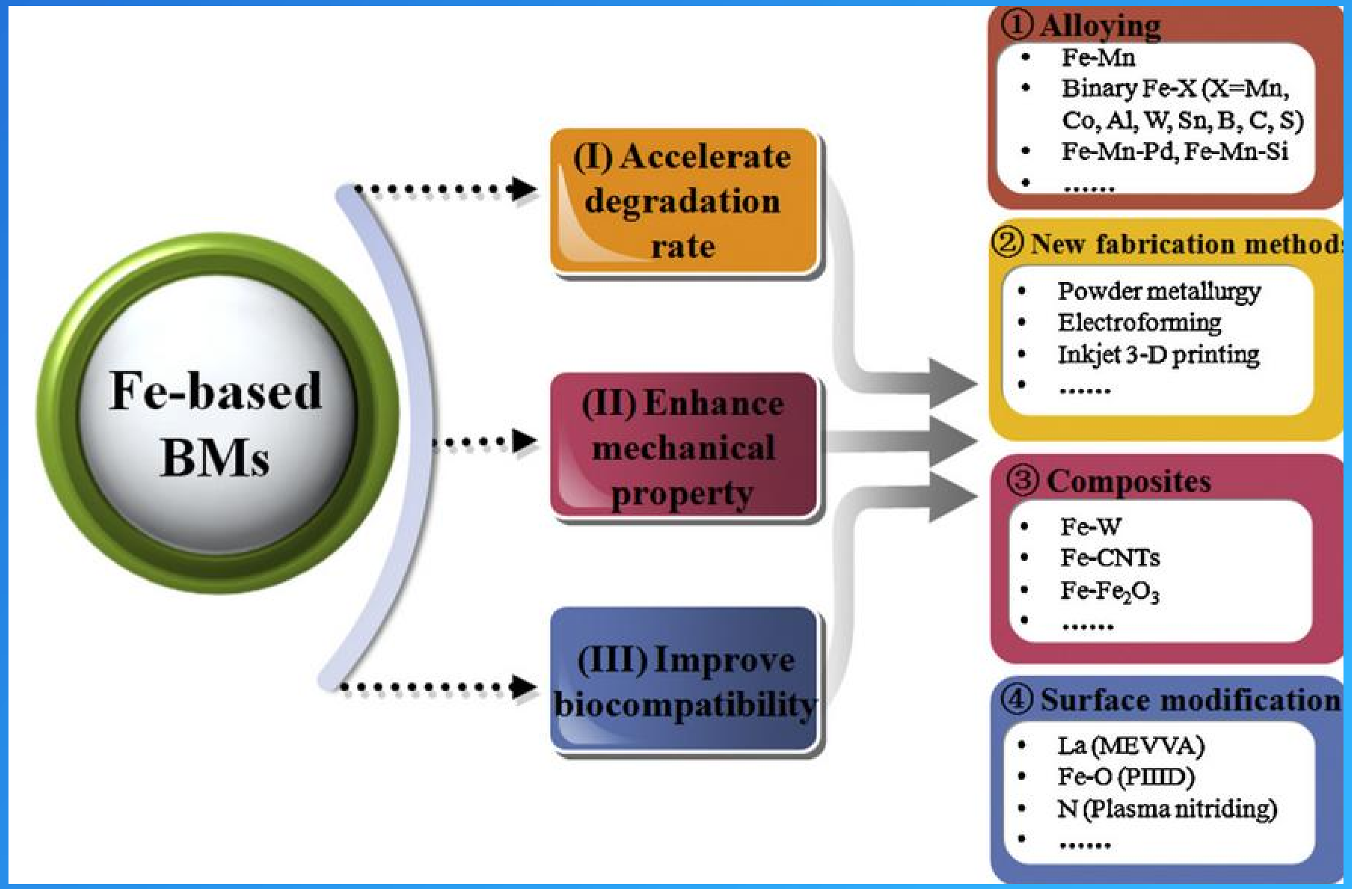
3D Printing Biodegradable Metals in Healthcare

What are Biodegradable Metals?

Biodegradable metals (BMs),corrode gradually in vivo after performing their supportive assisting functions during tissue healing or disease diagnosis, under the influence of appropriate host responses.



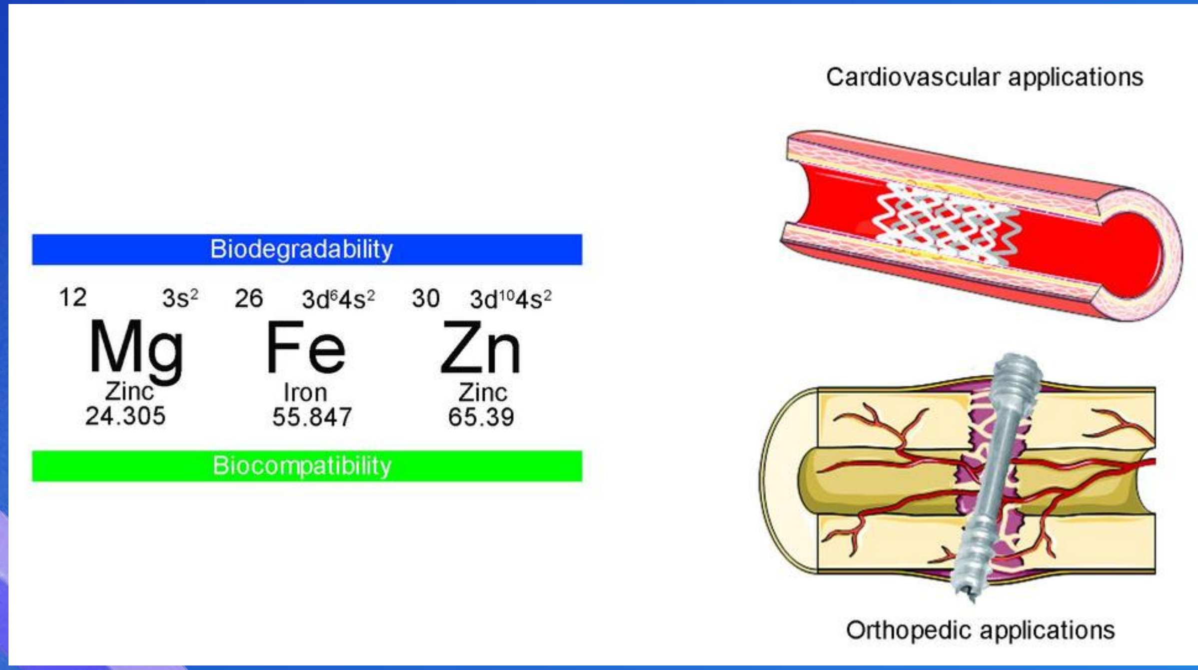


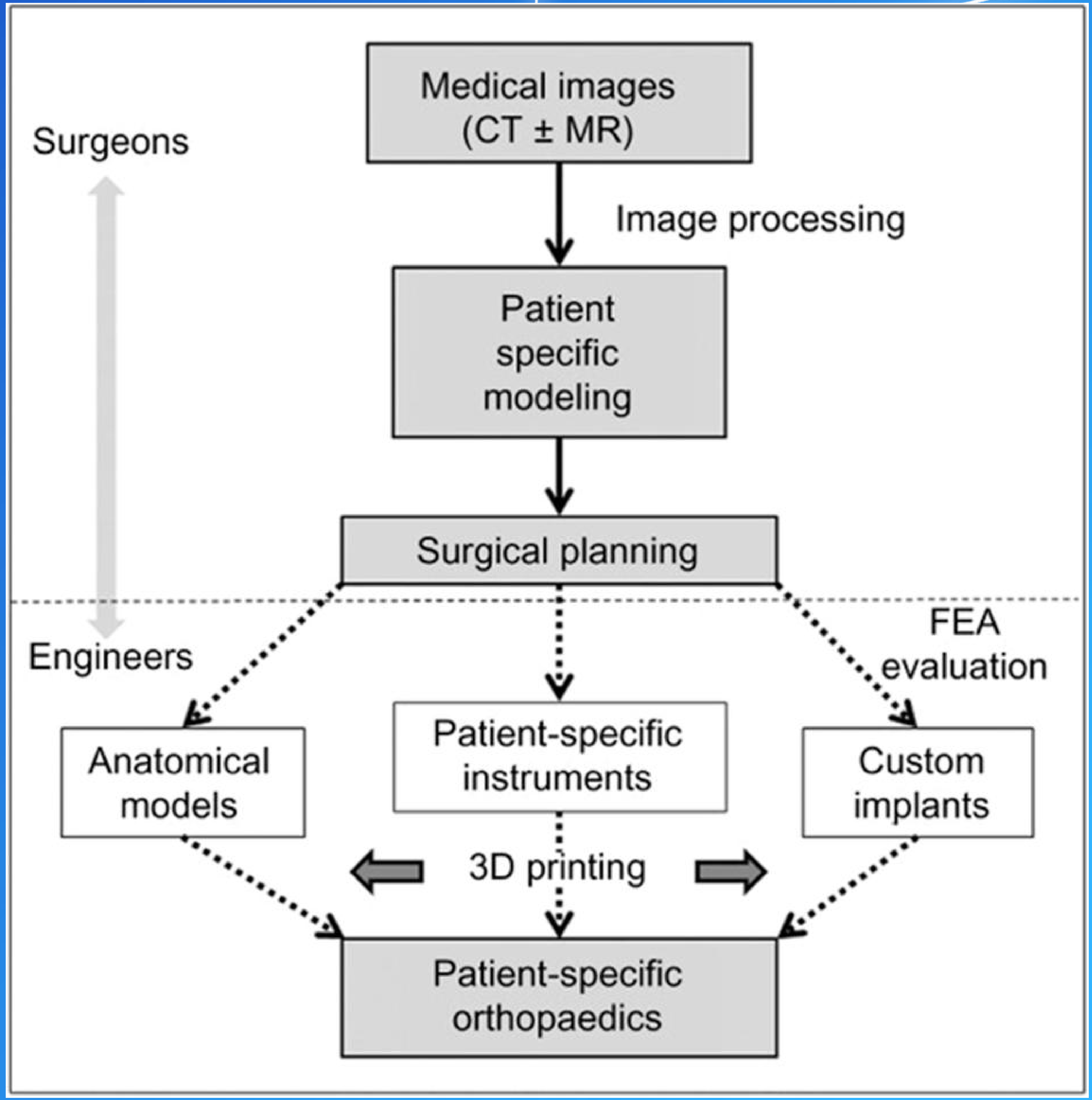


3D Printing Technology and Biodegradable Metals

Traditional powder and metallurgy casting methods cannot create intricate internal architecture and complex external shapes.

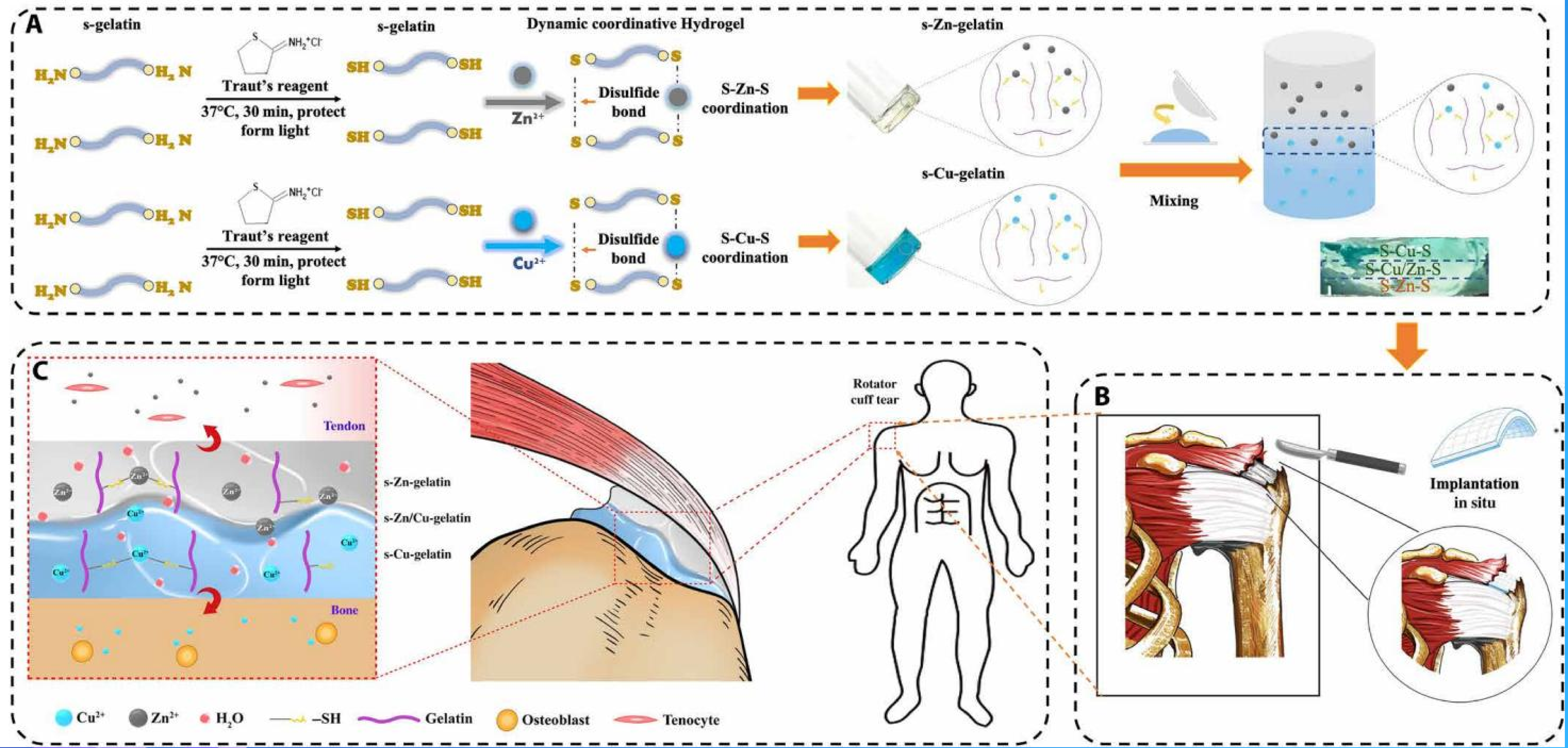
Benefits of Biodegradeable Materials:
Reduced Risk of Rejection
Customization and Patient-Specific Solutions
Drug Delivery Systems
Useful for Tissue Engineering
Making Metallic Implants resembling Natural Bone



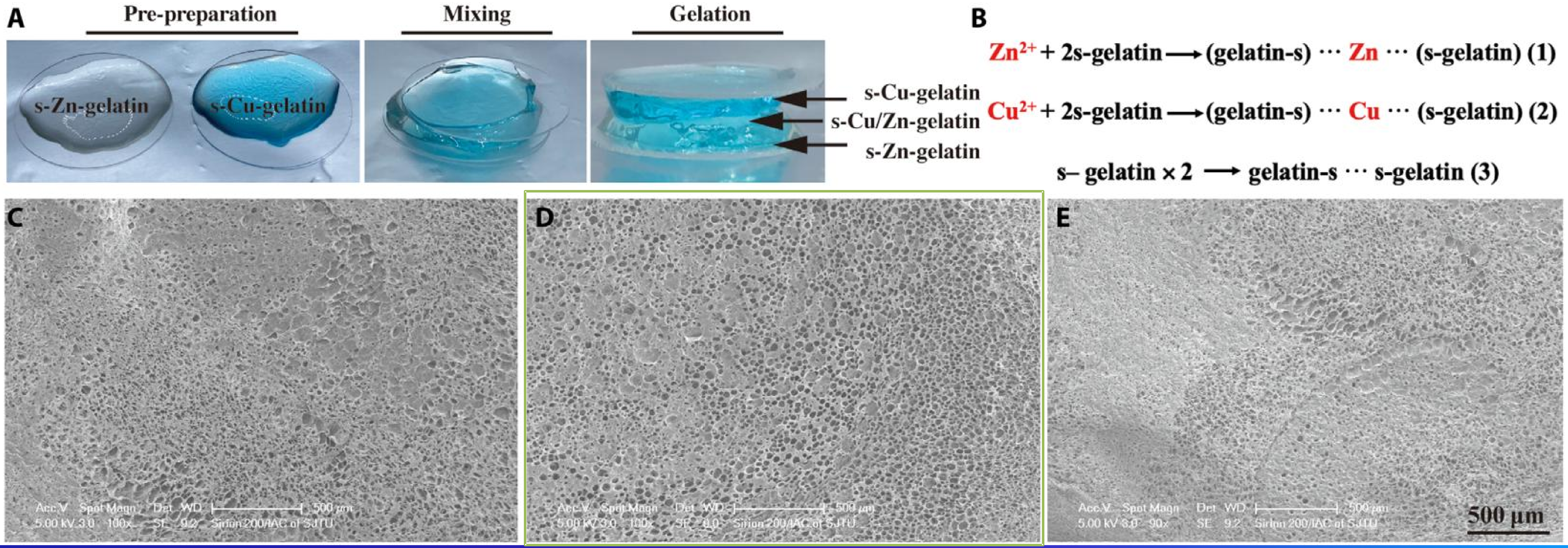


Case Studies-Aspects Of Gradient Bimetallic Ion–based Hydrogels

Aspects Of Gradient Bimetallic Ion–based Hydrogels

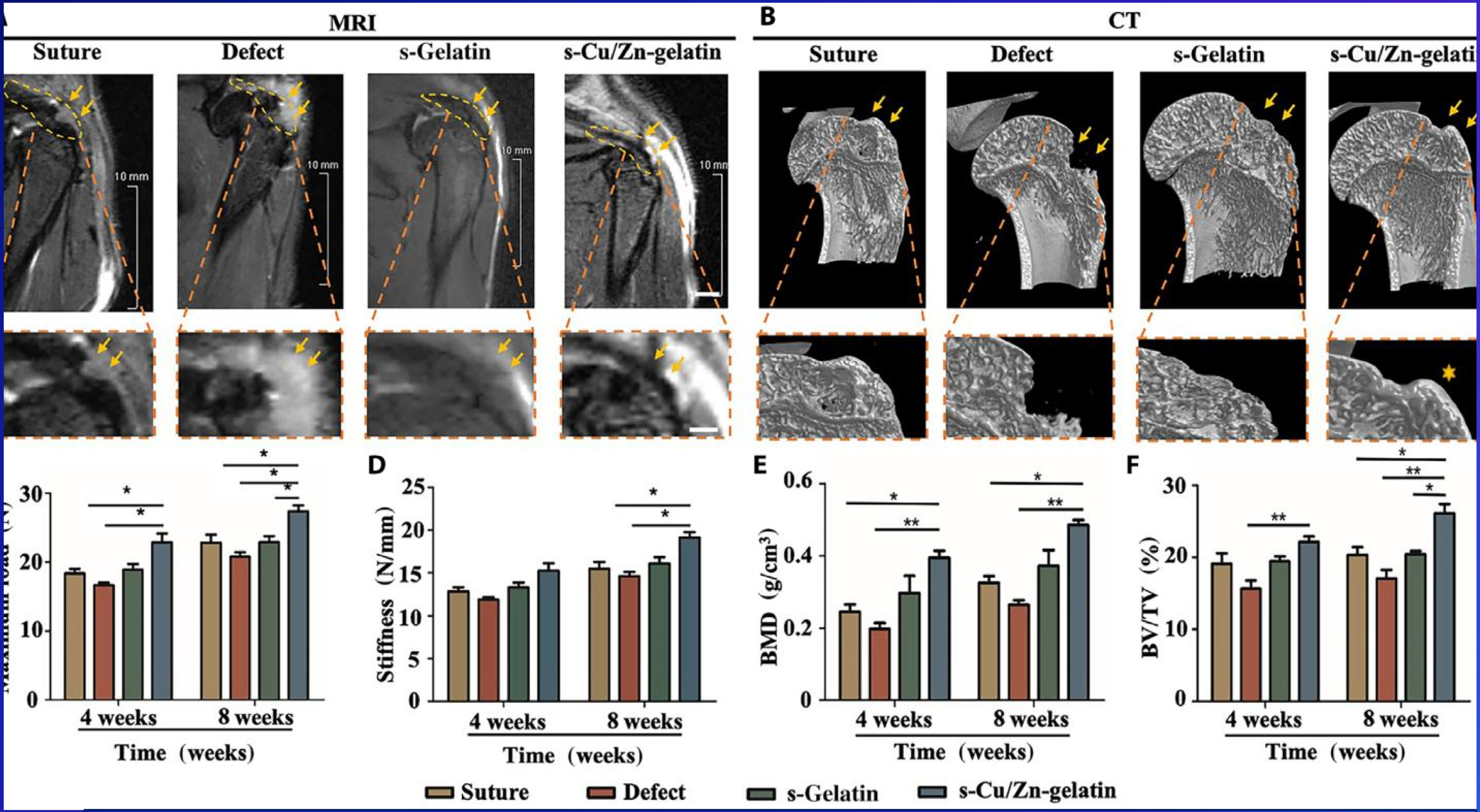


Visual And Quantitative Analysis Of The Properties



Panels A and B -hydrogel preparation process and its gradient composition
Panels C-E- microstructure of the hydrogels seen in SEM images (infiltration and nutrient diffusion)

Effects Of Different Treatments On The Healing



s-Cu/Zn-gelatin treatment could be a superior approach for enhancing tendon-to-bone healing.

BMD- -Bone Mineral Density - bone that has regenerated at the site of the injury

BV-Bone Volume Fraction - Reflecting the amount of bone volume compared to the total volume of the tissue

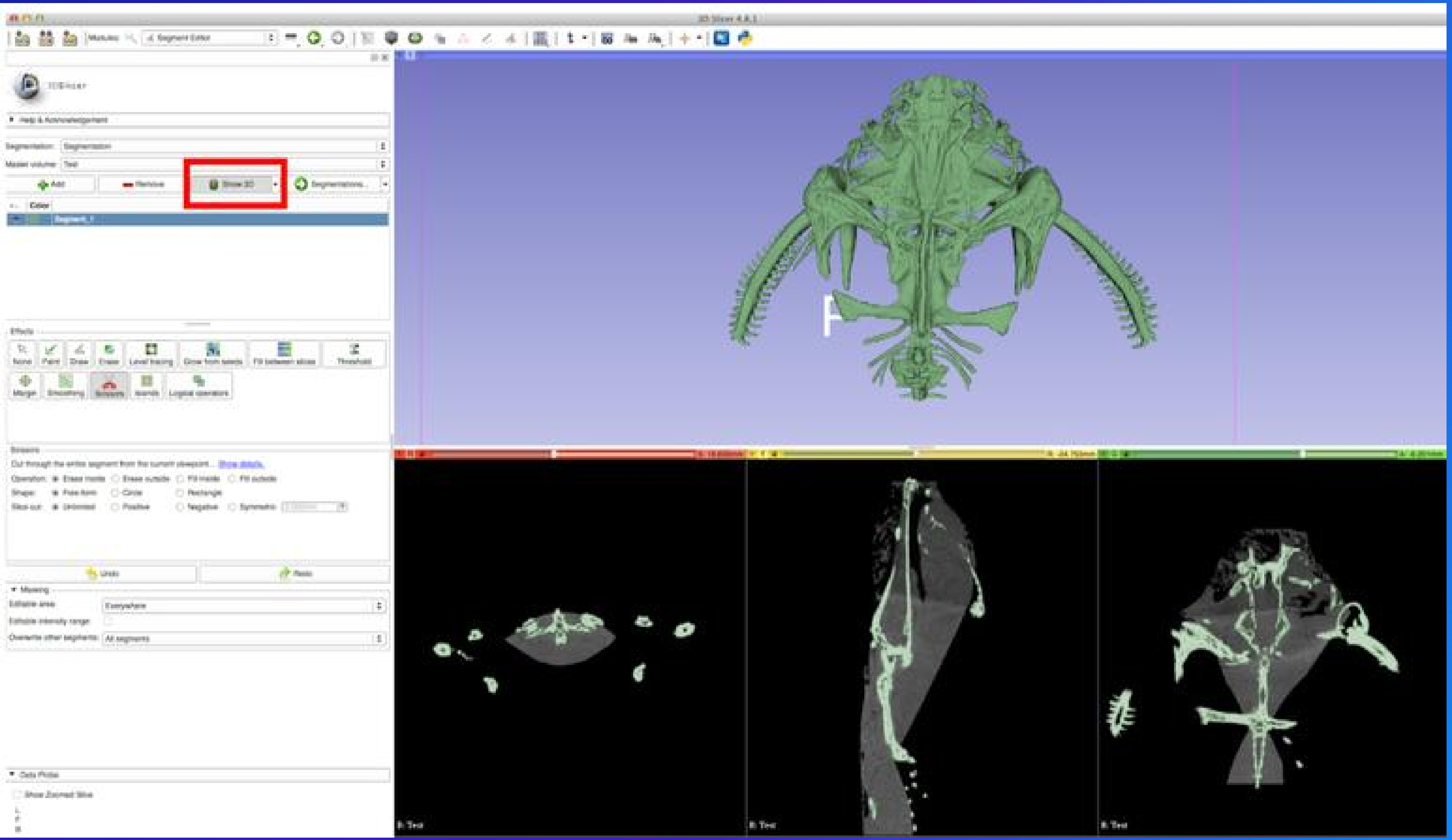
Use of AI in Healthcare 3D Printing

AI-driven tool makes it easy to personalize 3D-printable models

With Style2Fab, makers can rapidly customize models of 3D-printable objects, such as assistive devices, without hampering their functionality.

Watch Video

Adam Zewe | MIT News
September 15, 2023



OpenAI releases Point-E, an AI that generates 3D models

Kyle Wiggers @kyle_l_wiggers / 1:30 AM GMT+8 • December 21, 2022

Comment

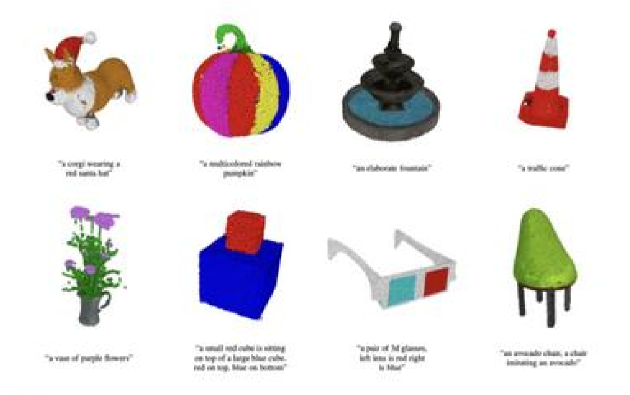
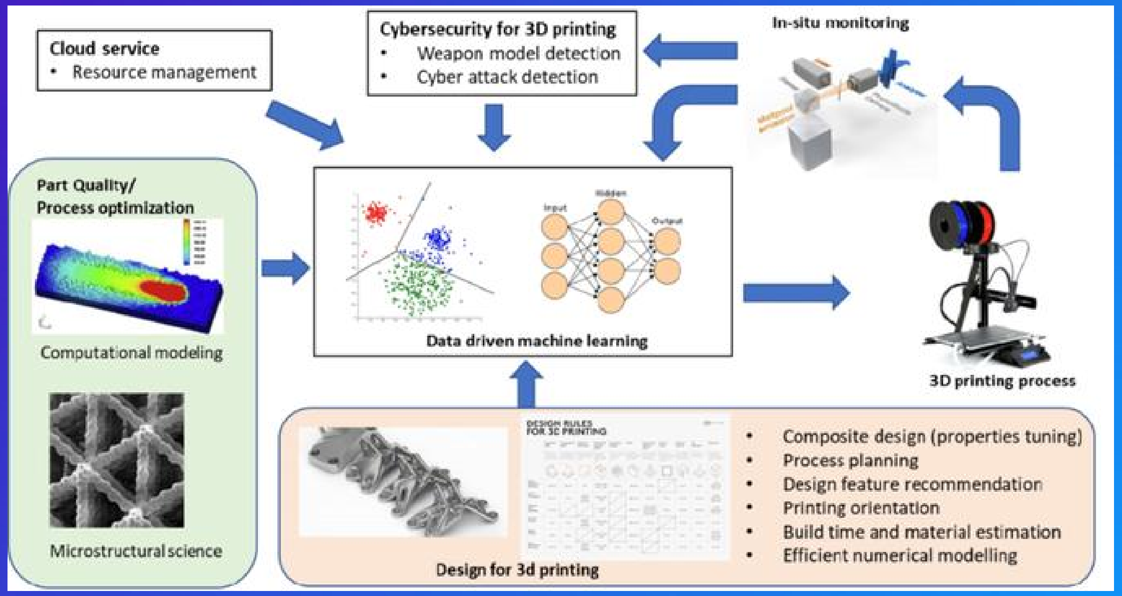


Image Credits: OpenAI



3D Printing in Healthcare for Developing Economies

Benefits:

1.Cost-effective Prototyping

3.Localized Manufacturing

4. On-Demand Production

5. Training and Education

6. Low-Volume Production

7. Innovation and Research

8. Supply Chain Resilience

Challenges:

1. Cost
2. Infrastructure
3. Access to Expertise
4. Regulatory Hurdles

SUCCESSFUL IMPLEMENTATION

AB3D
A social enterprise in Kenya that makes 3D printers and filament from recycled plastic waste for schools and entrepreneurs

Field Ready
A project in Nepal that uses 3D printing to make humanitarian supplies, such as water filters, medical equipment, and solar lamps, in disaster-affected areas

Enabling the Future
A non-profit organization in Tanzania that provides 3D printed prosthetic hands and arms for children with limb differences

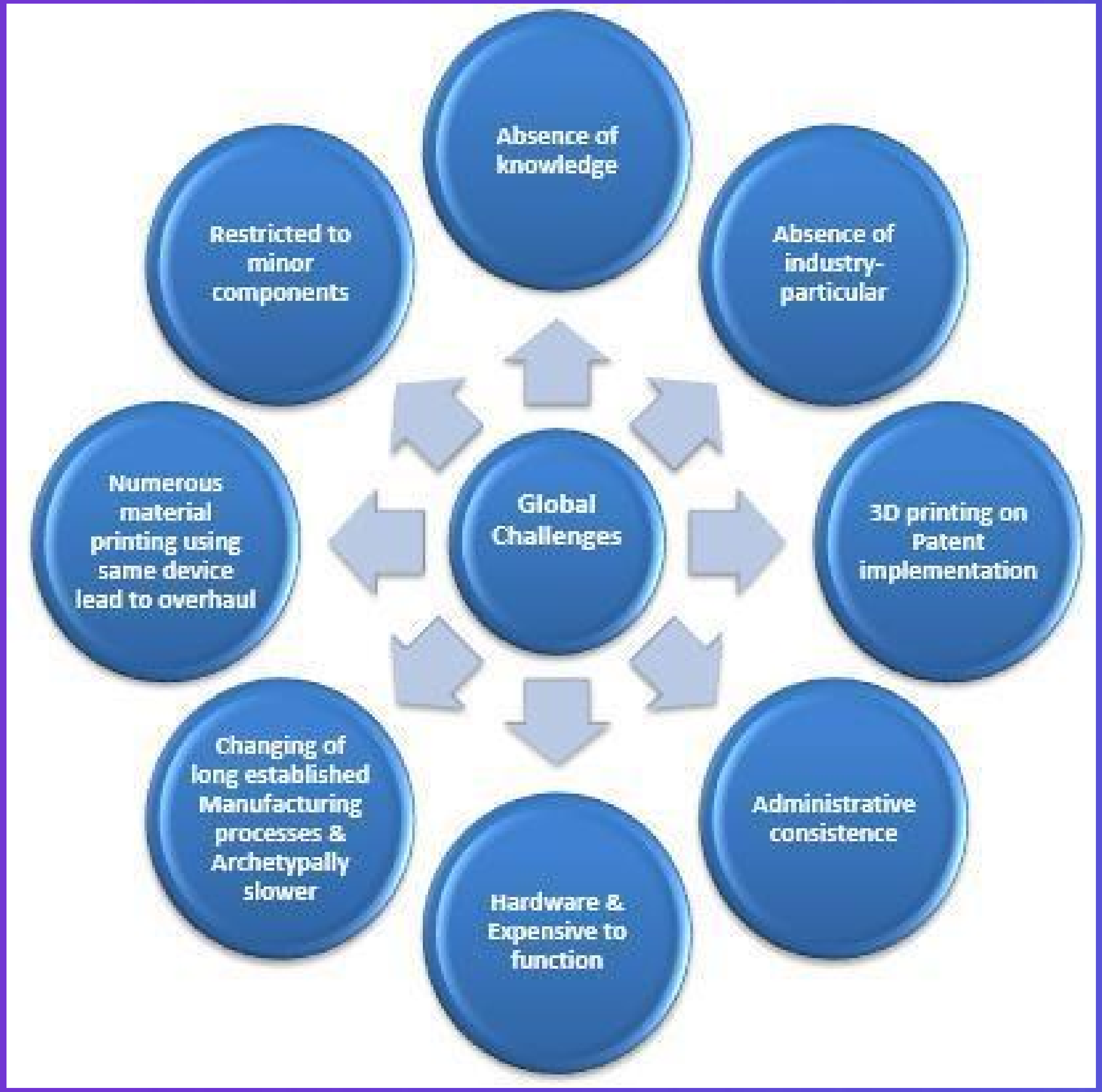
Haiti
A 3D printing laboratory that produces umbilical clamps for a local hospital

Cambodia
A group that uses 3D printing to build large-scale models of unexploded ordnances, which can be used to demonstrate how to deactivate them safely

South Africa
The 3D printing industry has had considerable success in recent years, making inroads in areas such as cell phone accessories, car accessories, jewelry, and housing

IV. CHALLENGES AND CONSIDERATIONS

CHALLENGES OF 3D PRINTING IN HEALTHCARE

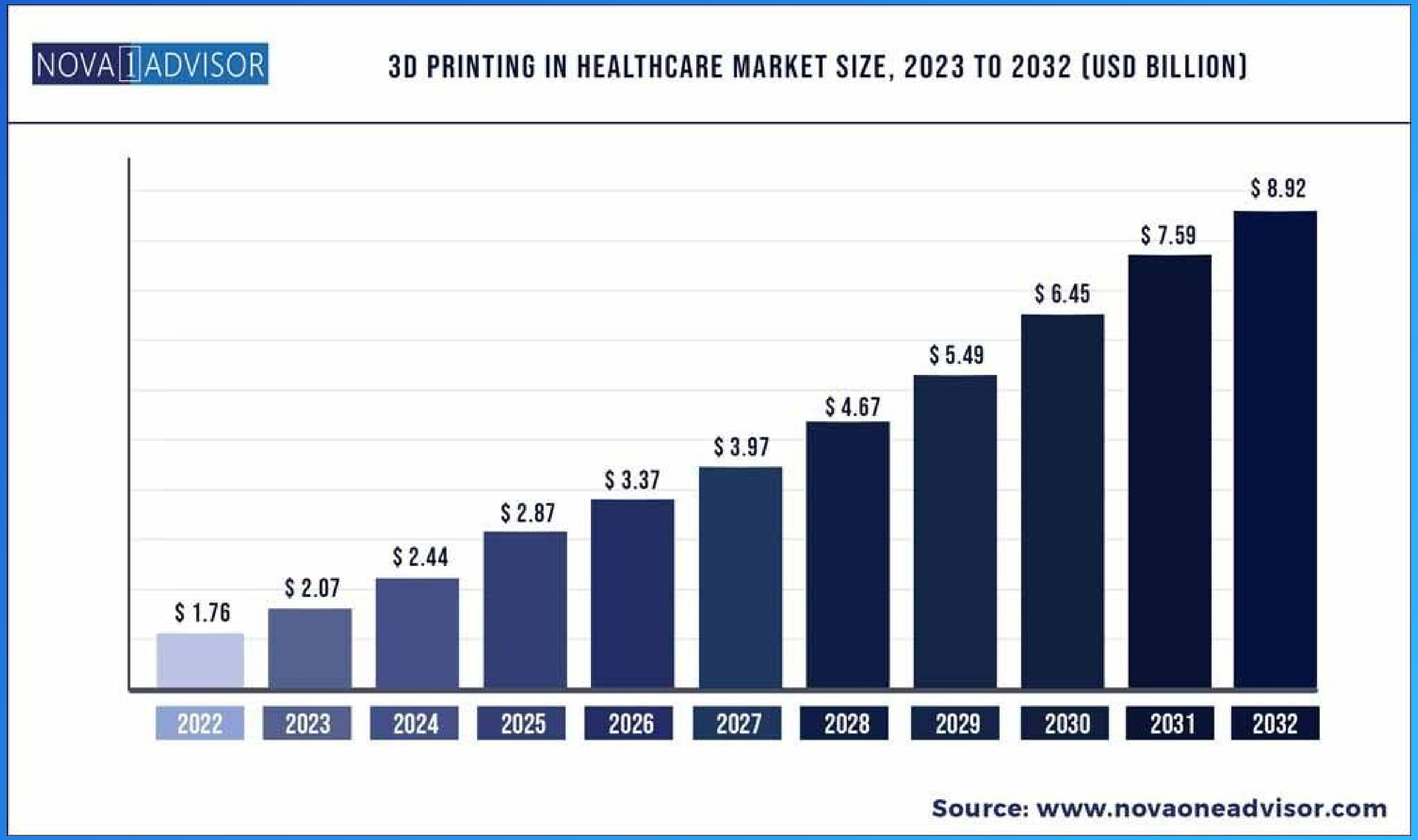


1. Regulatory Hurdles
2. Material Selection and Standardization
3. Quality Control and Validation
4. Intellectual Property Issues
5. Cost and Accessibility
6. Ethical and Legal Considerations
7. Scalability and Integration
8. Education and Training

Future Directions

The future of 3D printing in Healthcare is bright, promising faster, more diverse, and more integrated production methods.This technology can revolutionize manufacturing and empower businesses to create a more resilient and responsible future.

The global 3D printing in healthcare market size was exhibited at USD 1.76 billion in 2022 and is projected to hit around USD 8.92 billion by 2032, growing at a CAGR of 17.61% during the forecast period 2023 to 2032



THANK YOU!