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Product Brochure
Medical

J5 Digital Anatomy™ 3D Printer Solutions

Anatomical Realism
Within Your Reach

goengineer

Anatomical Realism Within Your Reach

Open the door to a world of medical representations and discover precision anatomy modeling. Our new small footprint and high performance **J5 Digital Anatomy 3D Printer** with its unique materials and software, enables the creation of biomechanically accurate and functional anatomical models - now within reach.

This multi-color, multi-material platform constructs models that not only look like the real thing- but also accurately replicate the actual feel and responsiveness of human anatomy. Have models when you need them as the software streamlines the workflow, adjusts your pathologies controlling material composition/microstructures, and utilizes remote management.

Create unmatched realistic and cost-effective education resources, enhance product development and expedite time to market. The printer is safe to operate with biocompatible and sterilizable materials.

The J5 Digital Anatomy 3D Printer is the ideal solution for point-of-care and academic medical centers looking to enhance surgical planning and training, as well as medical device companies looking to accelerate innovation. The printer reduces costs and environmental hazards by minimizing the use of cadavers and animal testing.

Printer Benefits

Medical Device Companies

- **Fast-track innovation** in product design and accelerate time to market.
- Enhance product testing and development processes while **reducing costs.**
- **Create repeatable**, predictable consistency and minimize confounding variables for clinical benchtop testing.
- **Develop sales aids** to demonstrate new device**s**
- Safe to operate and **facility-friendly:** quiet, no odors, no direct contact with chemicals.

Point-of-Care and Academic Medical Centers

- **Presurgical planning** and highly realistic point-of-care training with life like models.
- Bring to life detailed, **patient-specific models** that can elevate patient outcomes by providing risk-free planning to reduce complications and decrease OR time.
- **Standardize surgical skills** and delivery of care by practicing cost-effective, accurate representations of the targeted pathology.
- **Improve doctor-patient communications** for more informed consent.

See and Feel

Explore a world of endless possibilities with ultra-realistic 3D printed anatomical representations

The J5 Digital Anatomy 3D Printer's software gives you the power to create clinically validated preset anatomy options that utilize 3D printing materials. These behave with biomechanical accuracy that mimics human tissue and bone like never before.

Structural Heart

Experience the physiological response of native cardiac tissue. Create durable heart models that maintain compliance, as well as replicate reality, making them invaluable learning and development tools.

See the remarkably accurate details of the human heart, as the myocardium, the vasculature of the heart, valve leaflets, cords, and annulus – all in a 3D printed representation.

Feel realistic feedback while suturing, cutting, inserting and deploying devices.

A medical device company study compared the biomechanical properties of porcine tissue to 3D printed myocardium. It found that models printed on the Digital Anatomy Printer mimicked real tissue better than any other material.[1]

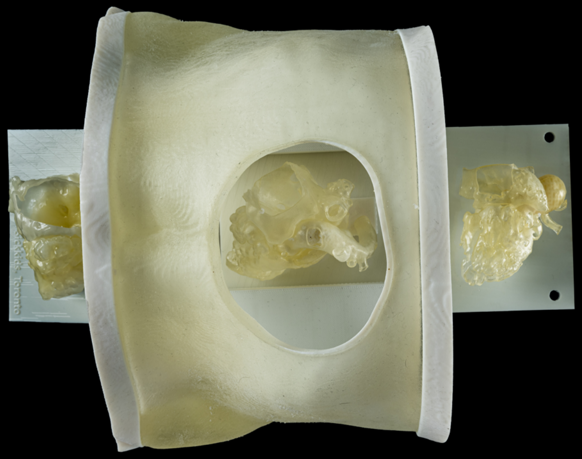
Blood Vessels

Experience the arterial elasticity caused by changes in blood pressure and disease.

See how complex vasculature systems respond under simulated surgical procedures.

Feel realistic vessel responses while inserting and deploying guidewires and catheters, valves, grafts, and closure devices. Simulate actual blood flow with an active flow loop. Practice navigating tortuous anatomy with patient-specific models. Replicate calcifications and view them under fluoroscopy.

A Jacobs Institute study compared 3D printed aortic, carotid, and coronary artery models to native vessel behavior found that the Digital Anatomy Printer creates the most accurate arterial models available.[2]



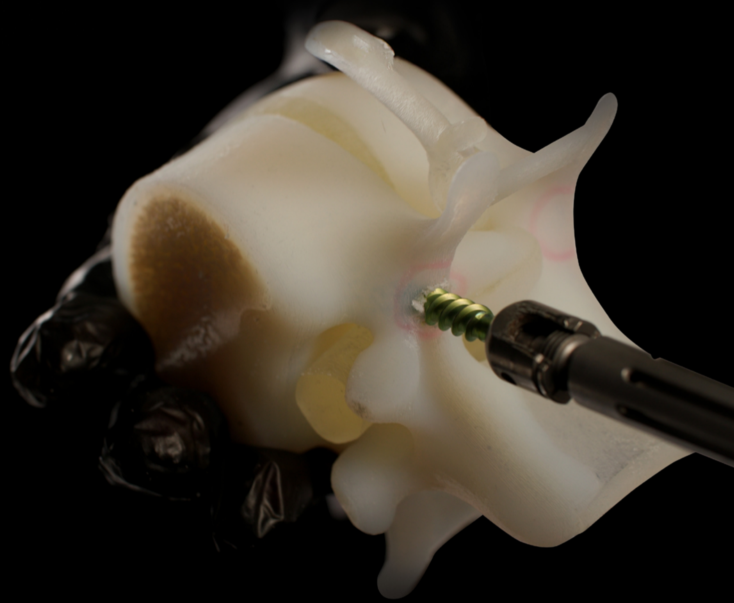
Musculoskeletal

Experience the density properties of human bone. Create complex models that include both bone and soft tissue along with ligaments and nerve roots. Vary bone density to mimic healthy and osteoporotic bones.

See how accurately bones articulate with variations in cancellous and cortical density.

Feel realistic feedback while tapping, reaming, sawing, inserting screws and attaching plates.

Biomechanical testing confirmed that the driving torque and pullout force of screw fixation in 3D printed bone models have similar haptic responses to human bone.3 Mechanical tests confirm spine models accurately simulate the natural axes of movement of the human spine as the following forces are applied: disc compression, extension, flexion, lateral bending, and axial tension.[4]



Radiopaque

Radio realistic models with full contrast options. Print models that not only look like real anatomy with a similar biomechanical behavior, but they also have the same results under a CT scan.

See radiopaque properties just like real tissue under CT and X-ray imaging.

Control the radiopacity properties of each printed model. Choose the material mixture to get the desired radiopacity level (HU value) and print with repeatable and accurate results.

General Anatomy

Experience the response of native organ tissue. Produce functional models to mimic organs such as liver, subcutaneous fat, or connective tissues. Replicate encapsulated and non-encapsulated tumors. Simulate tumor resection and experience realistic haptic feedback to instruments.

See the complex organ structures and disease states before entering the surgical suite.

Feel realistic feedback while suturing, cutting, inserting, and deploying devices.

Innovative materials make it possible

Unlock unique material combinations that create realistic models that vary in softness, flexibility, and density, mimicking native tissue behavior. The unique voxel-based engine of the J5 Digital Anatomy 3D Printer will automatically generate your model's detailed anatomical structures giving it the look and feel of the real thing.

The J5 Digital Anatomy 3D Printer comes pre-programmed with a series of anatomical applications, developed in partnership with device manufacturers, world-class research institutions, hospitals and medical personnel.

Utilizing the Digital Anatomy Printer unique and exclusive materials, enables the creation of over 300 unique digital materials to create complex, multi-texture structures.

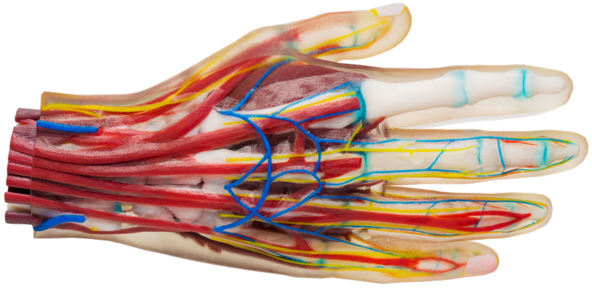
- **GelMatrix™** — Unique GelMatrix material and GelSupport™ depositing patterns allow you to print small, complex vascular structures and easily remove internal support material. GelMatrix is also used for mimicking soft tissues such as liver and subcutaneous fat.
- **TissueMatrix™** — Sophisticated soft material configurations allow for models that feel and behave like native organ tissue when force is applied. This is ideal for replicating the look and feel of heart tissue.
- **BoneMatrix™** — Complex material depositing patterns mimic bone structures with various densities to demonstrate different conditions and pathologies. This material is useful when creating orthopedic models that can be drilled and dissected, with biomechanical behavior like human bone.
- **RadioMatrix™** — Radiopaque 3D printing material gives you the power to create medical models that exhibit realistic features under X-ray and CT.

A full range of PolyJet materials are also available for use on the J5 Digital Anatomy 3D Printer to help you achieve a level of visualization never seen before including Vero™ Family Vivid multicolor materials, DraftWhite™ rigid white material, Elastico™ rubber-like material, and Biocompatible Materials with ISO certifications for biocompatibility and sterilization.

Visual model

Demonstration

Using a combination of rigid Vero and Elastico materials, we created a visual hand model with fine details, colors, varying texture gradients, transparencies, and durometers to help visualize the hand's vessels, bones, nerves, mussels, and skin.



Functional model

Surgeon training and device testing

Using ultra-soft TissueMatrix, the subcutaneous fat preset in GrabCAD software, and BoneMatrix material for rigid internal bone structures, we created a functional hand model with the same biomechanical behaviors as human anatomy. Realistic haptic feedback allows cutting, suturing, drilling and device insertion just as you would into tissue, fat, or bone.

RadioMatrix adds radio-realism to the desired anatomy, creating radiopaque tissues that are visible under CT or fluoroscopy.

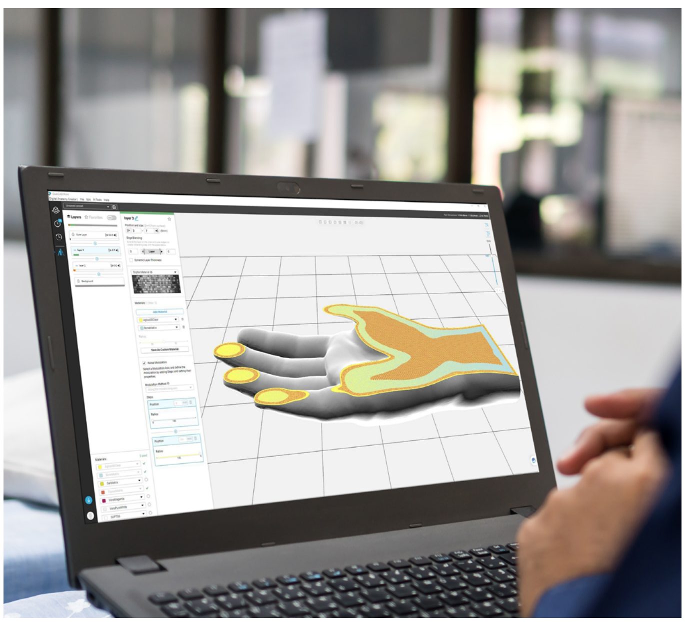
All on a Certified System

- 510k cleared for clinical diagnostic use with leading segmentation software companies
- Biocompatibility certification
  - ISO 10993-1:2018 for limited contact to tissue and bone and permanent contact to intact skin
  - ISO 18562-1:2017 for breathing gas pathways in healthcare applications
- Sterilization methods
  - Steam, Gamma and EtO for MED610 and MED615RGD
  - Steam for Biocompatible Digital ABS Plus™ (MED531 and MED 5151+)
  - Steam, Gamma, and EtO for Rigid Transparent family
- ISO 13485 Certified (material and hardware manufacturing sites)

Digital Anatomy Software

The power to create

GrabCAD Print™ Digital Anatomy Software gives you the power to create your desired lifelike anatomical models via intuitive software. Clinically validated preset anatomy options deposit 3D printing materials to behave with biomechanical accuracy, mimicking human tissue and bone like never before. The advanced output from our user-friendly 3D printer and software is unmatched.



The power to produce accurate biomechanical behavior

Anatomies are configured using unique material combinations that vary in softness, flexibility, and density to mimic native tissue and bone behavior.

The power to create models in a few simple clicks

The preset anatomy menu offers more than 300 options that allow you to print accurate, lifelike models by simply choosing the desired anatomy. Each selection allows you to easily mimic complex pathological conditions.

The power to mimic native tissue and bone structures

• **Slice Preview** — visualize individual slices of internal anatomy structures and confirm pathology, material, and orientation choices.

• **Screw Insertion Strain Relief** — in orthopedic models, create regions for screw entry so you can place screws without cracking the model.

• **Long Bone Manipulation** — autogenerate the intricate, unique structures of bone in each region with control over the proximal/distal orientation which will define cortical, cancellous and the medullary canal in the right anatomical division/regions.

• **Myocardium Consistency** — experience the same non-directional behavior as human tissue when force is applied in any direction.

The power to print with physician-tested, validated presets

Digital Anatomy Printer Software was developed and refined over years of expert testing in partnership with top academic medical centers and hospitals across the globe.

The power to control radiopacity values

The Digital Anatomy Printer Software enables easy control over the desired values to mimic different tissues under CT/X-ray.

Make a big impact with a small footprint

Service multiple departments and create more medical models with less handling - all within a small footprint.

Create in a few simple clicks

GrabCAD Print Digital Anatomy Software has a user-friendly UI, allowing easy adjustment of attributes to mimic healthy or diseased tissue and complex pathological conditions.

Make post-processing quick and easy

Remove gel support material from complex vessels with little to no effort.

Utilize multi-material, multicolor, sterilizable, and biocompatible capabilities

Multiple materials and multicolor capabilities enable academic medical centers, hospitals, and medical device companies to create brilliantly vivid anatomical models that are sterilizable and biocompatible (when using approved materials).

Product Specifications

Model Materials	Biocompatible materials: ☐ Biocompatible Rigid Transparent (MED610) ■ Biocompatible Opaque (MED615RGD™ IV) ☐ Biocompatible Digital ABS Plus™ (MED531 and MED515+) Rubber like: ☐ Elastico®Clear (FLX934) ■ Elastico®Black (FLX984)	Rigid Transparent Colors: ■ VeroCyan™V (RGD845) ■ VeroMagenta™V (RGD852) ■ VeroYellow™V (RGD838) ☐ VeroUltra™ClearS (RGD821) ■ VeroUltra™Black (RGD864) ☐ VeroUltra™White (RGD824) ■ VeroBlackPlus™ (RGD875) ☐ DraftWhite (MED858)	Digital Anatomy™ Materials: ■ TissueMatrix™ (MED410) ■ GelMatrix™ (FLG111) ■ BoneMatrix™ (RGD526) ☐ RadioMatrix™ (MED410)
Support Materials	• SUP710S™ (WaterJet removable) • WSS™150 (Water soluble, not compatible with the Digital Anatomy materials)		
Supported Sterilization Processes	• Steam (4 minutes at 132 °C) • Gamma (25 – 50 kGy) • EtO (specifications available upon request)		
Digital Model Materials	• Composite materials including over 500,000 colors • Hundreds of presets available to mimic different anatomies with Digital Anatomy materials		
Build Tray	• Printing area: 1,174cm^2 • Max Part Size: Up to 140 x 200 x 190mm (5.51 x 7.87 x 7.48 in.)		
Layer Thickness	Horizontal build layers down to 18 microns (0.0007 in.)		
Accuracy	Deviation from STL dimensions with rigid materials,based on size: under 100 mm: ±150μ; above 100 mm: ±0.15% of part length.*		
Network Connectivity	LAN – TCP/IP		
System Size and Weight	651 x 661 x 1511mm (25.63 x 26.02 x 59.49 in.); 228 kg (503 lbs.)		
Operating Conditions	Temperature 18 – 25 °C (64 – 77 °F); relative humidity 30 – 70% (non-condensing)		
Power Requirements	100 – 240 VAC, 50 – 60 HZ, 10A, 1 phase		
Regulatory Compliance	CE, FCC, EAC		
Software	GrabCAD Print		
Build Modes	• High Quality Speed (HQS) Compatible with Digital Anatomy materials. • Long Print (LP) • High Speed (HS)		

*Accuracy spec doesn't include Digital Anatomy materials; true for 67% (1 sigma) models printed for future information can be found in the spec sheet.

[1] Severseike, Leah et al., "Polyjet 3D Printing of Tissue-Mimicking Materials: How Well Can 3D Printed Synthetic Myocardium Replicate Mechanical Properties of Organic Myocardium?," bioRxiv, 2019, doi.org/10.1101/825794.

[2] Sparks, Adam et al., "Digital Anatomy Printing (DAP): A Direct Characterization of DAP Materials for Use as Compliant 3D-Printer Arteries Using Intravascular Ultrasound (IVUS)," The Jacobs Institute, Submitted for publication, 2020.

[3] Dahan, Gal, "Synthetic Bones vs. Human Bones for Screws Testing: A Literature Survey," In progress, 2020.

[4] Biomechanical Evaluation of a Printed Digital Anatomy Lumbar (L3-S1 Spine Model), Technion Institute of Technology Materials Science and Engineering Laboratory, Final Report (2020).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Digital Anatomy™
PUSH