

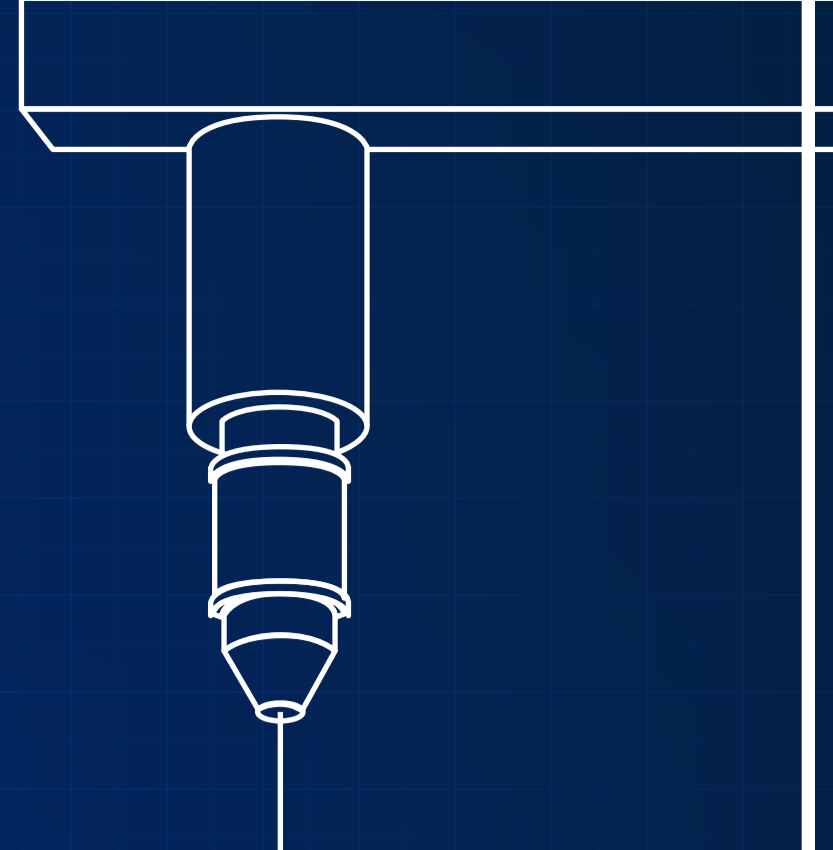
# 3D BIOMEDICAL PRINTING

## CHANGING WHAT BIOMEDICINE CAN ACHIEVE

From the first mention of 3D printing in the 1940s to today's applications in tissue and organ fabrication, personalized pharmaceutical production, 24-hour custom prosthetic limb generation, and more, 3D printing is enabling new approaches in medicine and life science research.

See how 3D printing is reshaping biomedicine, building an exciting future filled with innovative ways to deliver healthy outcomes.

Learn more and see all the references at [cas.org/3d-biomedical-printing](https://cas.org/3d-biomedical-printing).



CARTILAGE



MUSCLE



SKIN

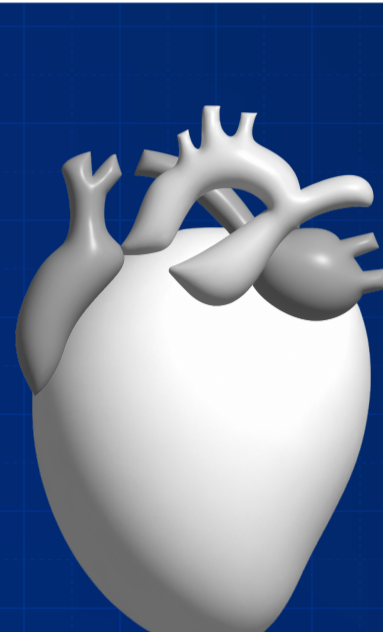
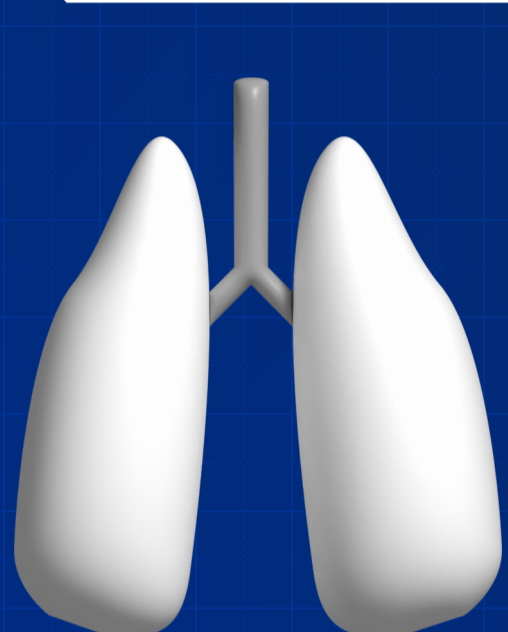
### SHIFTING HOW WE SOURCE TRANSPLANT TISSUE AND ORGANS

3D printing cells and biomaterials is enabling the production of constructs that provide part or even all of the function of the native counterpart.

### ENABLING 3D ANATOMICAL MODELING AND FAST PROSTHETIC FABRICATION

Planning for complex surgery can be more accurate with 3D printed reconstructions of a patient's exact anatomy.

Fast fabrication of custom prosthetics is already changing their cost and accessibility.

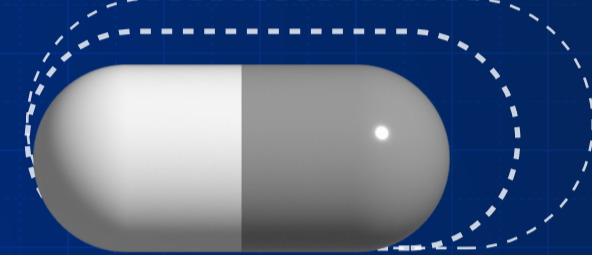


ANATOMICAL MODELS

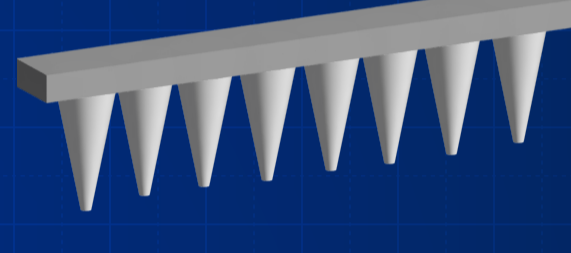
### ADVANCING PHARMACEUTICAL DOSING AND DELIVERY

In the future, medications may be 3D printed to personalize the dosage, shape, size, and release characteristics.

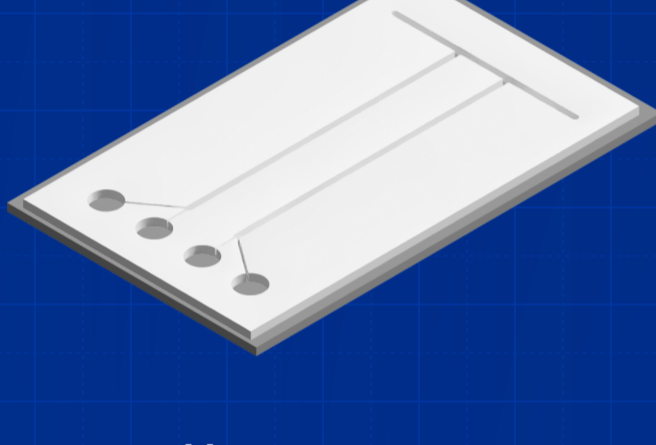
Today, companies are using stereolithography to create microneedle arrays for transdermal delivery.



PERSONALIZED MEDICINE



NOVEL DRUG DELIVERY DEVICES

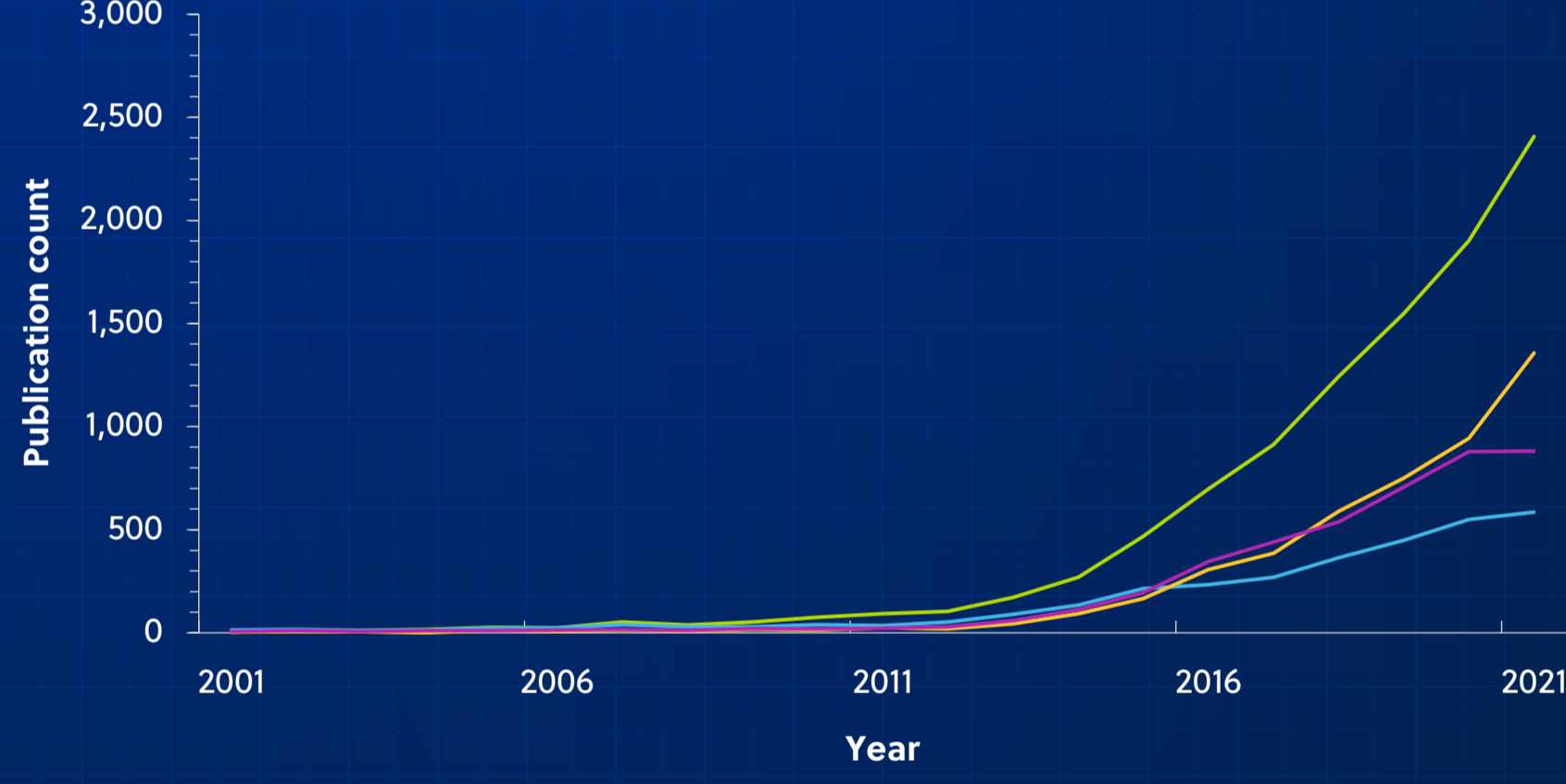


MICROFLUIDICS

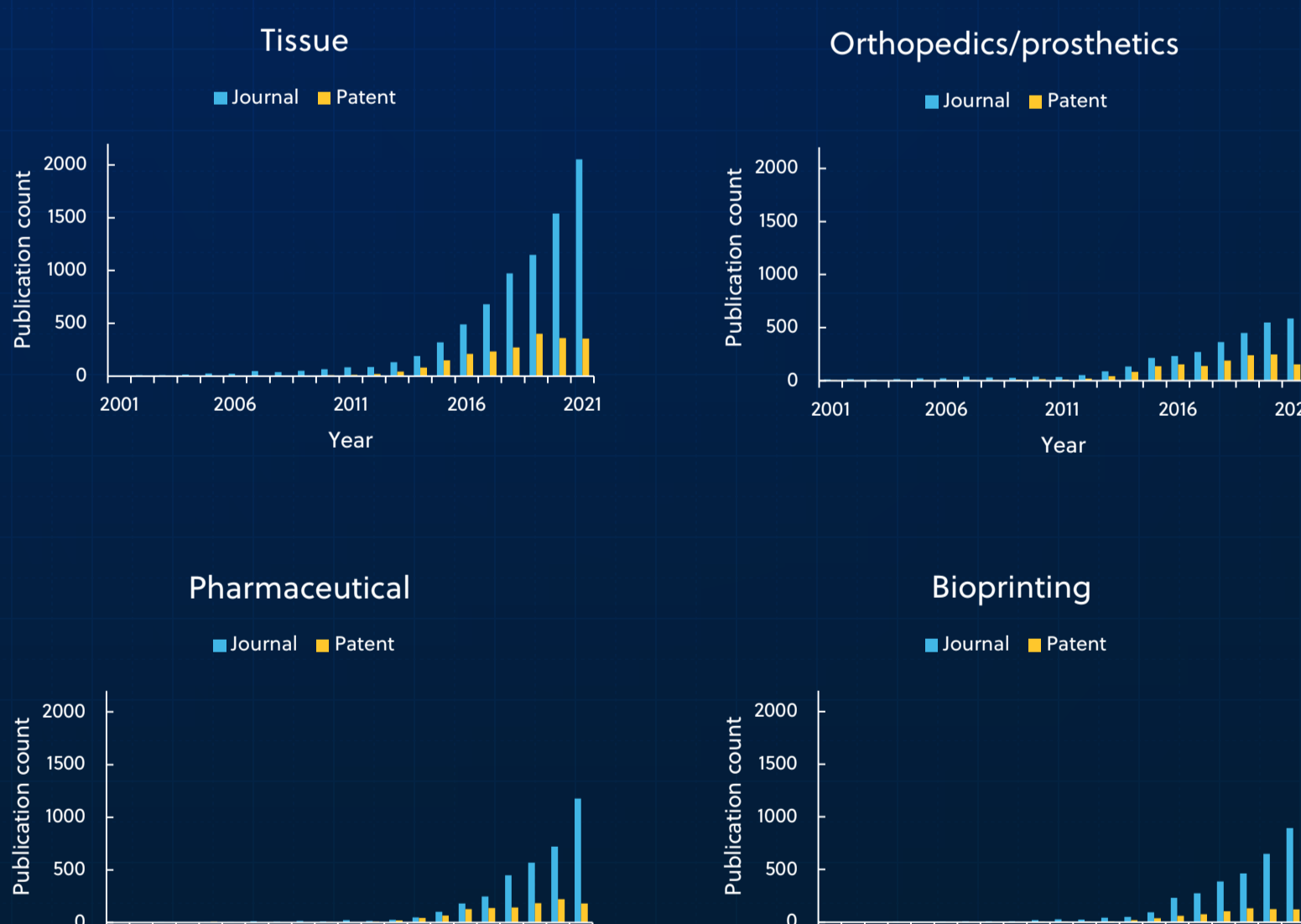
### SPEEDING THE FABRICATION OF MICROFLUIDICS AND SURGICAL INSTRUMENTATION

Manufacturing specialized devices for research and medicine such as microfluidics for lab-on-a-chip and surgical instruments becomes faster, especially when creating and testing prototypes.

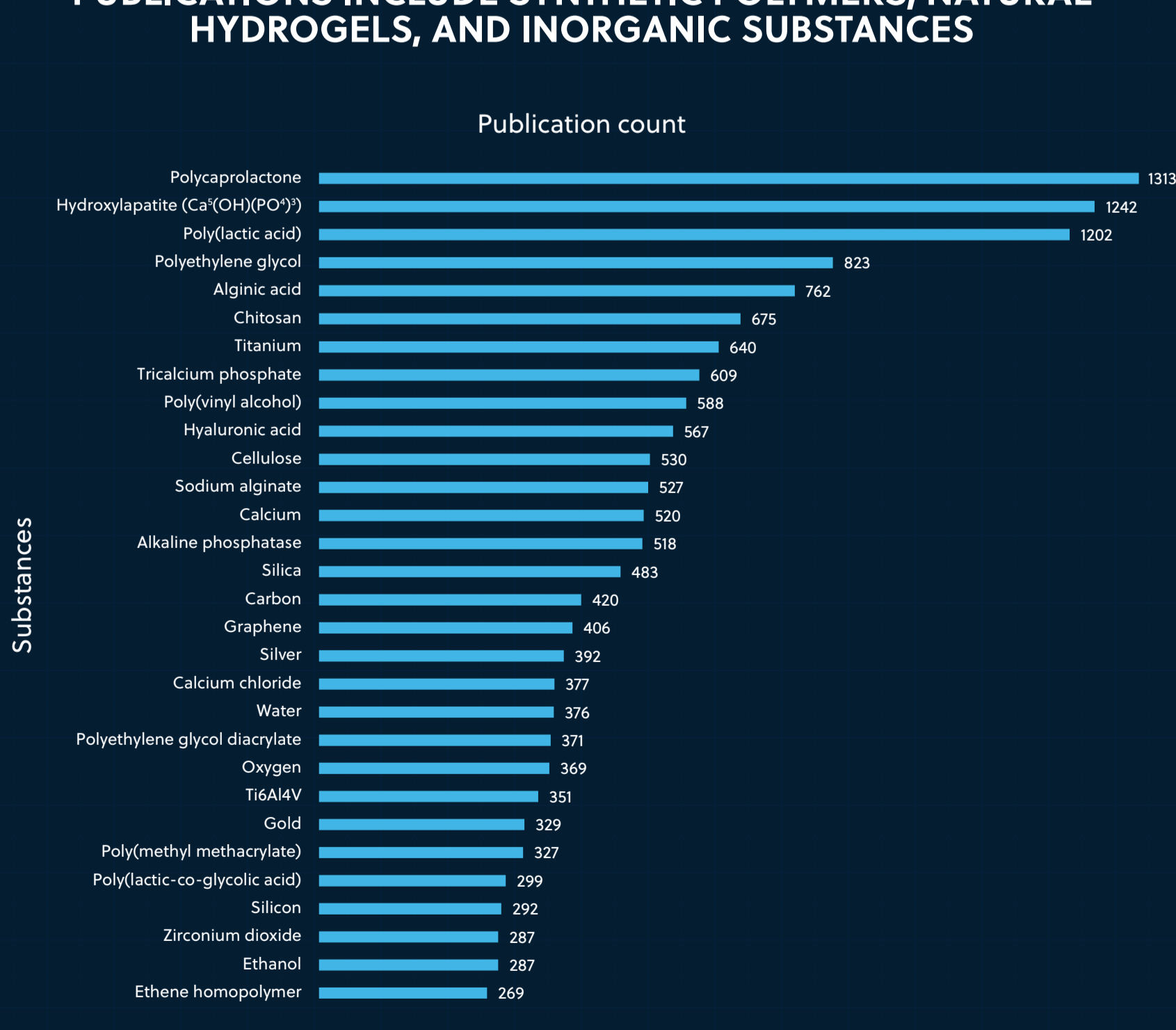
### MOST PUBLICATIONS ON 3D PRINTING INVOLVE TISSUE AND ORGAN FABRICATION



### WHILE THE NUMBER OF JOURNAL ARTICLES IS RAPIDLY GROWING, THE NUMBER OF PATENTS IS HOLDING STEADY OR EVEN DROPPING SLIGHTLY



### THE MOST WIDELY MENTIONED MATERIALS IN 3D PRINTING PUBLICATIONS INCLUDE SYNTHETIC POLYMERS, NATURAL HYDROGELS, AND INORGANIC SUBSTANCES



### EXTRUSION IS THE MOST WIDELY USED 3D PRINTING TECHNOLOGY, USING APPROACHES LIKE FUSED DEPOSITION MODELING (FSD) AND PRESSURE-ASSISTED MICROSYPINGES (PAM)

