

Bioengineering New Organs and Novel Cancer Therapeutics

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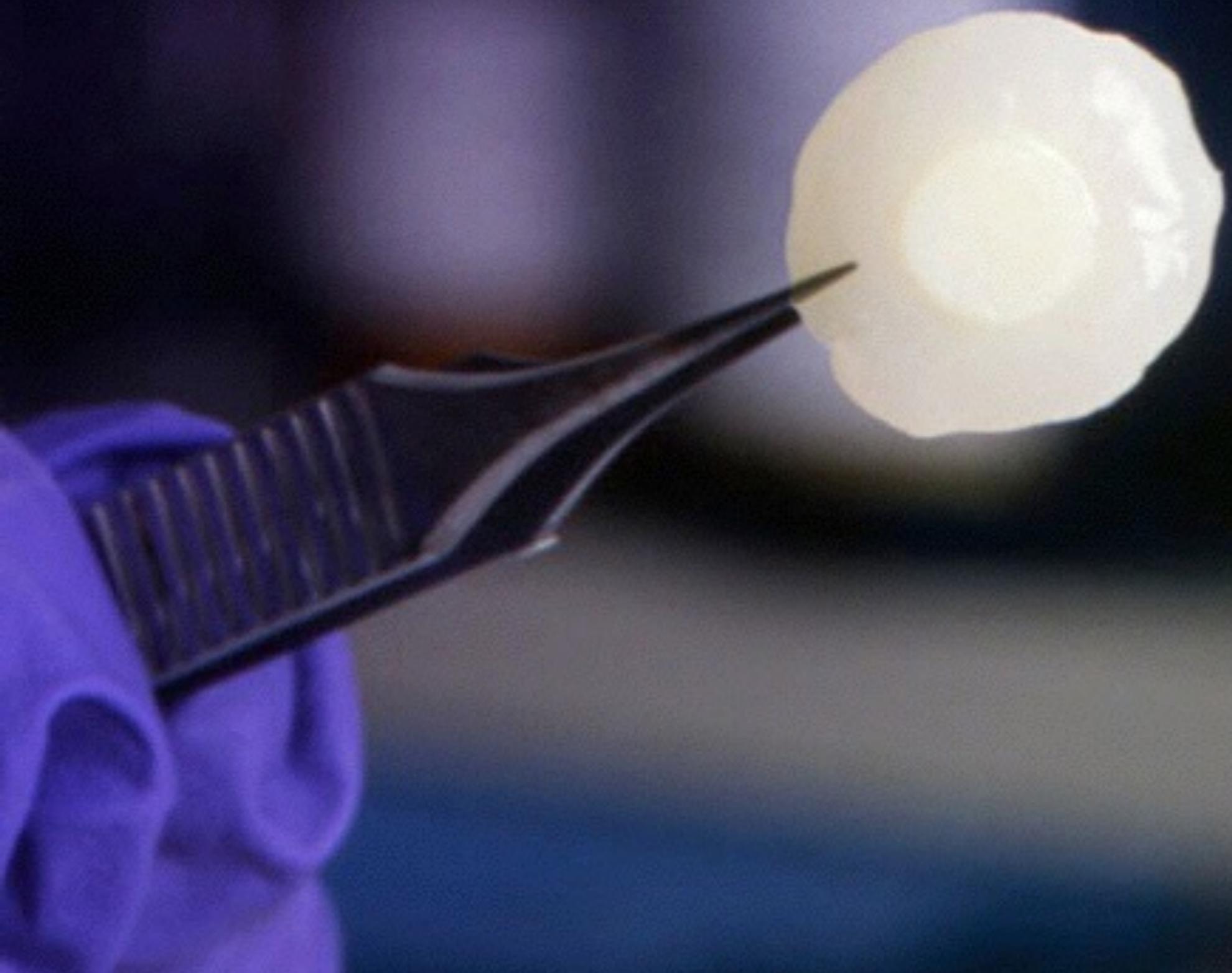
Three topics

1. The father of biomaterials
2. Tissue engineering
3. Cancer therapeutics

Robert Langer



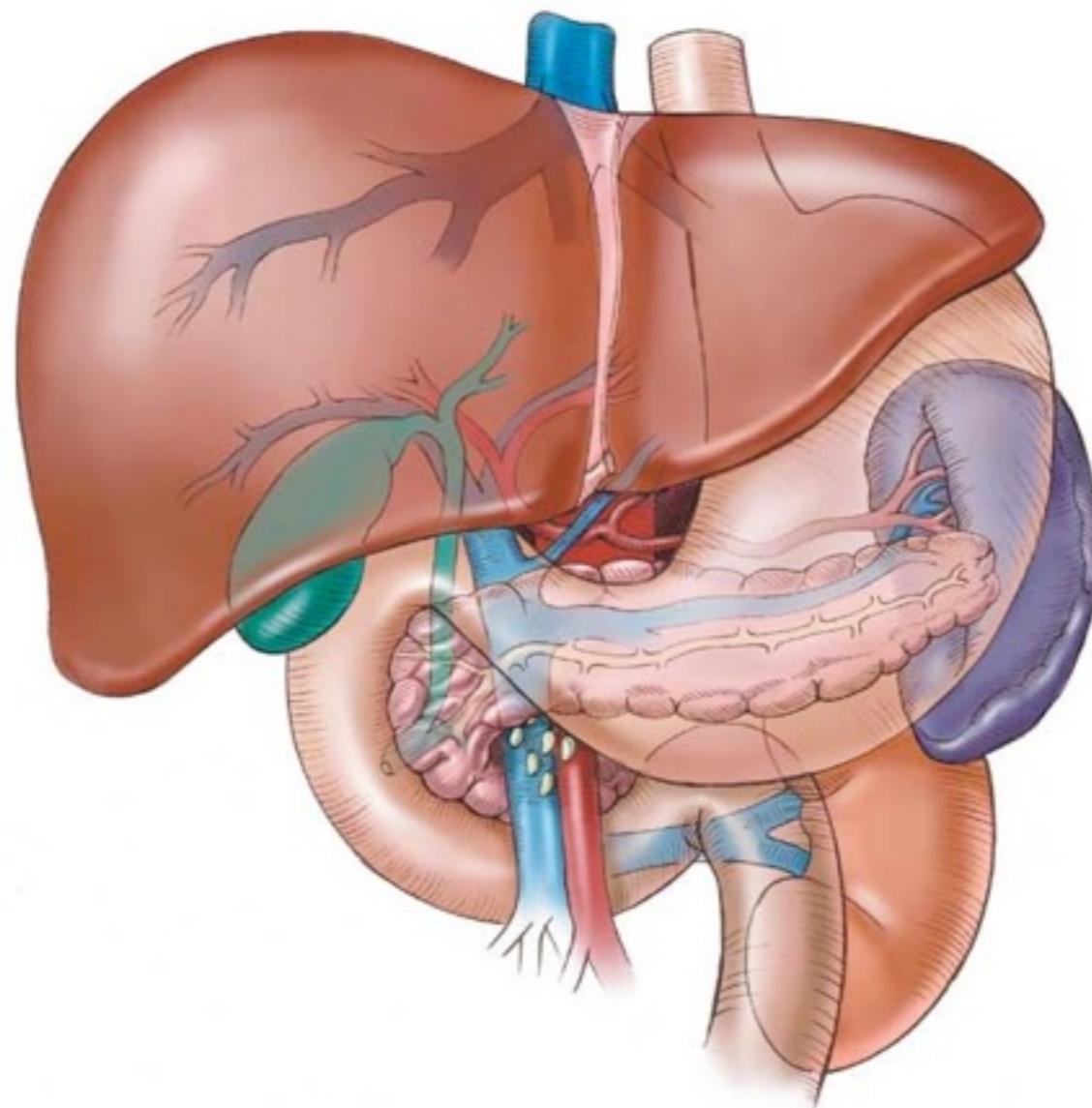
Gliadel



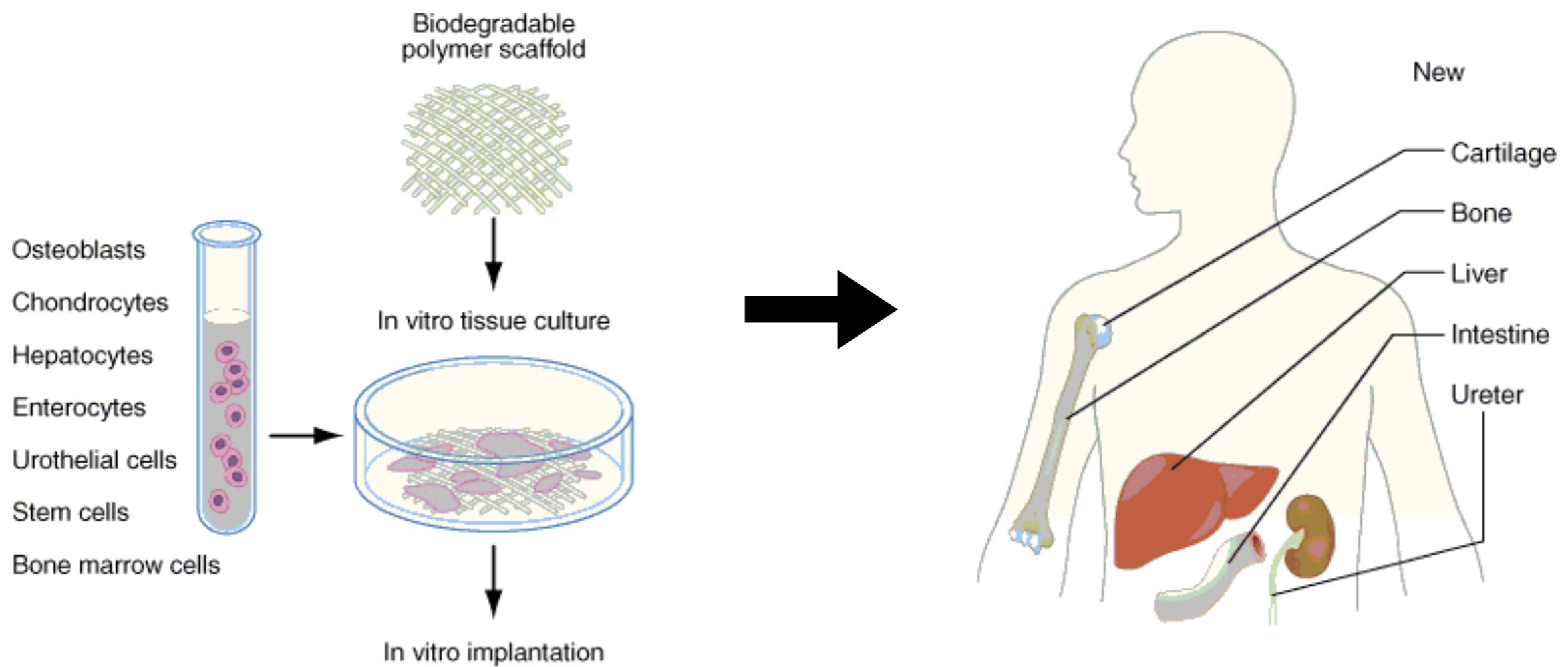
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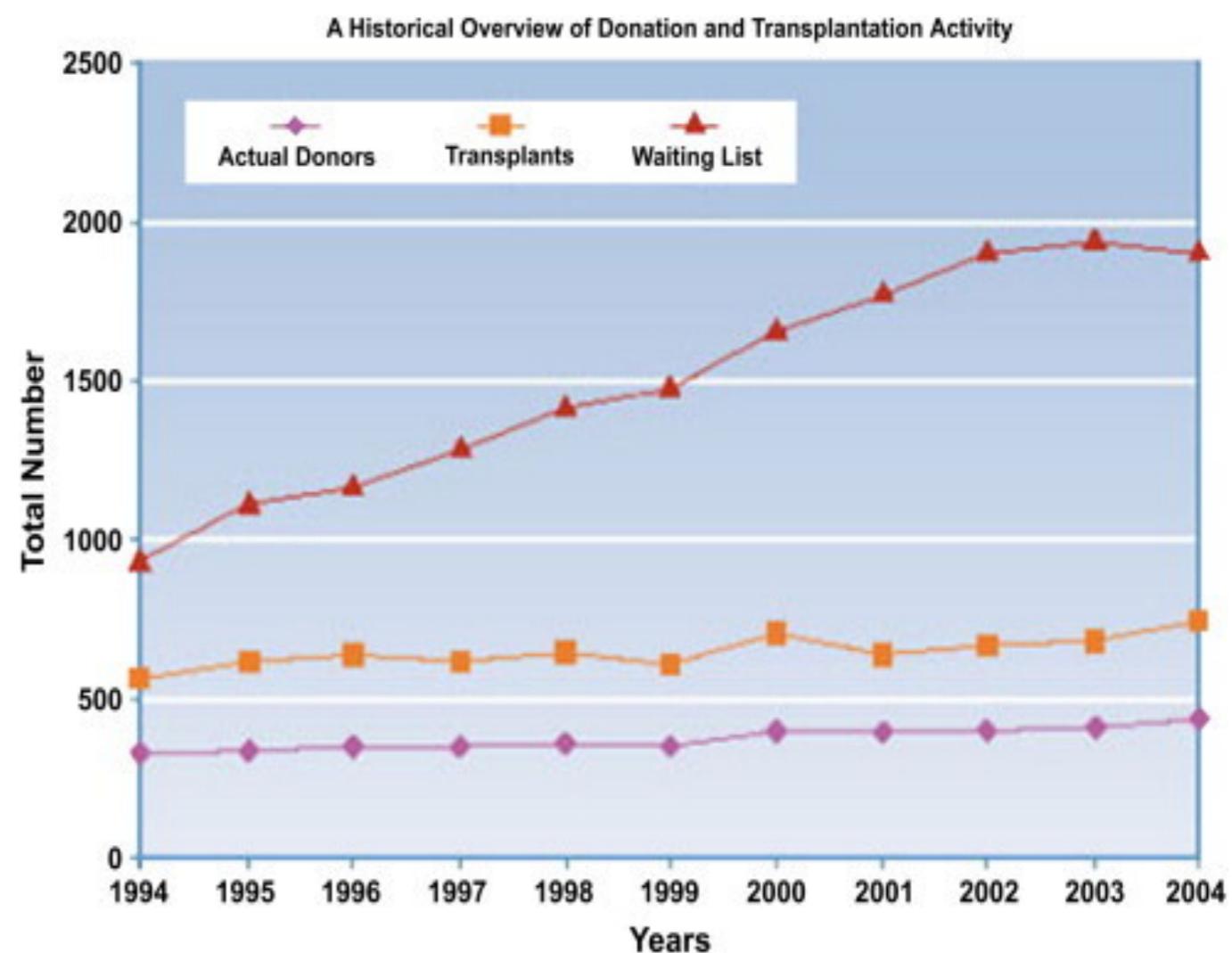
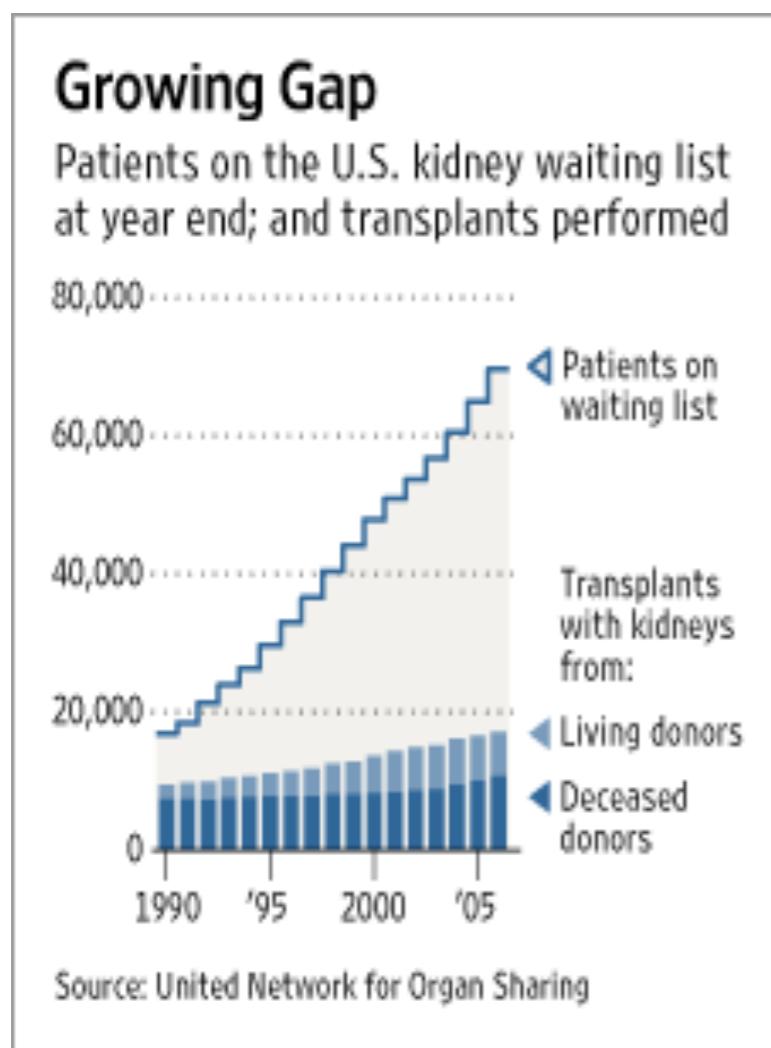
Engineering tissues & organs



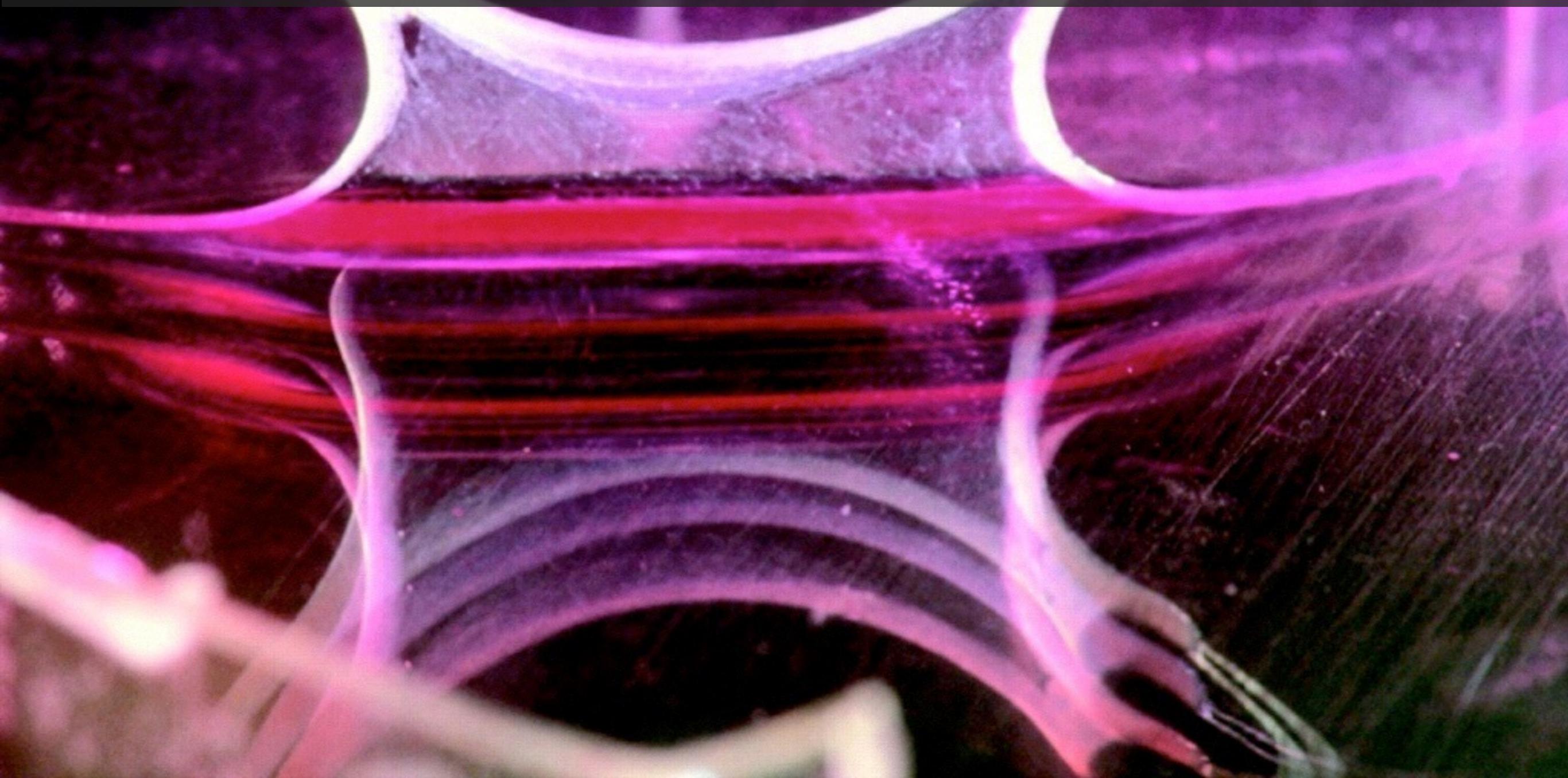
Engineering tissues & organs



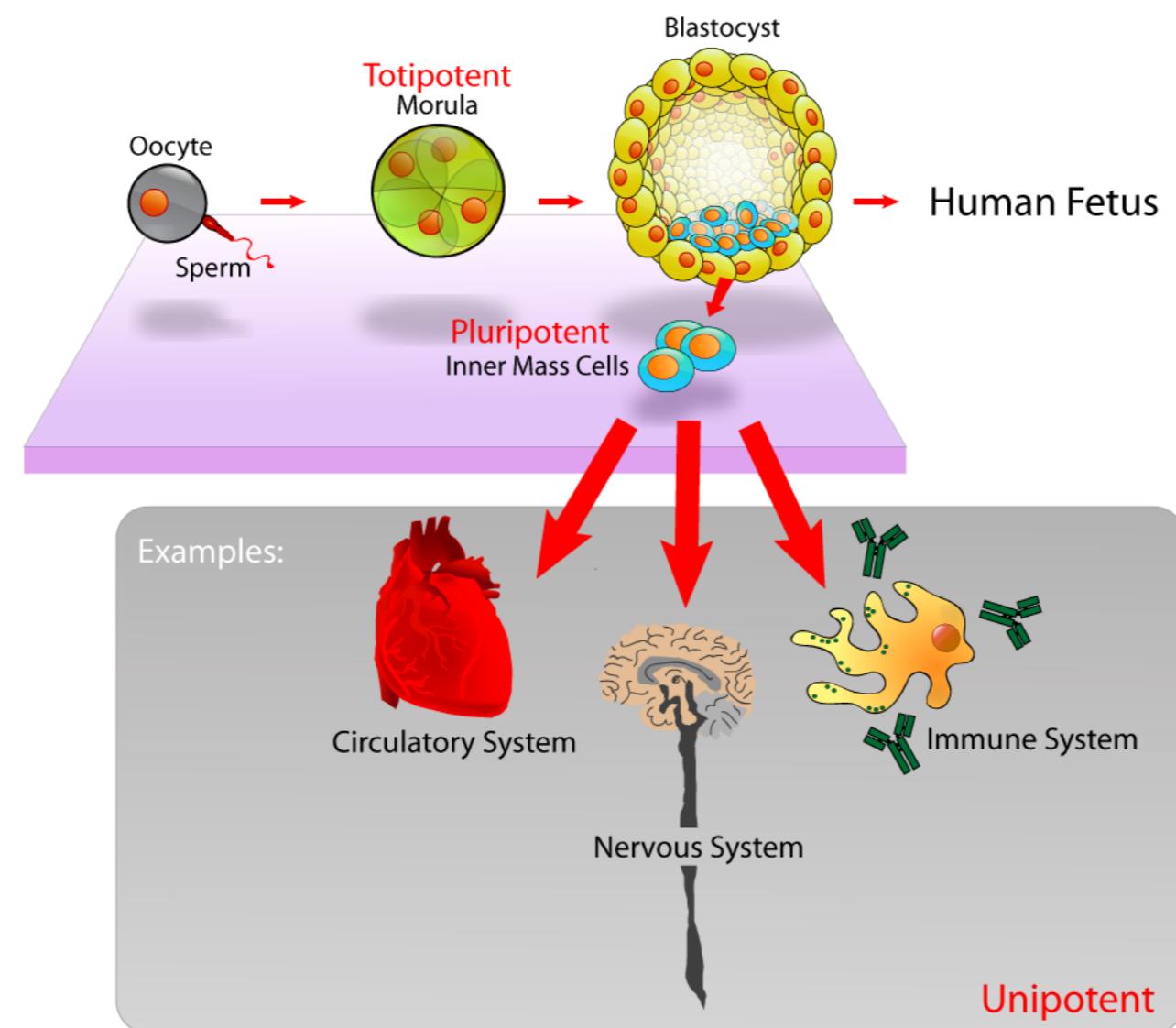
Tissue engineering could address organ shortages



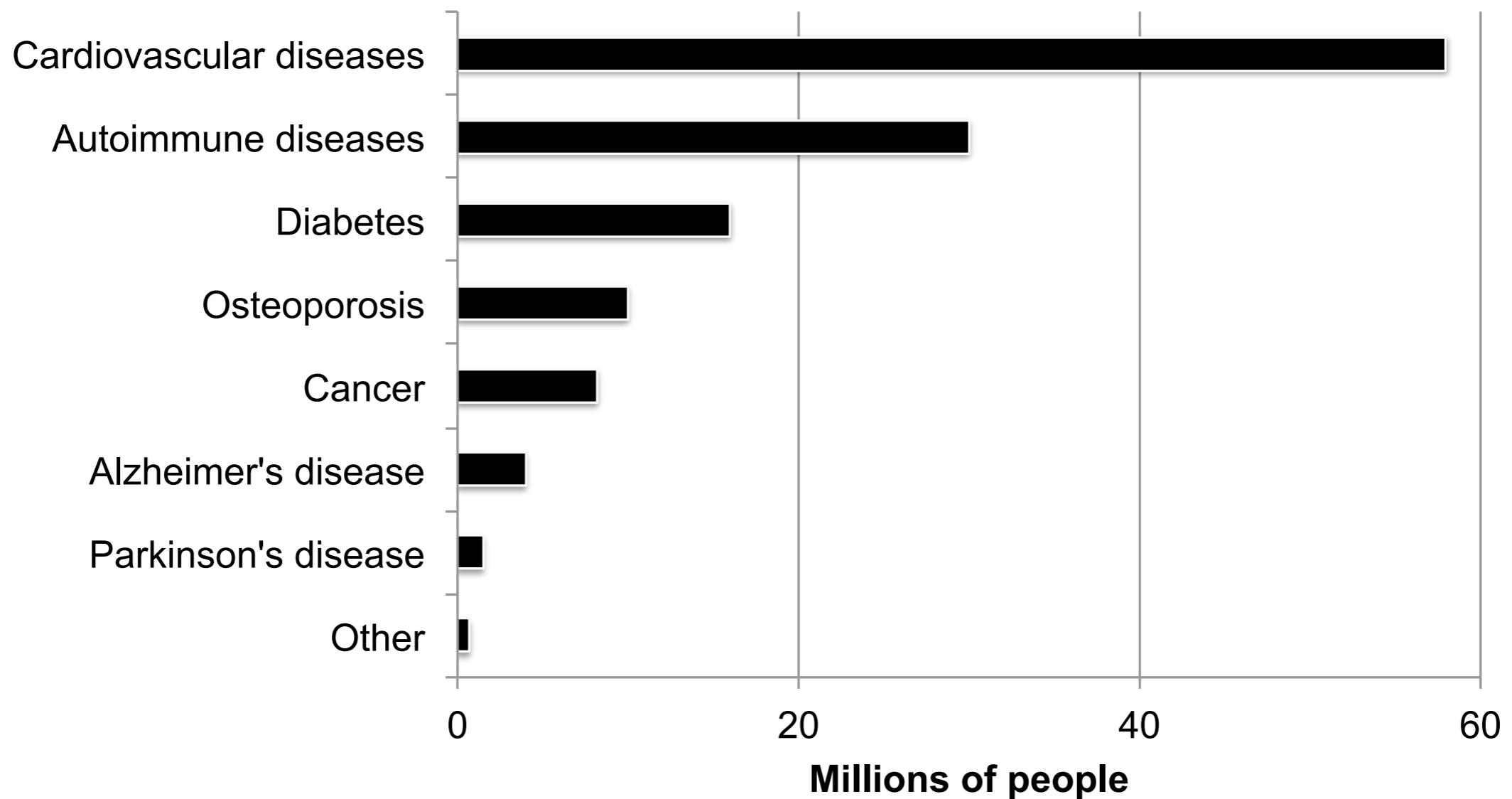
In vivo-like platforms for pharmaceutical testing



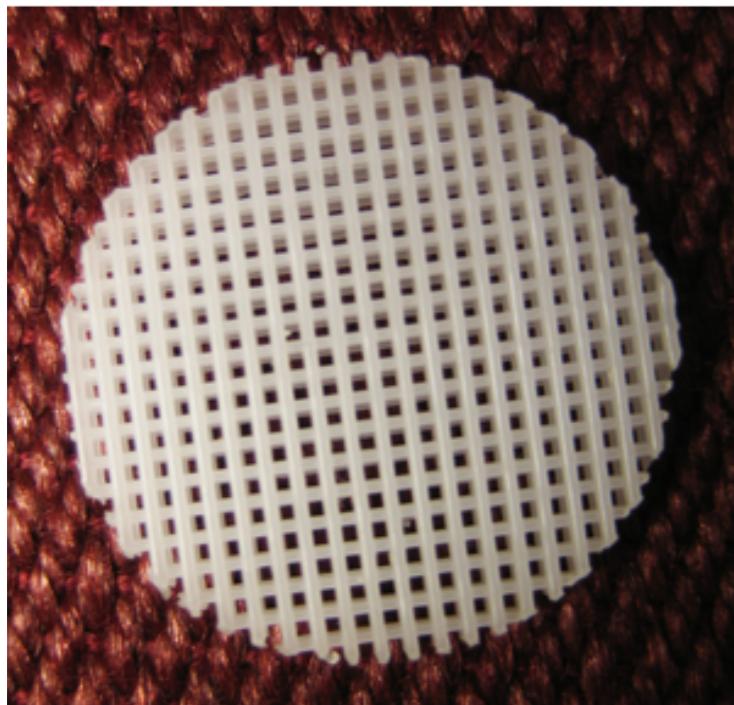
Huge potential in tissue engineering + stem cells



Stem cell therapies could help millions of patients



Scaffolds engineered from biocompatible polymers



PLGA¹



PCL²



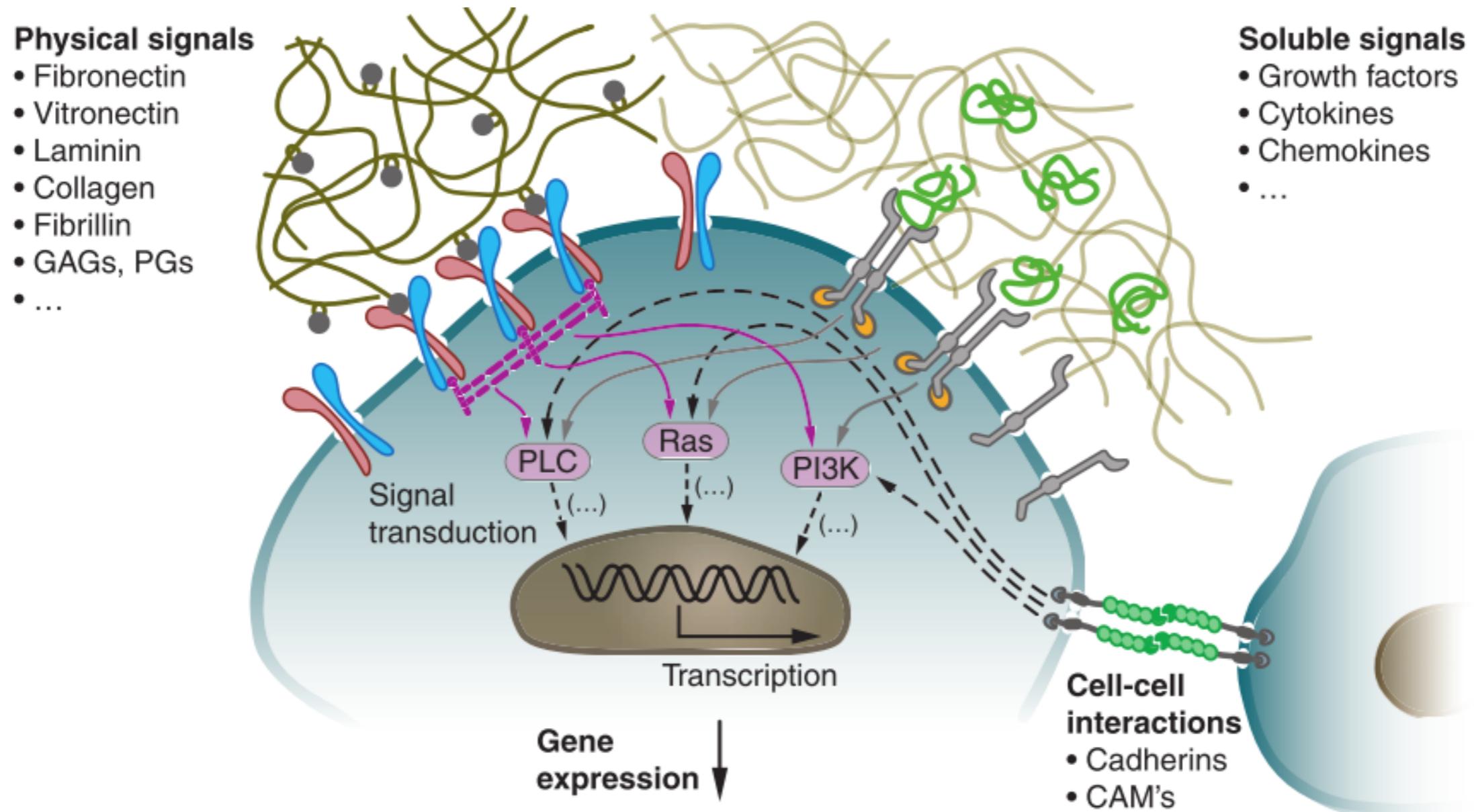
Collagen³

1. www.techno-isel.com

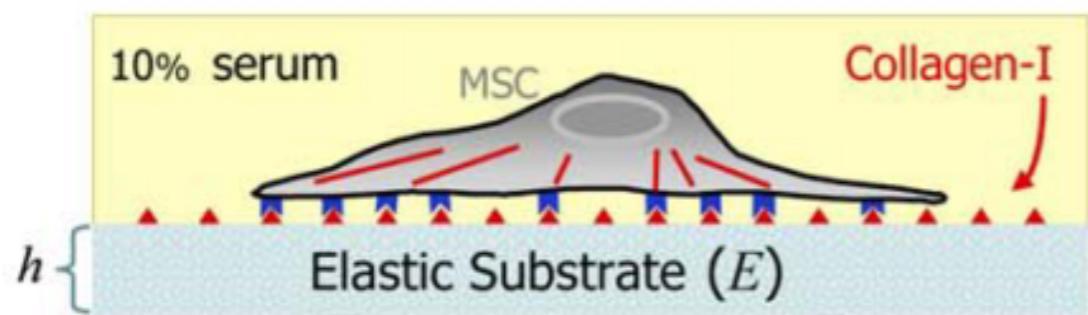
2. Wu Lab, UCLA Department of Bioengineering

3. www.pharmainfo.net

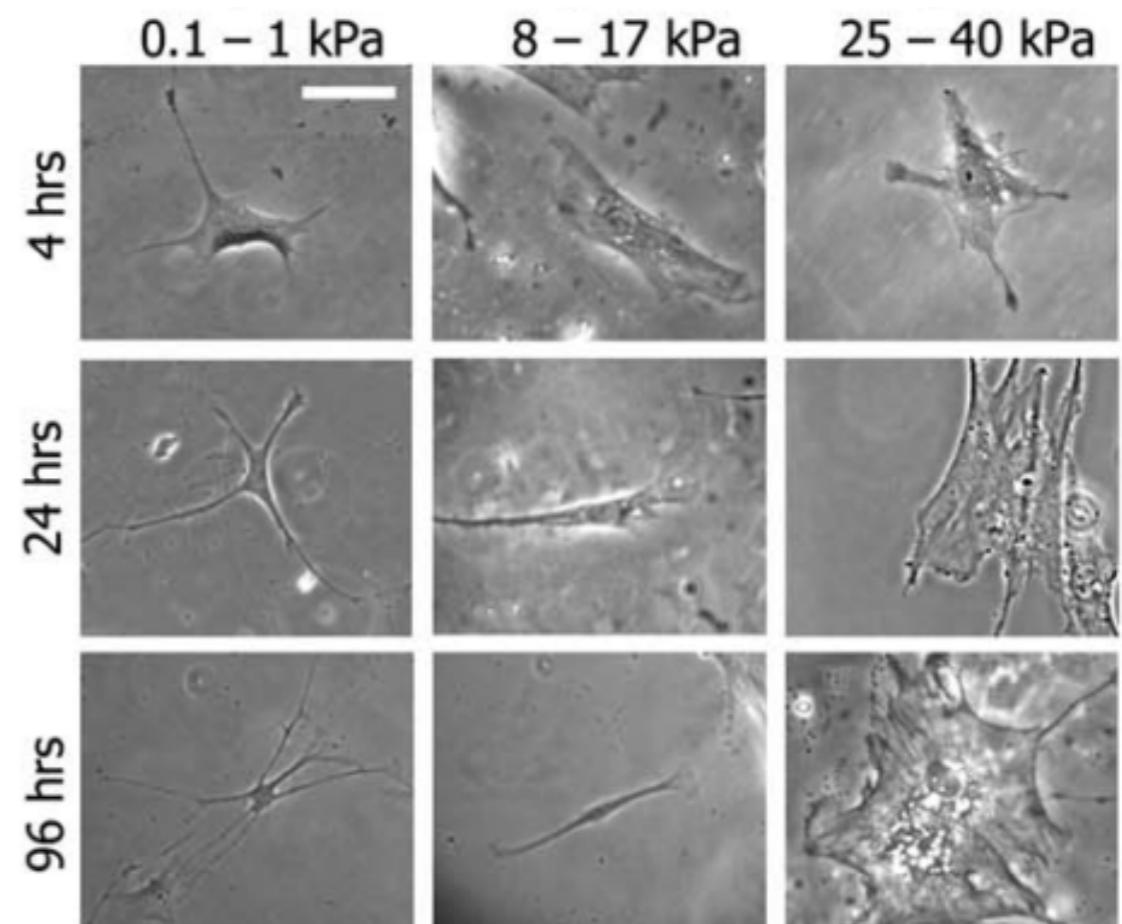
Biochemical signals



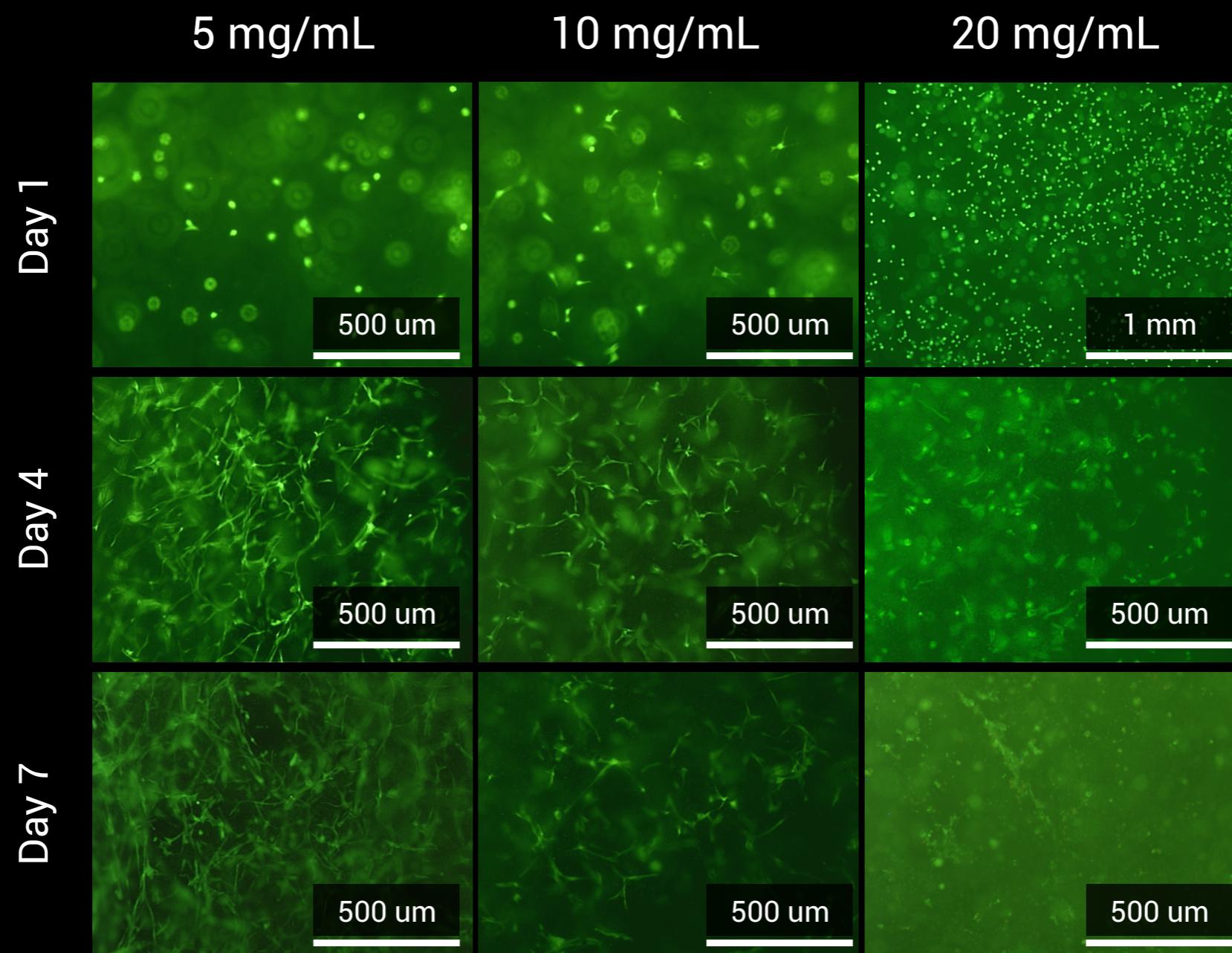
Physical signals



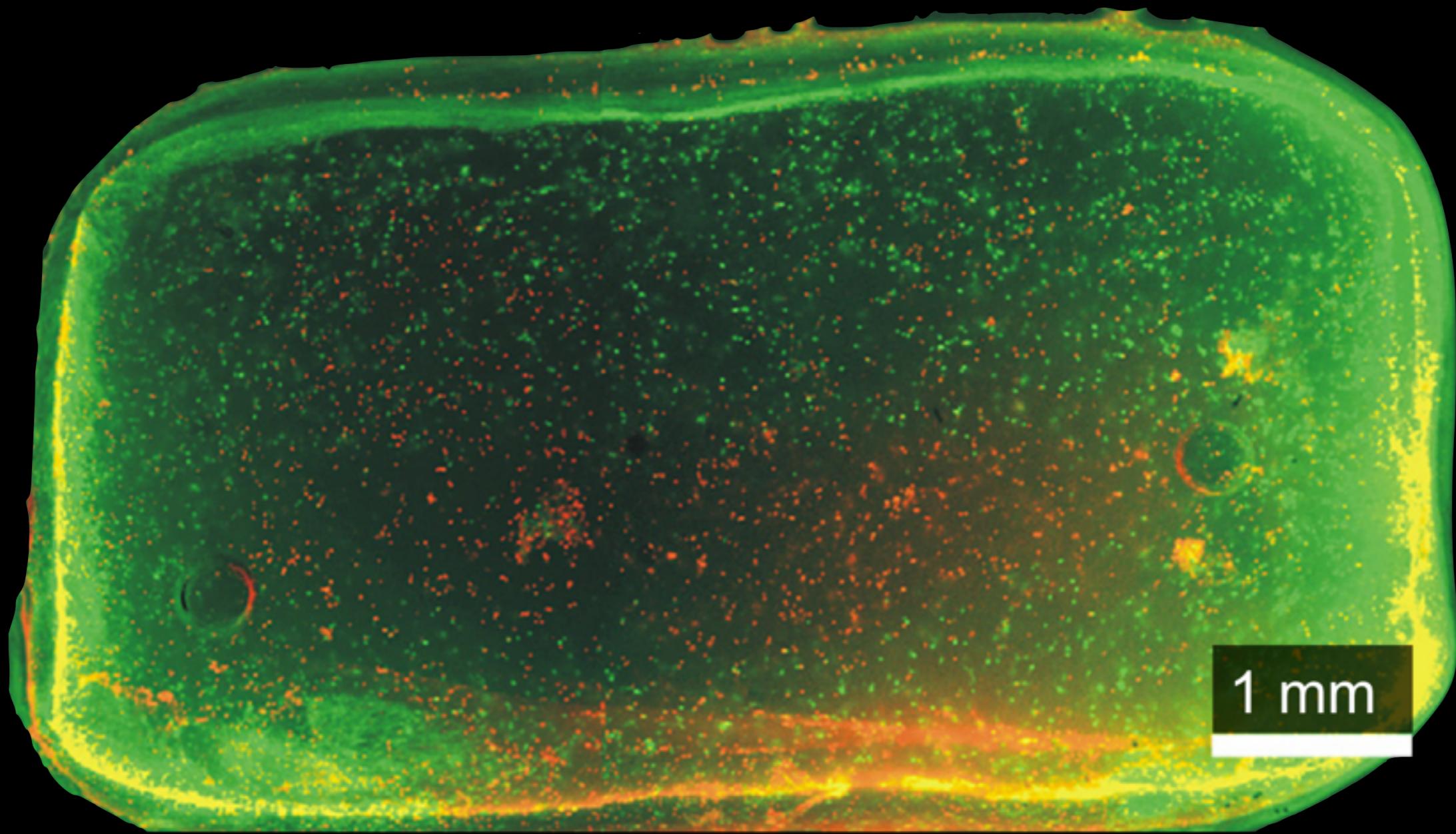
MSC morphology changes with elasticity



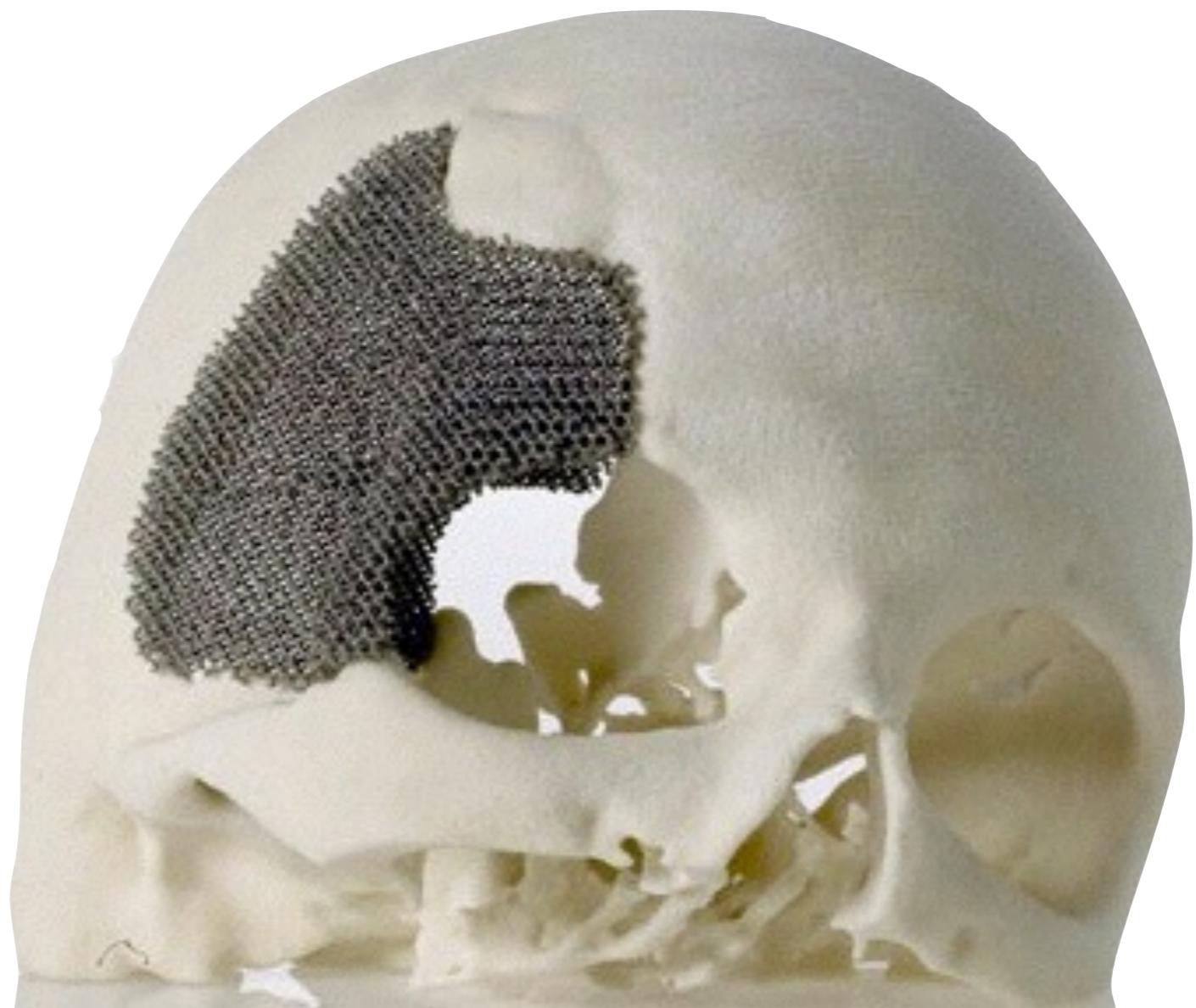
Fibroblasts spread more in lower fibrin concentration



Cell viability is limited by oxygen transport



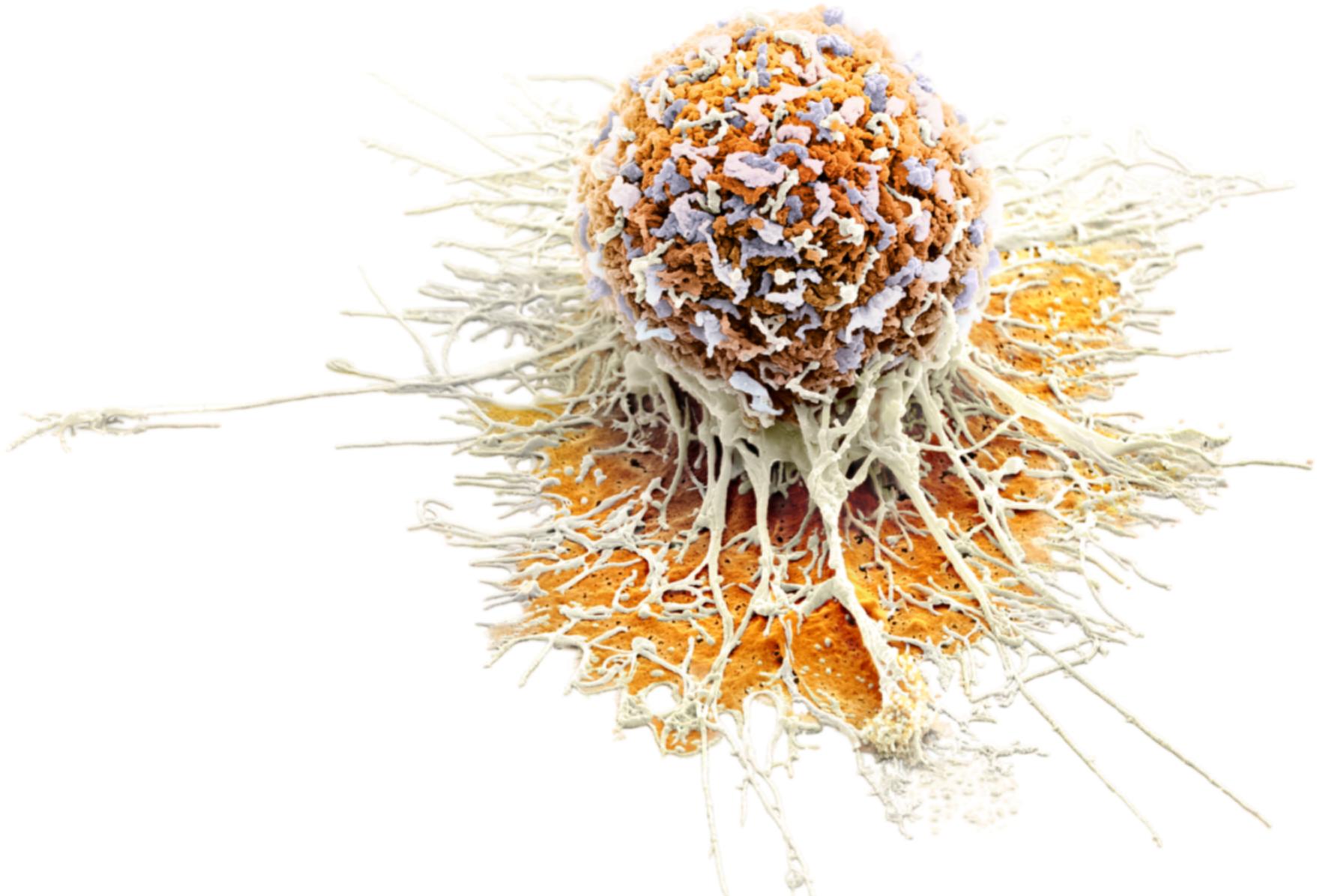
3D printing offers novel methods of shape control



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Cancer is the **#1 killer** in the world



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Worldwide

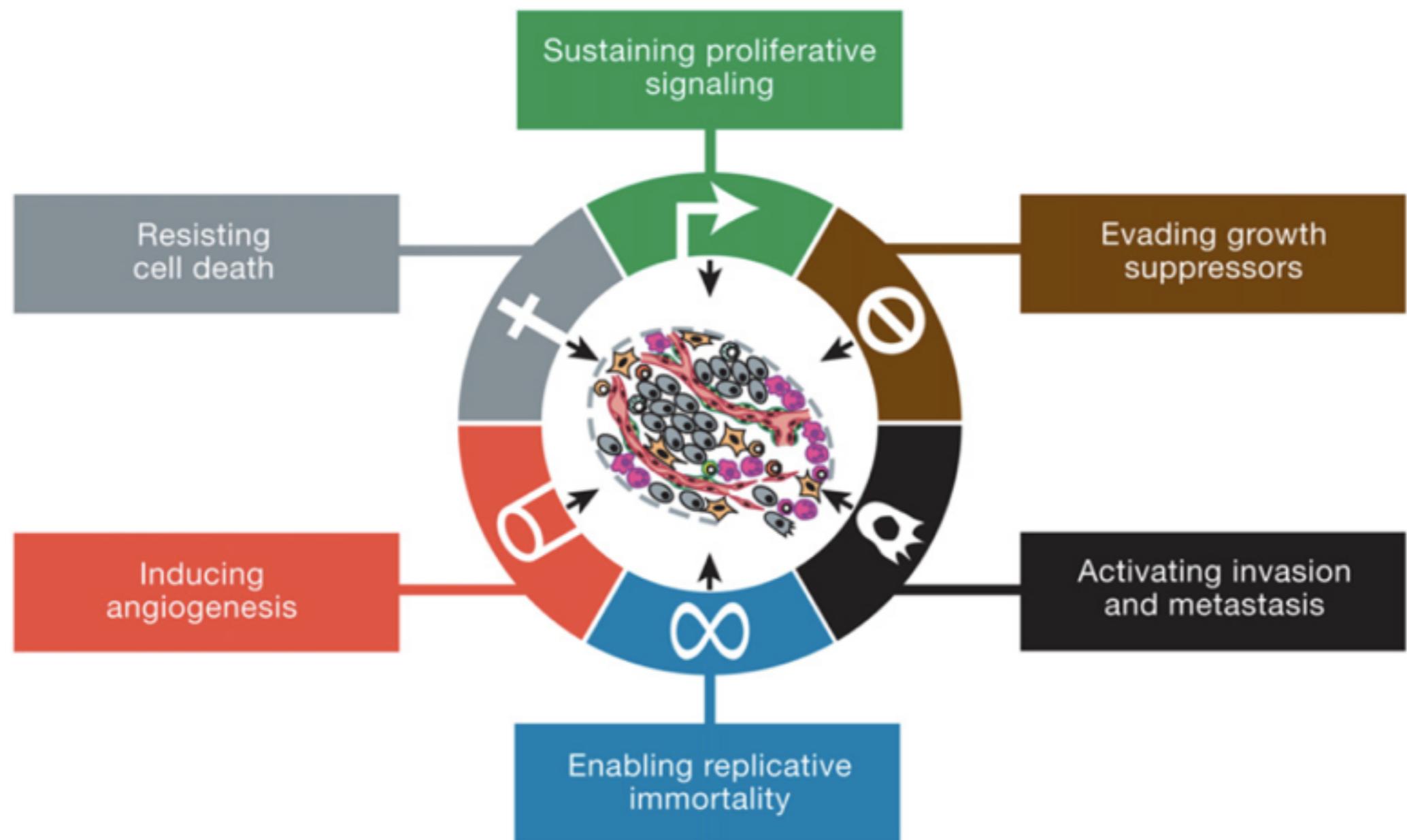
- 7.6 million deaths



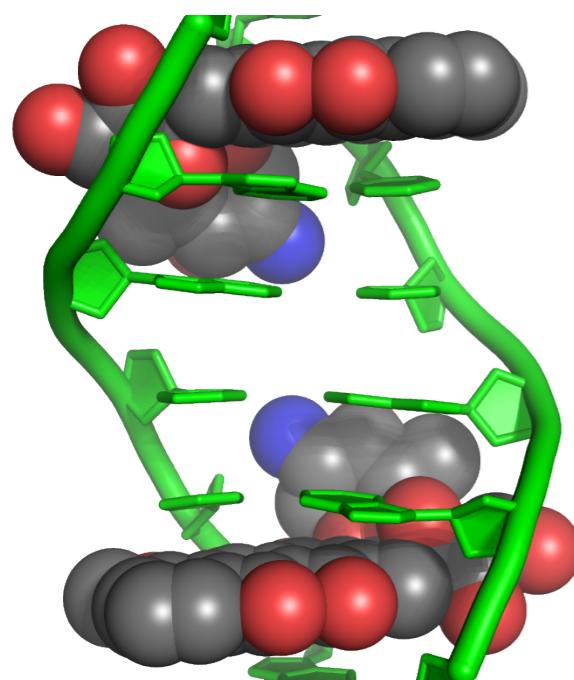
In the US alone

- 1.5 million cases
- 600,000 deaths

Six hallmarks of cancer



Current cancer therapeutics are limited



Chemotherapy

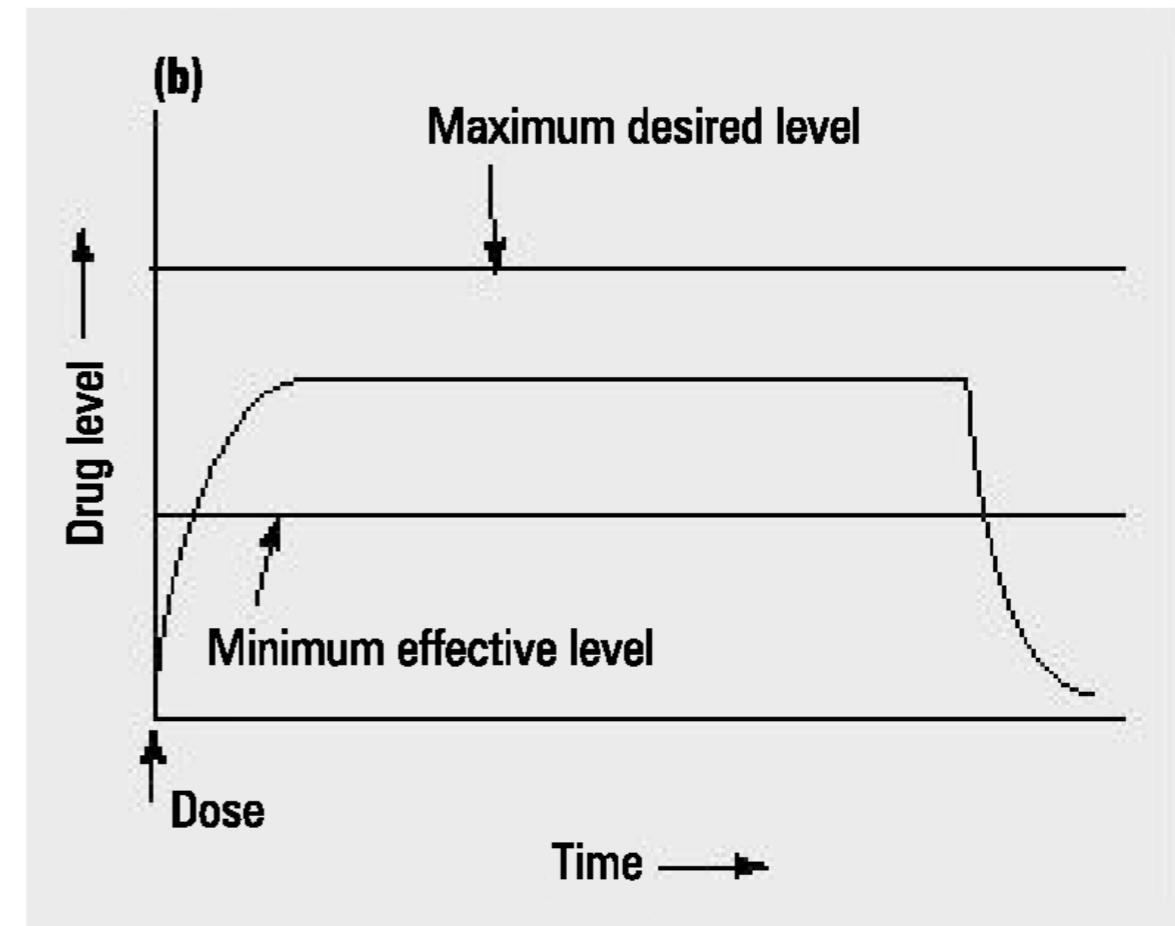
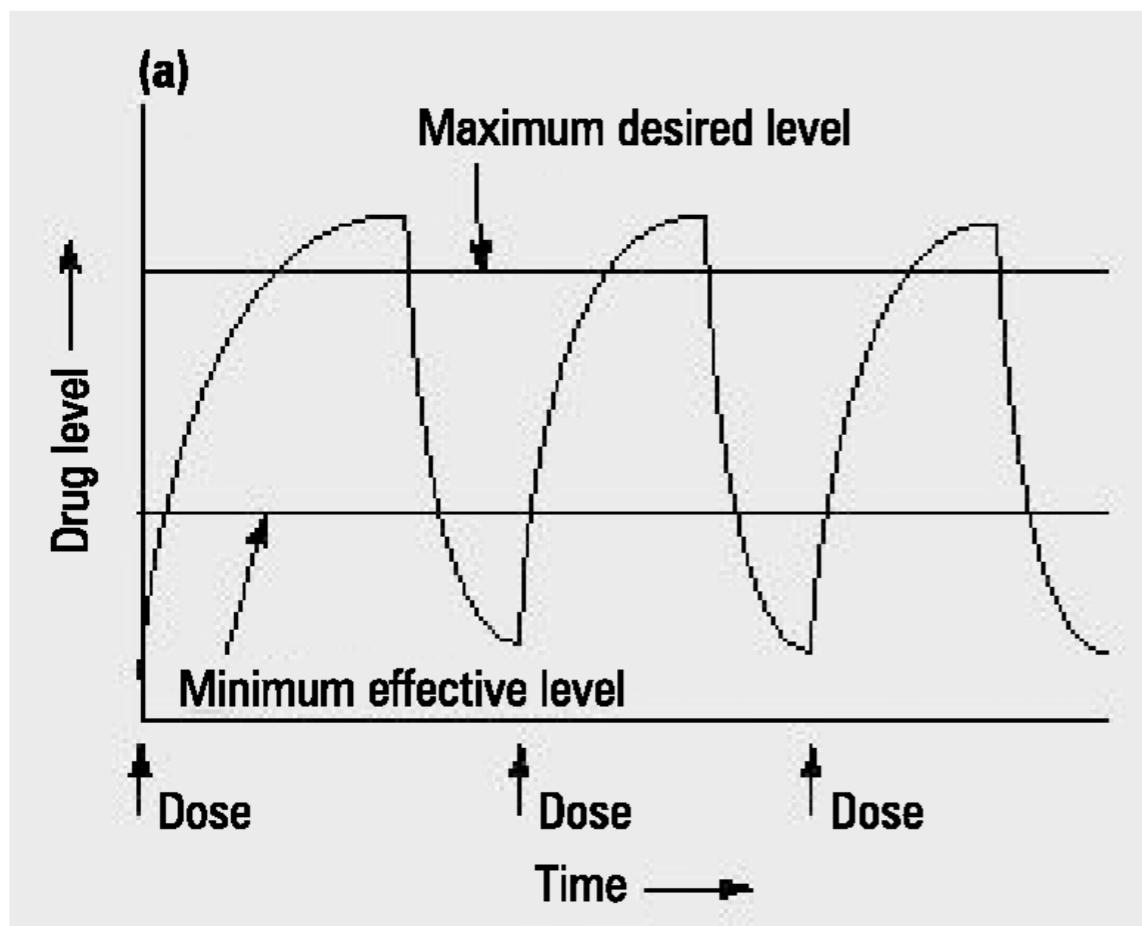


Antibodies



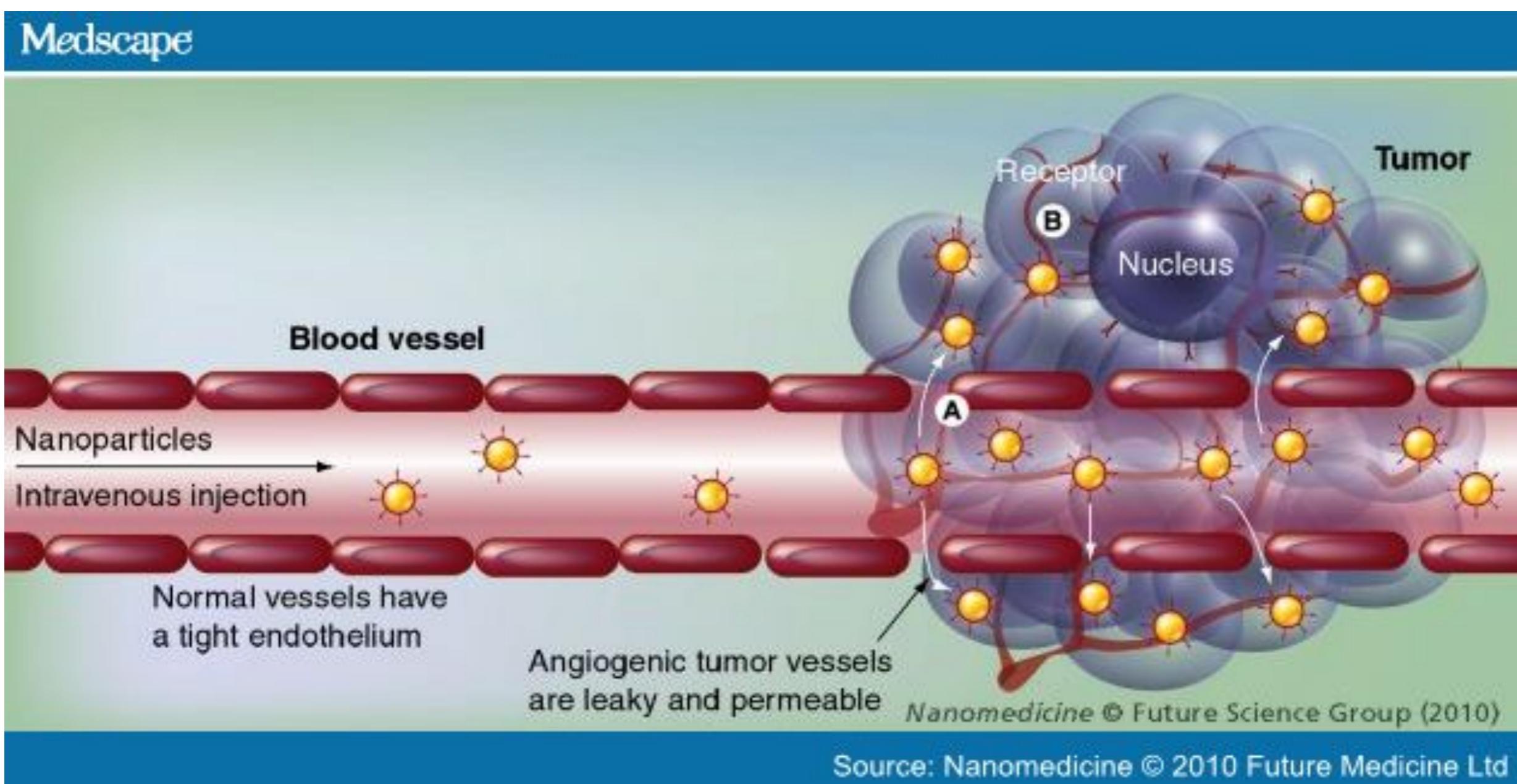
Surgery

Controlled drug release reduces nonspecific effects



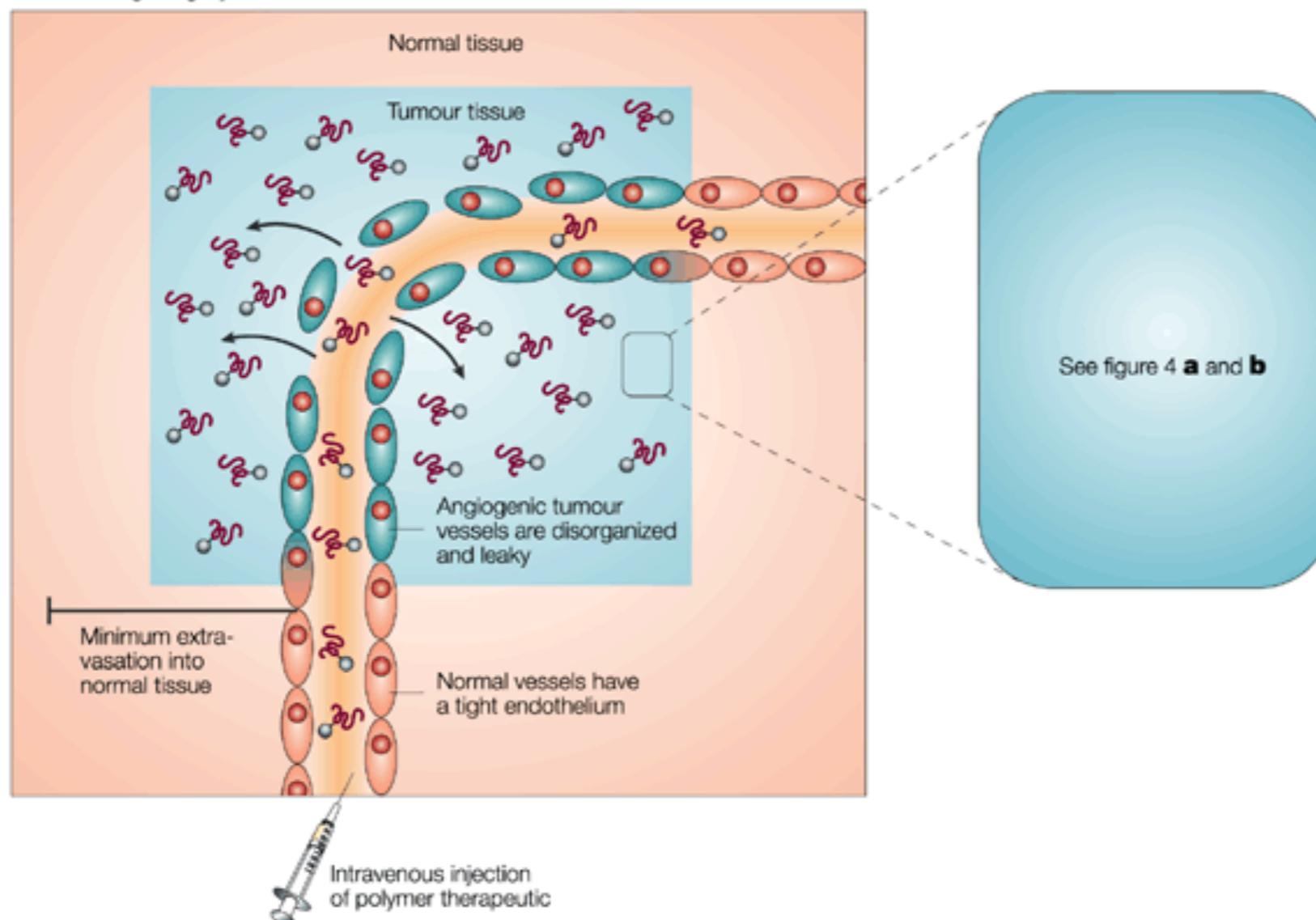
Source: Peppas (1997)

Biomolecular targeting for cancer therapeutics



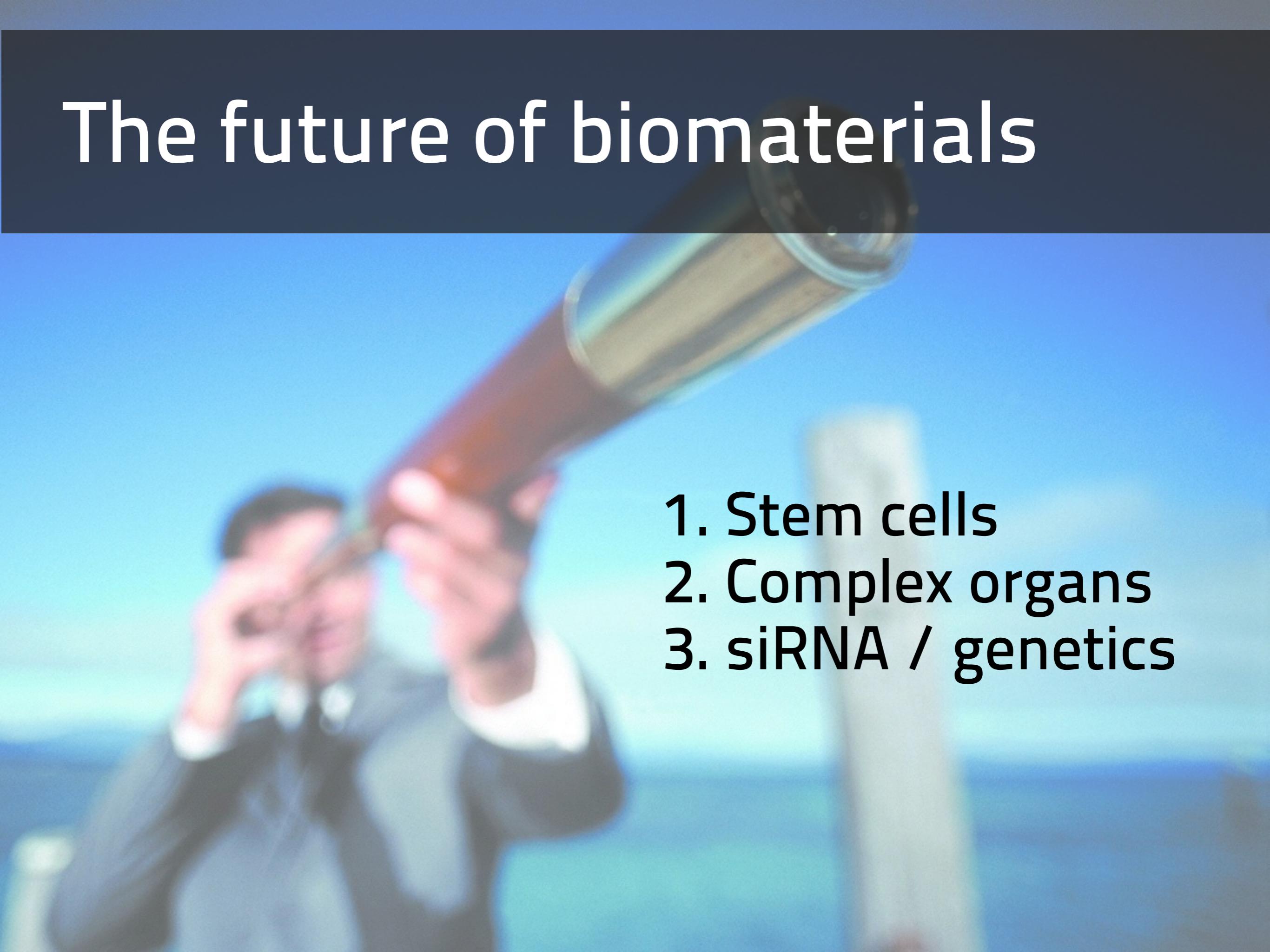
Enhanced permeability and retention (EPR) effect

Tumour targeting by EPR effect



Macromolecules and particles between **60-400 nm** accumulate in tumors

The future of biomaterials

- 
- A blurred background image of a scientist in a lab coat and gloves holding a test tube containing a red liquid. The scientist is positioned on the left side of the frame, with their hands and the test tube being the most distinct parts against a blue gradient background.
1. Stem cells
 2. Complex organs
 3. siRNA / genetics

Biomaterials is a highly multidisciplinary field

Physics

Materials science

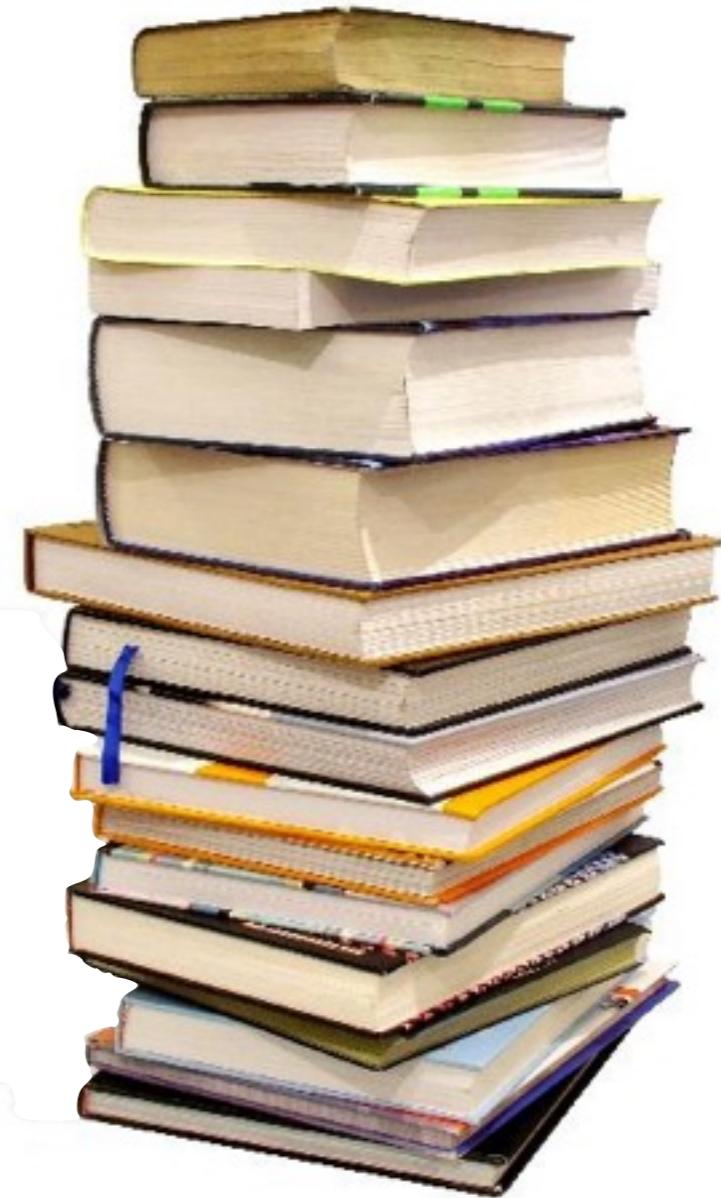
Cell biology

Medicine

Biochemistry

More (free) resources

PLoS
TED talks
iTunes U
@erikreinertsen



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Bioengineering

