

## Humana tkiva iz laboratorije za regenerativnu medicinu i nove lekove



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### Krivak i SANU

Beograd, 9. April 2015

## Motivacija:

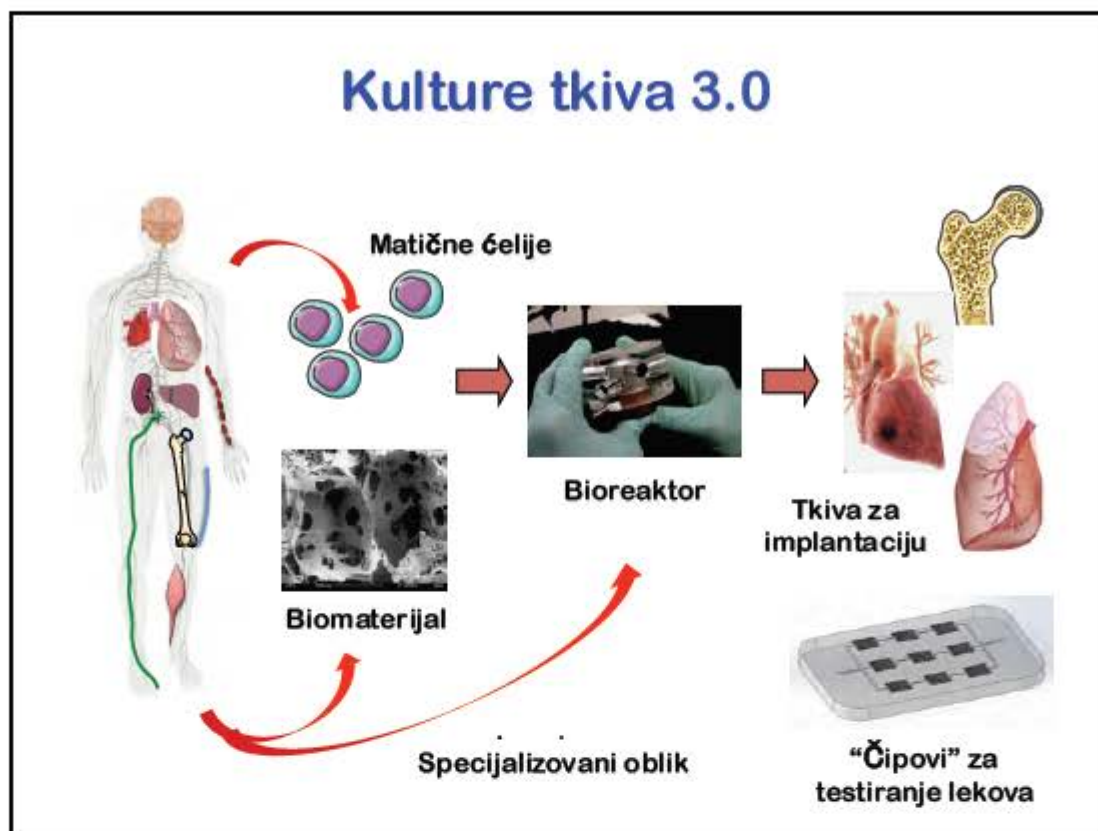
- Živimo duže i bolje nego ikada pre, sve više su nam potrebni “rezervni delovi”
- Humana tkiva mogu da se gaje u laboratoriji
  - Implantacija
  - Testiranje novih lekova

### Prosečan životni vek

Stara Grčka	28
Kraj 19 veka	40
Danas	80

**Kulture tkiva 1.0**






## Prirodni biomaterijali:

### Extracellular Matrix Biomaterials


ECM Scaffolds | Sponges | Hydrogels | Solutions

Specific organ- and tissue-derived ECM Biomaterials




Next generation three-dimensional, 100% natural, bioactive, tissue-specific micro-environments for stem cell differentiation, maturation, and tissue engineering

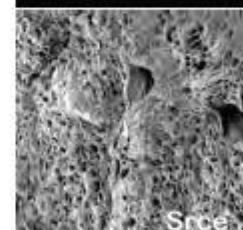
14 organ sources | human | animal | healthy | diseased




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**Kost**

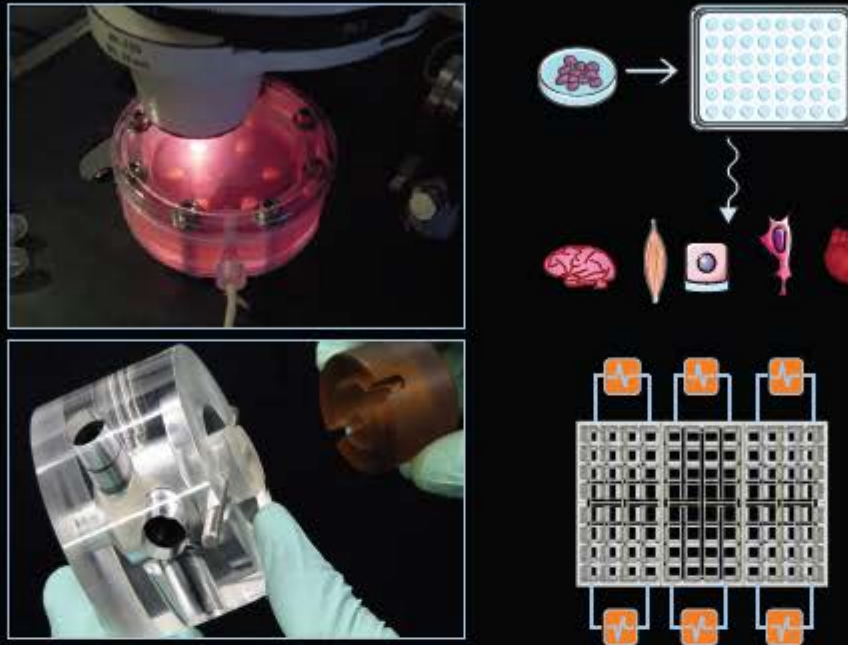


**Spica**






**Bubreg**

## Bioreaktori:



## 1. Kost:

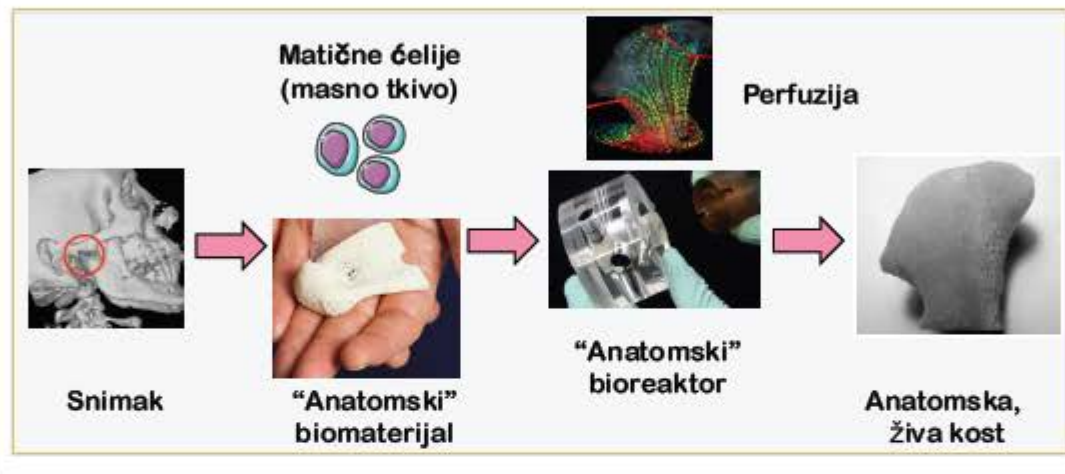
	<p><b>Prirodna kost</b></p> 	<p><b>Protein + mineral</b></p> 	
			
<p><b>Matične ćelije</b> Velika količina Biolška aktivnost</p>	<p><b>Biomaterijal</b> Mehanika Oblik, struktura, signali</p>		<p><b>Bioreaktor</b> Nutrijenti, kiseonik, signali</p>

## Veliki problem, novi pristup:



### Defekti lica i glave

- Urodjene mane, povrede, kancer
- Fizička i psihološka trauma



"A splendid example of tissue engineering at its best"

The New York Times

"An advance which could revolutionize reconstructive surgery"



Engineering anatomically shaped human bone grafts

Wang, L., George, M., Miller, F., et al. (2010). "Anatomically Shaped Human Bone Grafts." *Journal of Tissue Engineering and Regenerative Medicine*, 4(1), 1-10.

October 5, 2010 | [30 comments](#)

Breakthrough: Bone Graft Grown in Exact Shape of Complex Skull-Jaw Joint

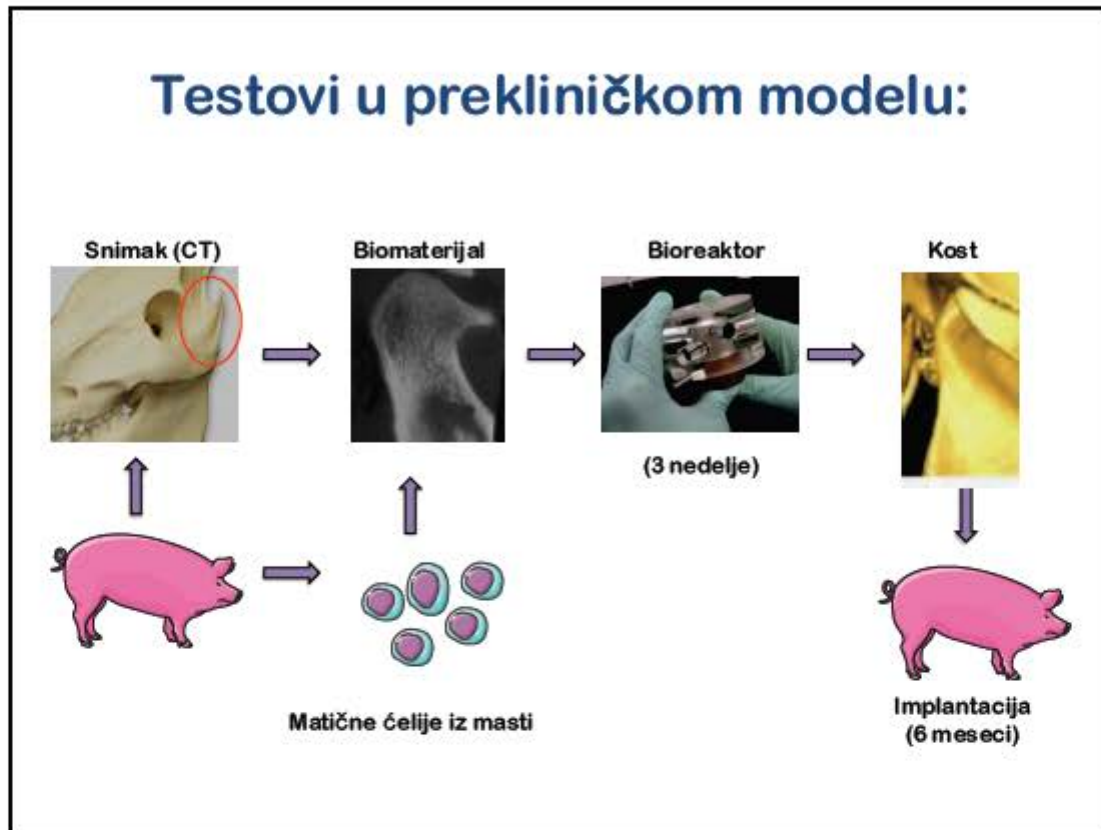
Technique could be a preferred substitute for replacing missing or damaged bones with titanium, donated bones or those harvested from elsewhere in a patient's body

By [Charles Q. Choi](#)

Replacement Bones, Grown to Order in the Lab

The researchers used a 3D printing technique to create a custom-shaped bone graft that perfectly fits the patient's skull-jaw joint. The graft is made from a porous material that allows for blood vessel growth and bone integration.

## Testovi u prekliničkom modelu:



## Organizacija:



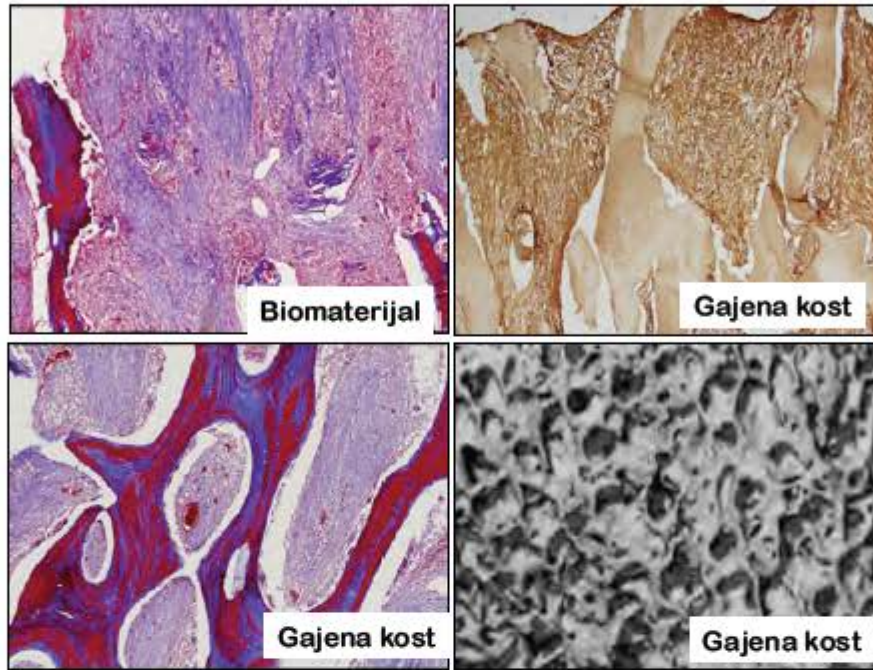
### Novi bioreaktor:



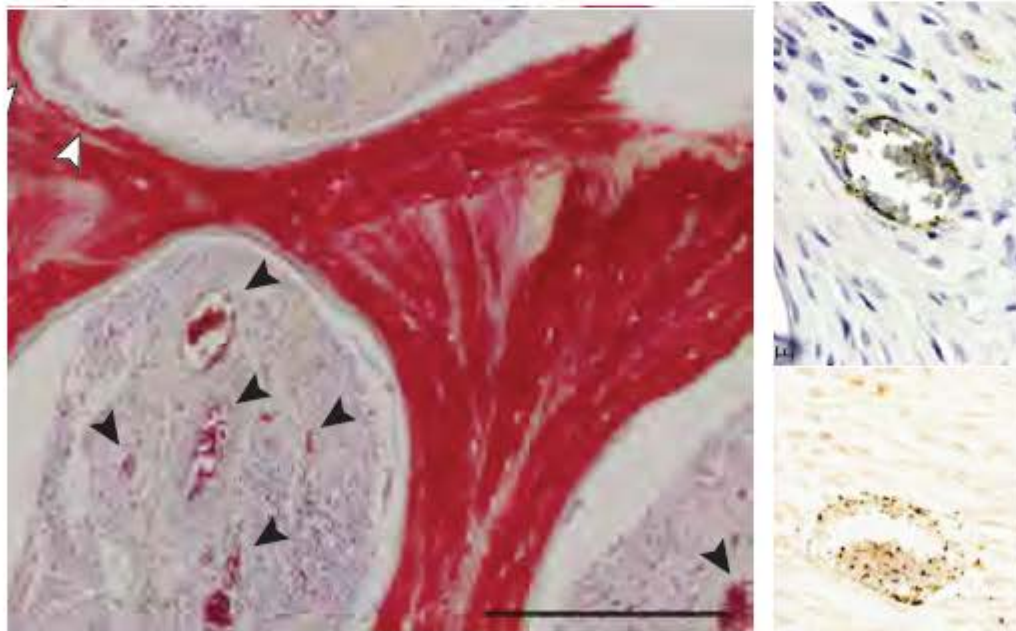
### Implantacija:



### Implantirana kost (posle 6 meseci):

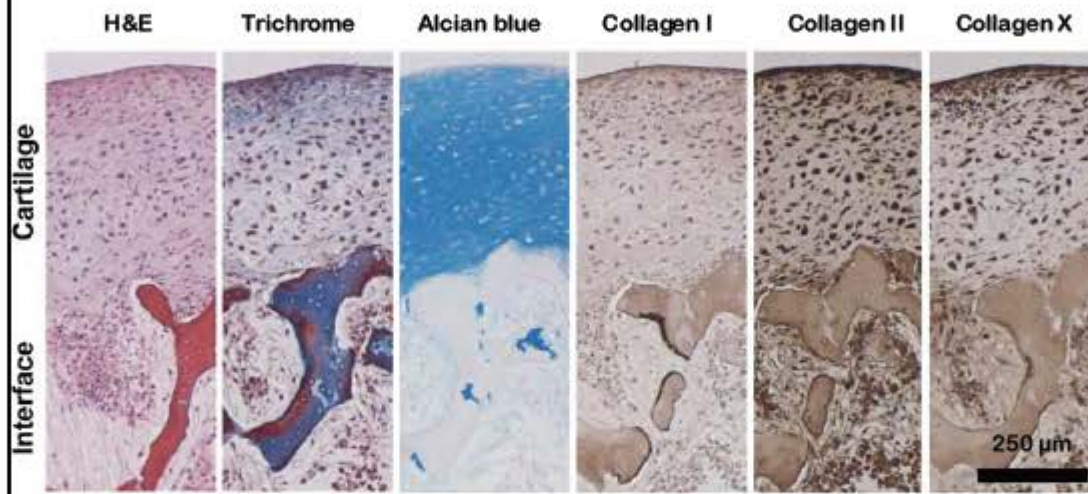


### Gajena kost (6 meseci):





## Fiziološki jaka humana hrskavica:



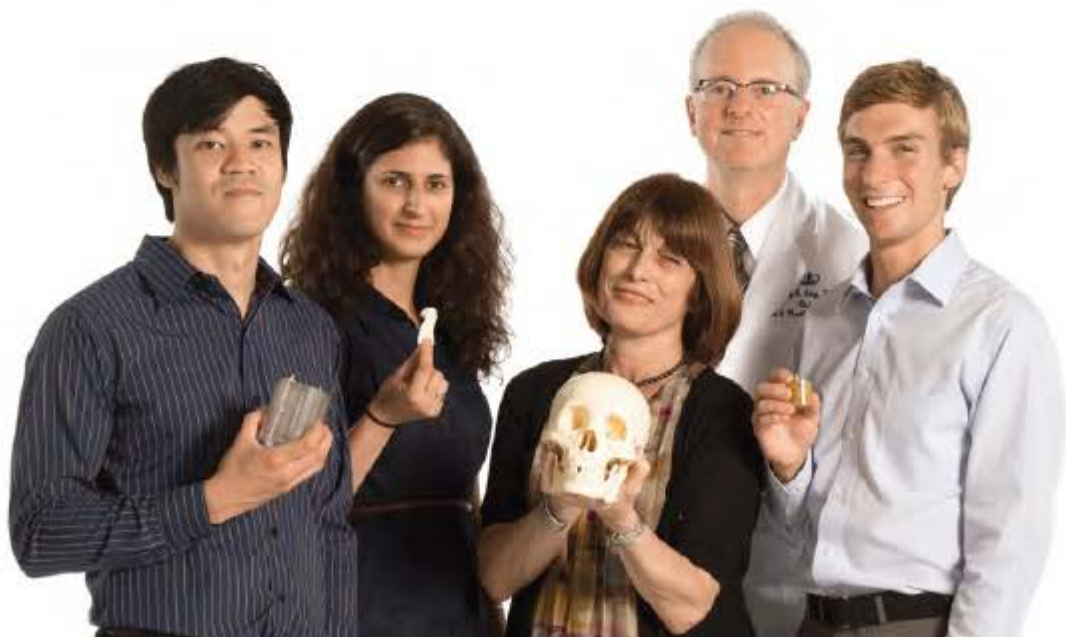
5 nedelja *in vitro*; matične ćelije iz koštane srži

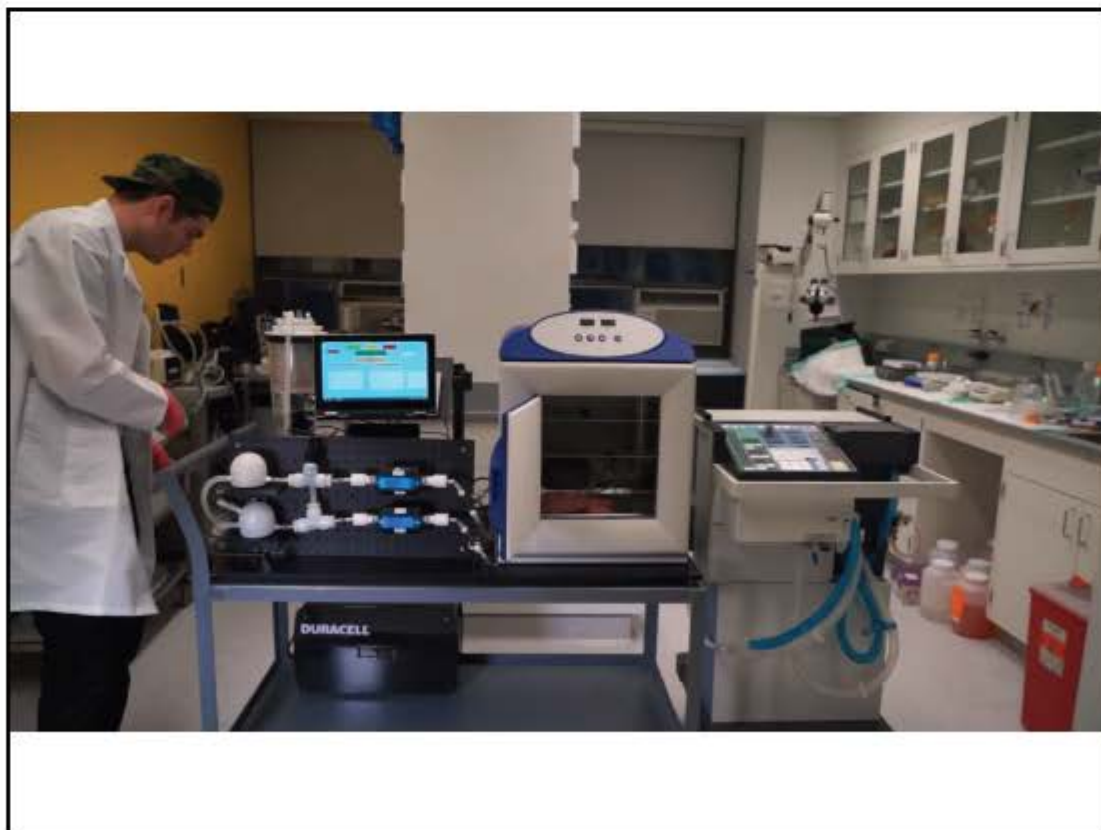
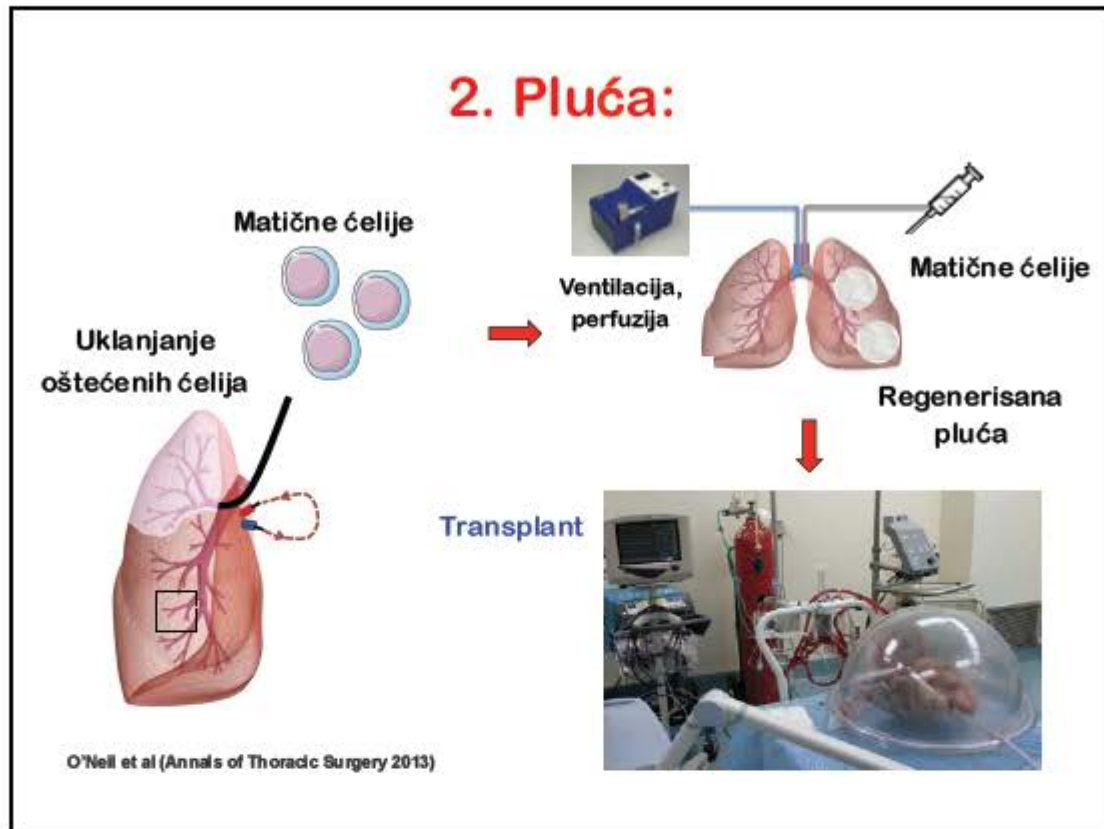
Jungov modul: ~800 kPa

Koeficijent trenja:  $\mu_{max} < 0.3$

Bhumiratana et al (PNAS 2014)

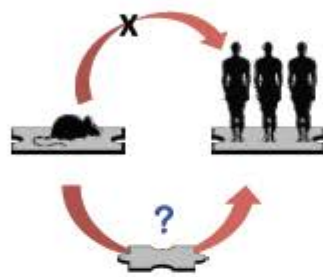
**EPIBONE**  
grow your own bone





### 3. Mikro-organi za ispitivanje lekova

8/9 lekova testiranih u životinjama pokazuje toksične efekte u kliničkim ispitivanjima  
1/3 srce, 1/3 jetra, 1/3 sve ostalo



Ćelije pacijenta

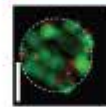


Mikro-tkiva

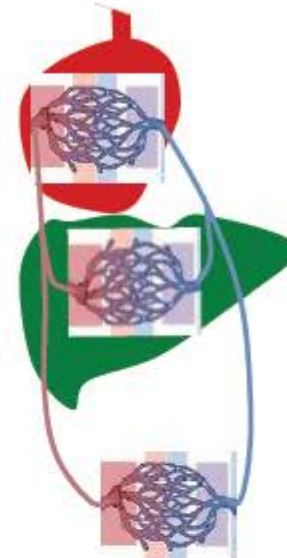
Srce



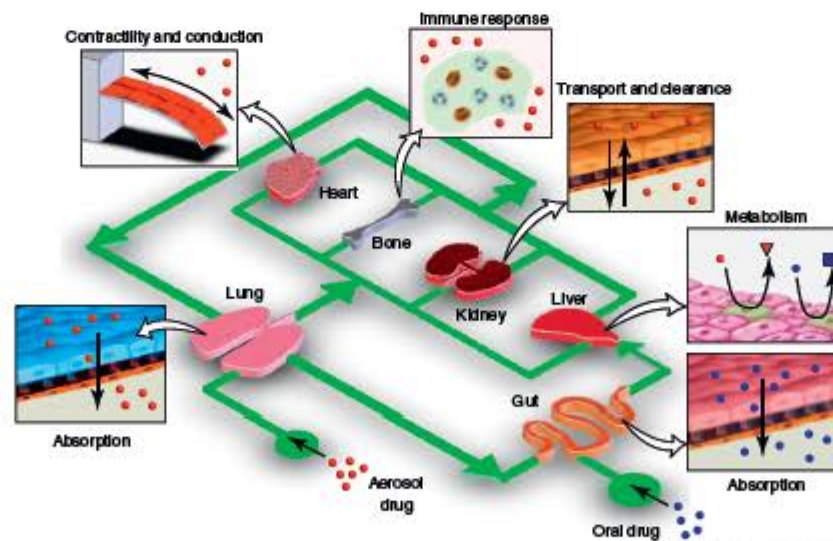
Jetra



Krvni sudovi



### Organi na čipu:







UNIVERSITY OF  
**TORONTO**

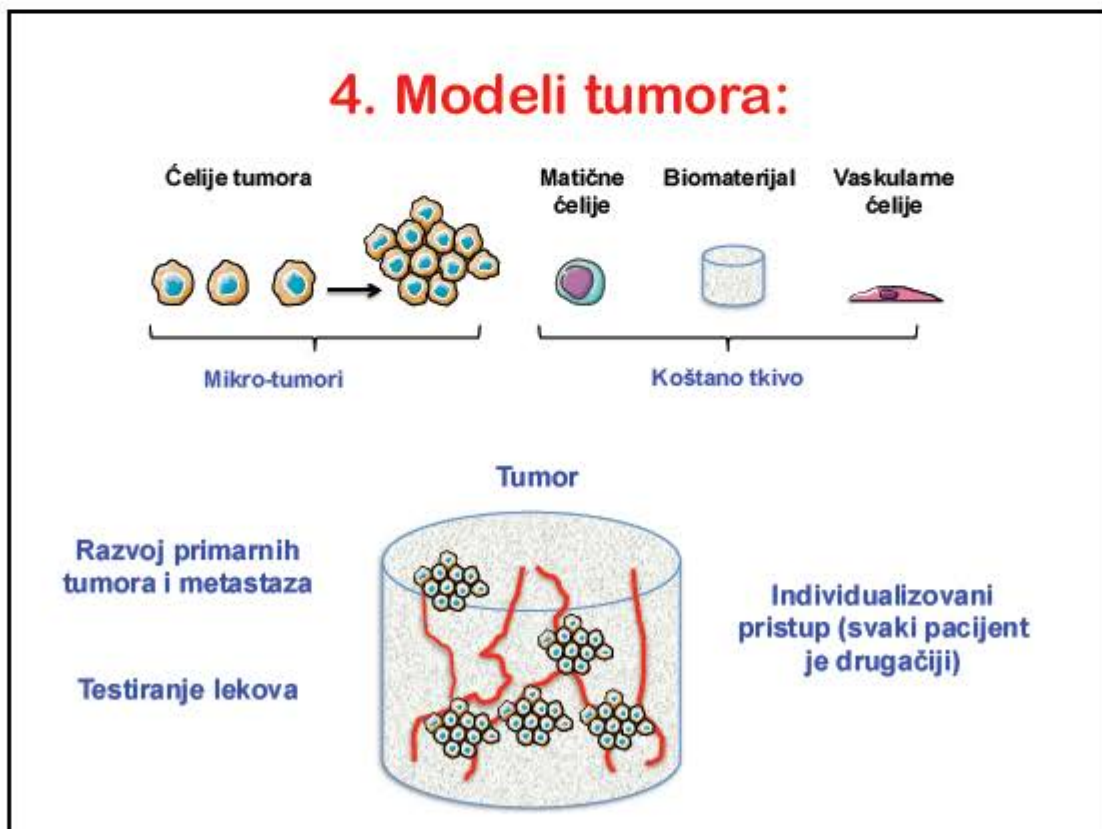
**Milica Radišić**



COLUMBIA | ENGINEERING







 **Laboratorija**

Stem Cells and Tissue Engineering



NHLBI, NIBIB, NIAMS, NIDCR, New York State, Helmsley Foundation, Columbia-Coulter Translational Research Partnership, Mikati Foundation

**Radimo**



## Slavimo rođendane



## ...I vidjamo se van posla



**Puno vam hvala!**

