



TECHNISCHE  
UNIVERSITÄT  
DRESDEN

# 3D Bioprinting von Modellorganen

Dr. Robert Wieduwild

B CUBE – TU Dresden – Zhang Gruppe

9. Tagung DGFT - 13. November 2015

# Themen in der Zhang Gruppe

## Rational Drug Design

*Immunosuppressant:*

*Cyclosporin*

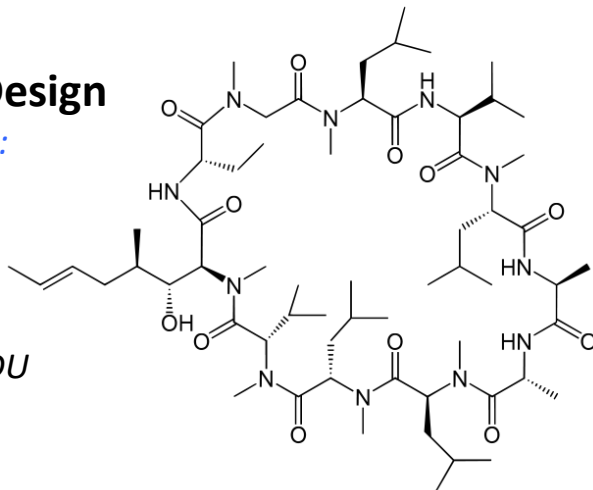
*Tacrolimus (FK506)*

*Rapamycin*

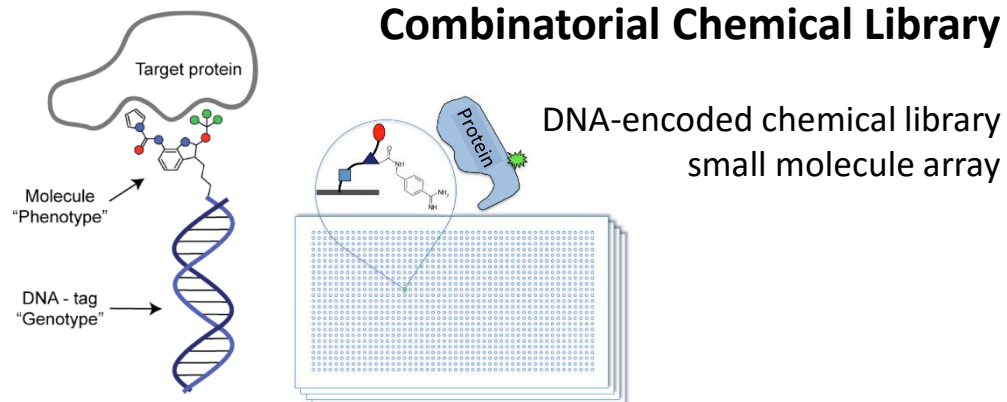
*Others:*

*Hsp27 inhibitor: BVDU*

*Vancomycin*

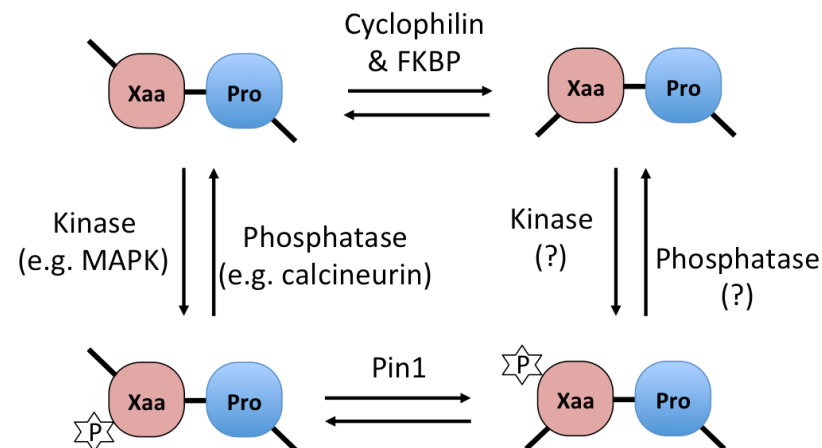
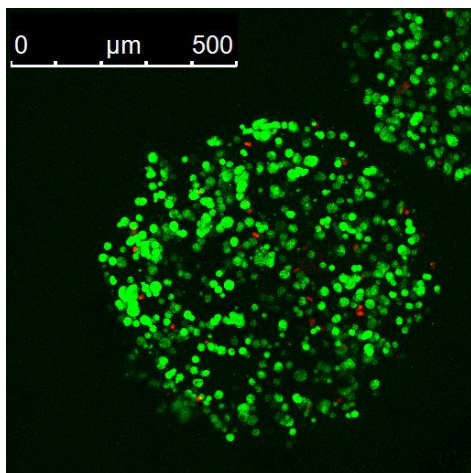


## Combinatorial Chemical Library



## Cell Culture in 3D

*- Design and Synthesis of Bio-matrices*

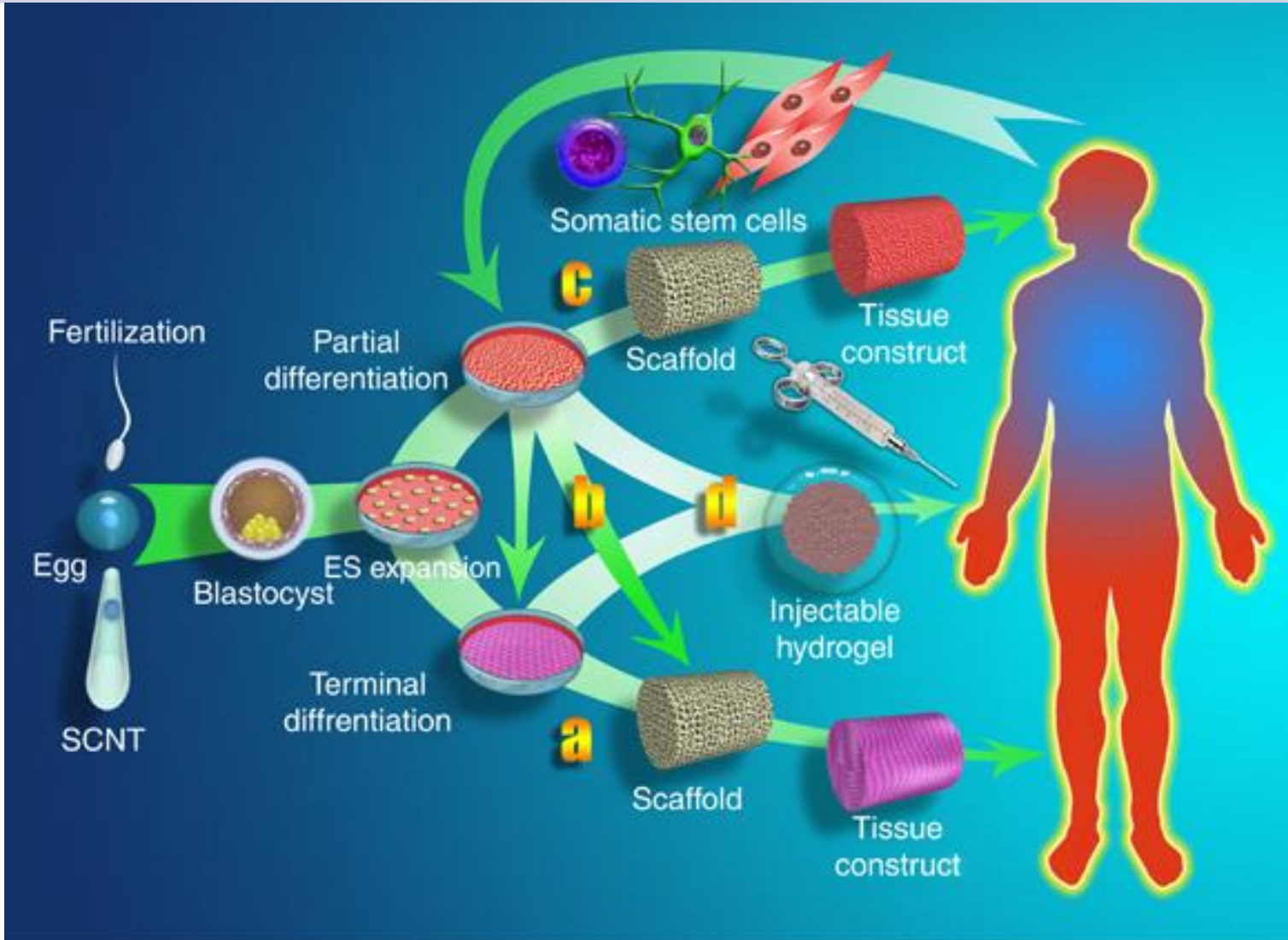


*Peptidyl-prolyl cis/trans Isomerases*

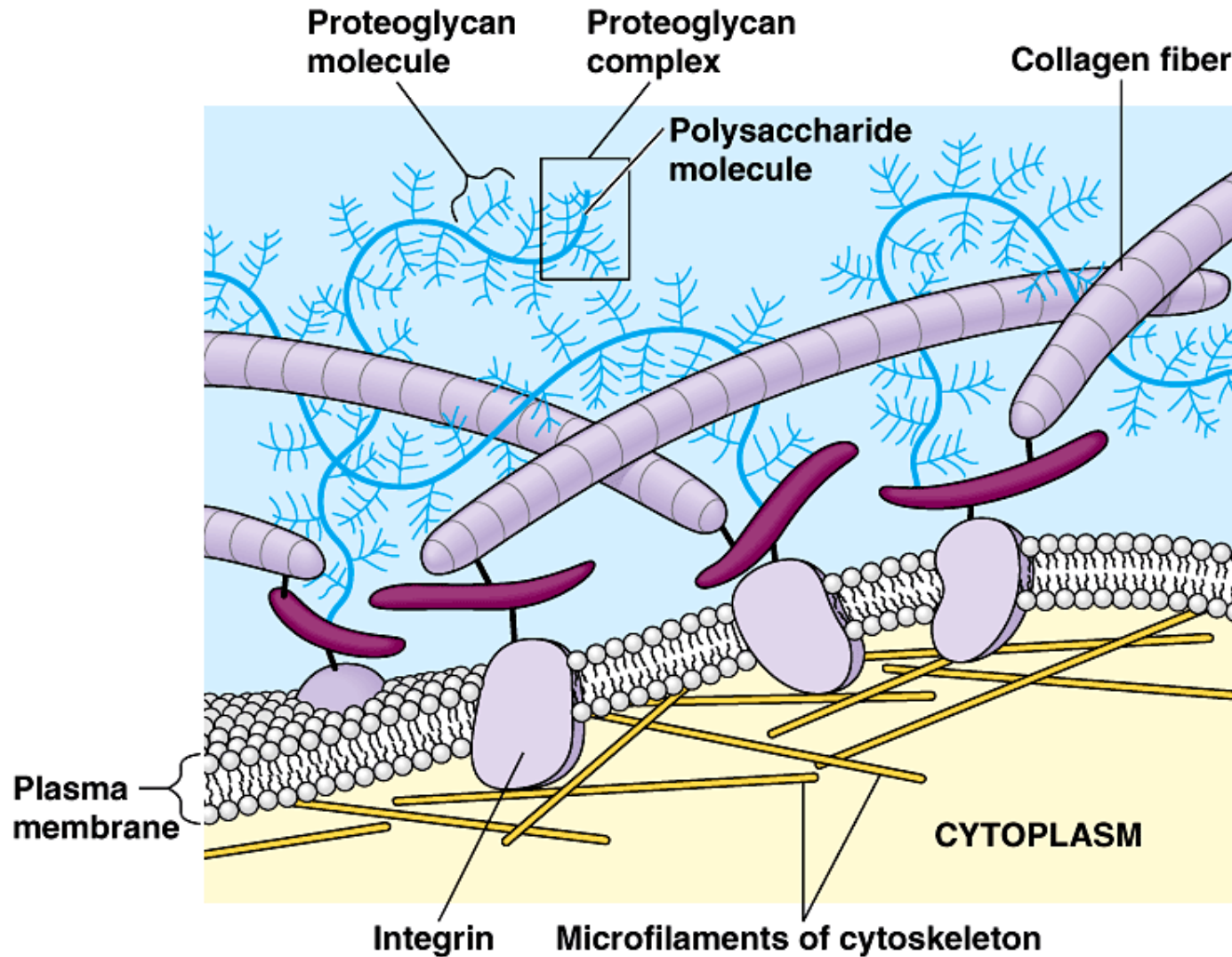
# Agenda

- **Aufbau und Eigenschaften des nicht-kovalenten Hydrogels**
- **Anwendung im 3D Druck:**
  - **Anforderungen der Zellen**
  - **Anforderungen des 3D Drucks**

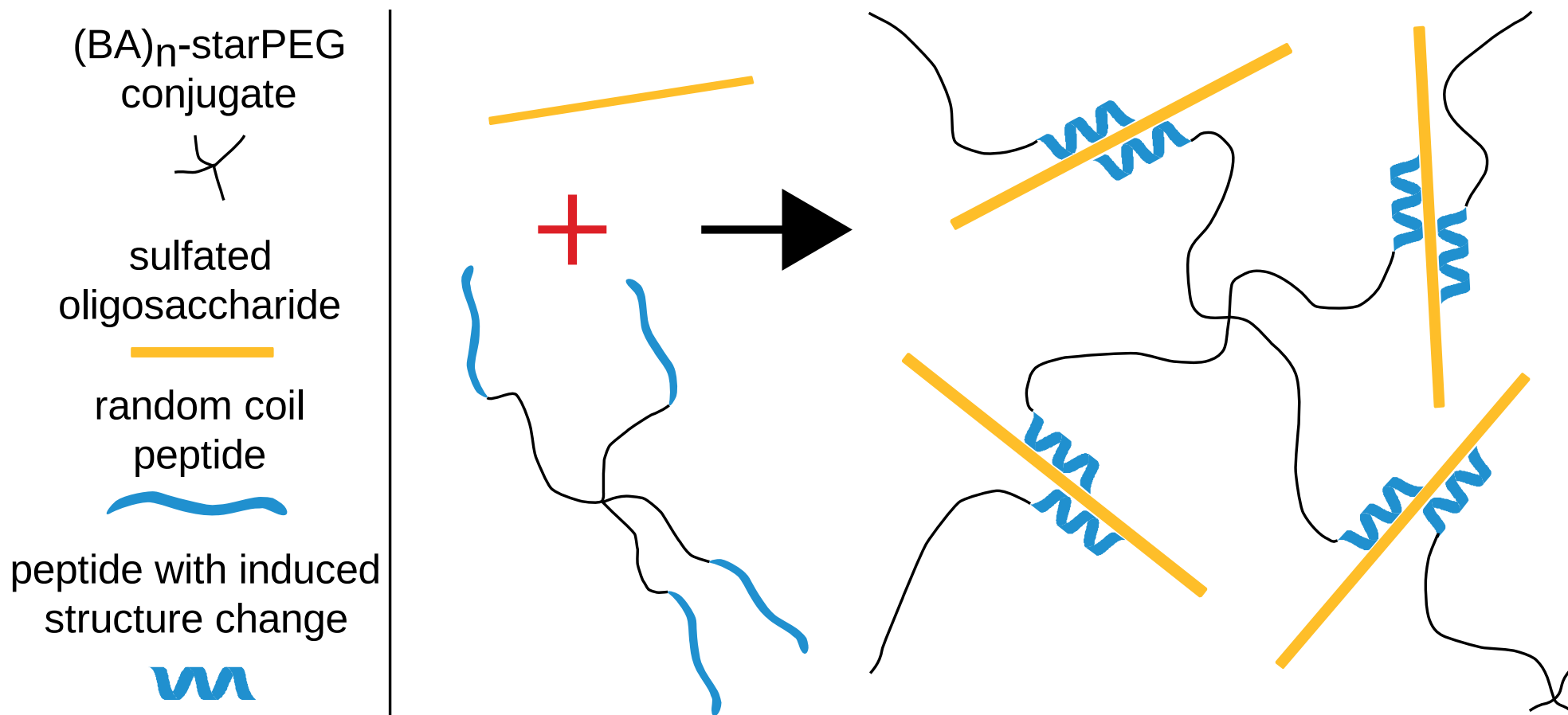
# Tissue Engineering



# Extrazelluläre Matrix



# Hydrogel Aufbau



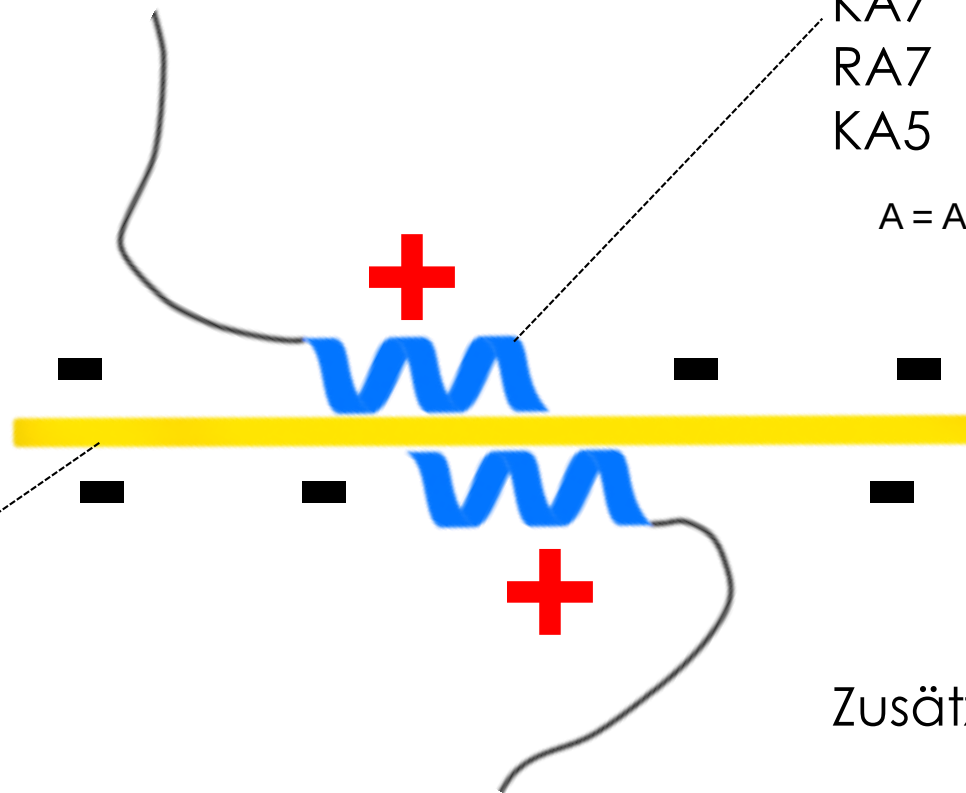
# Variabilität im Aufbau

~90% Wasser

KA7 KAKAKAKAKAKA  
RA7 RARARARARARARA  
KA5 KAKAKAKAKA

A = Alanin; R = Arginin; K = Lysin

Heparin  
Dextran sulfat



Zusätzliche Modifikationen:

Zellanhaftungssequenzen  
spaltbare Sequenzen

# Variabilität im Aufbau



KA7 KAKAKAKAKAKA  
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A = Alanin; R = Arginin; K = Lysin

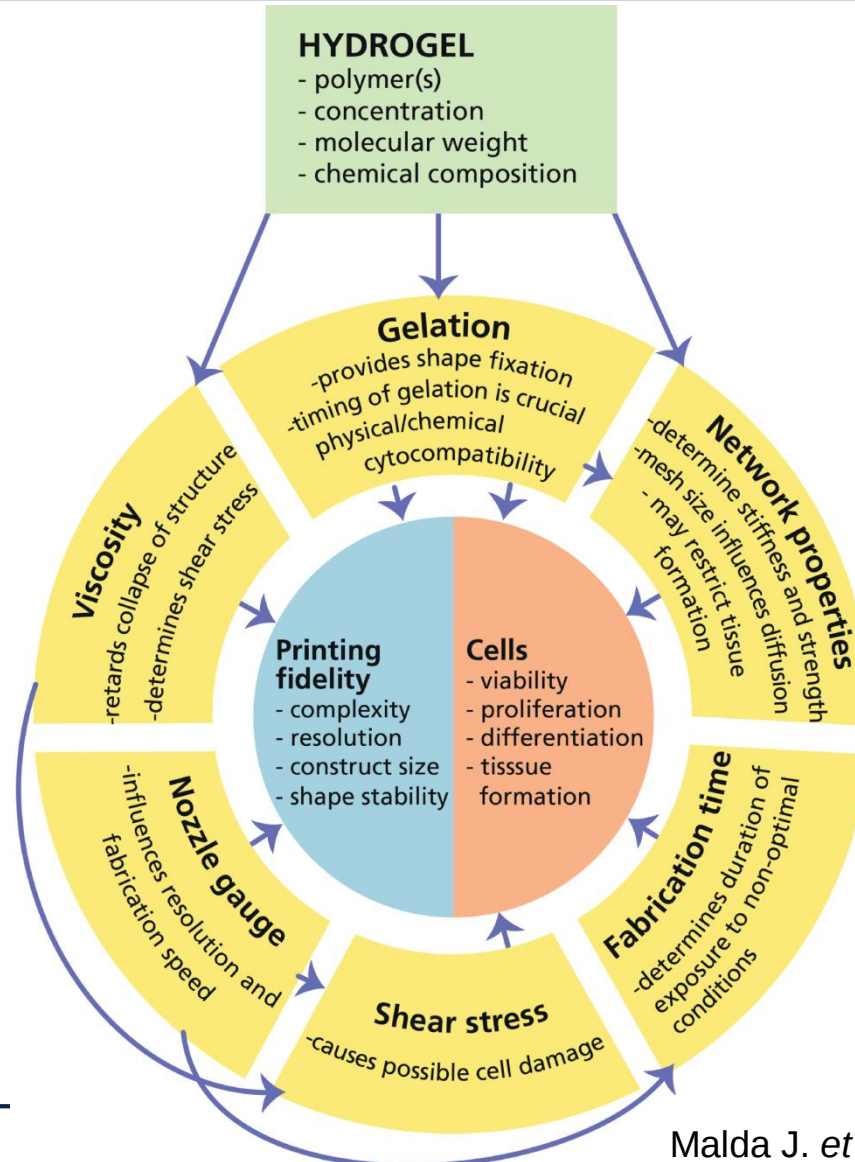


Zusätzliche Modifikationen:

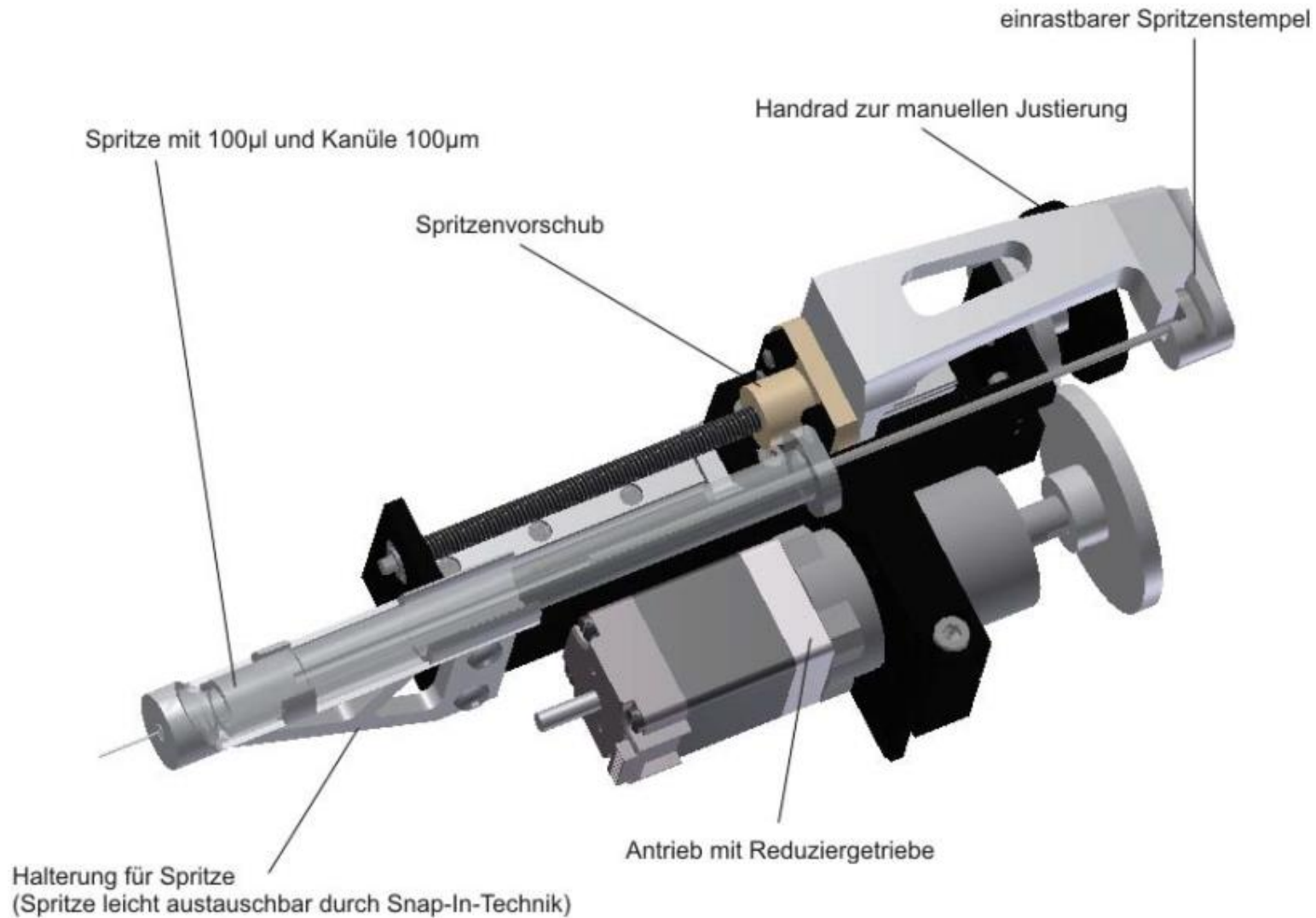
Zellanhaftungssequenzen  
spaltbare Sequenzen

MassDensity.com

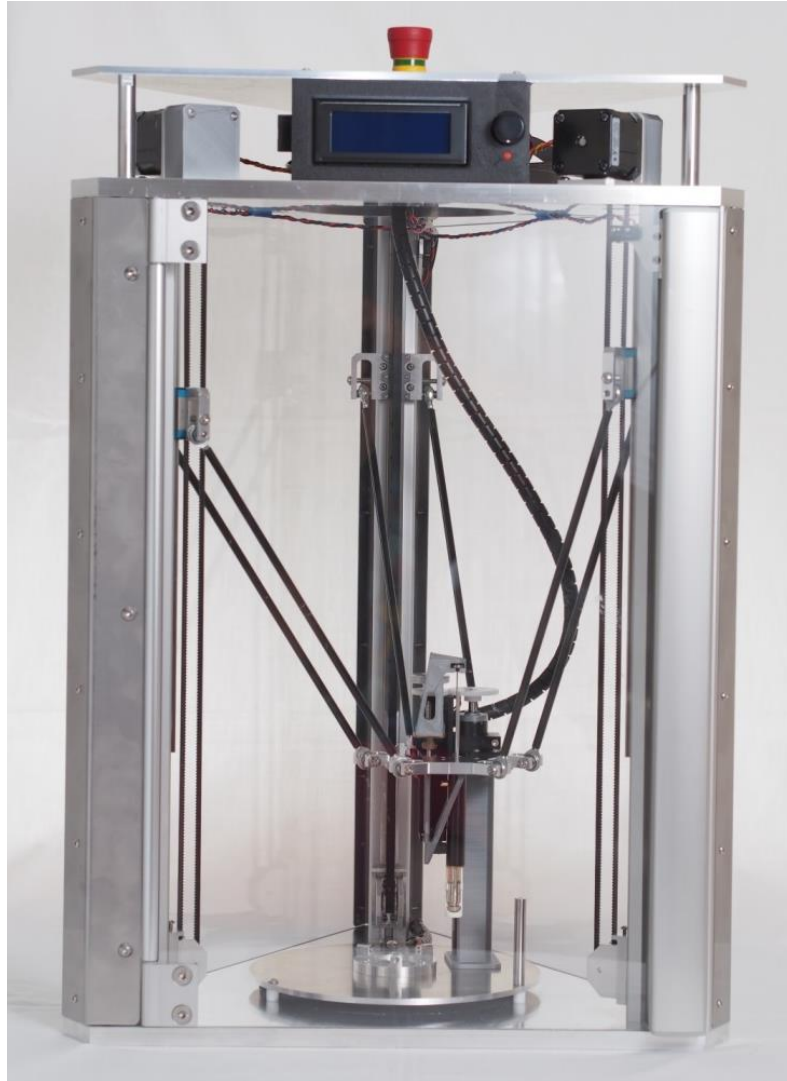
# Anforderungen an Druck und Zellen



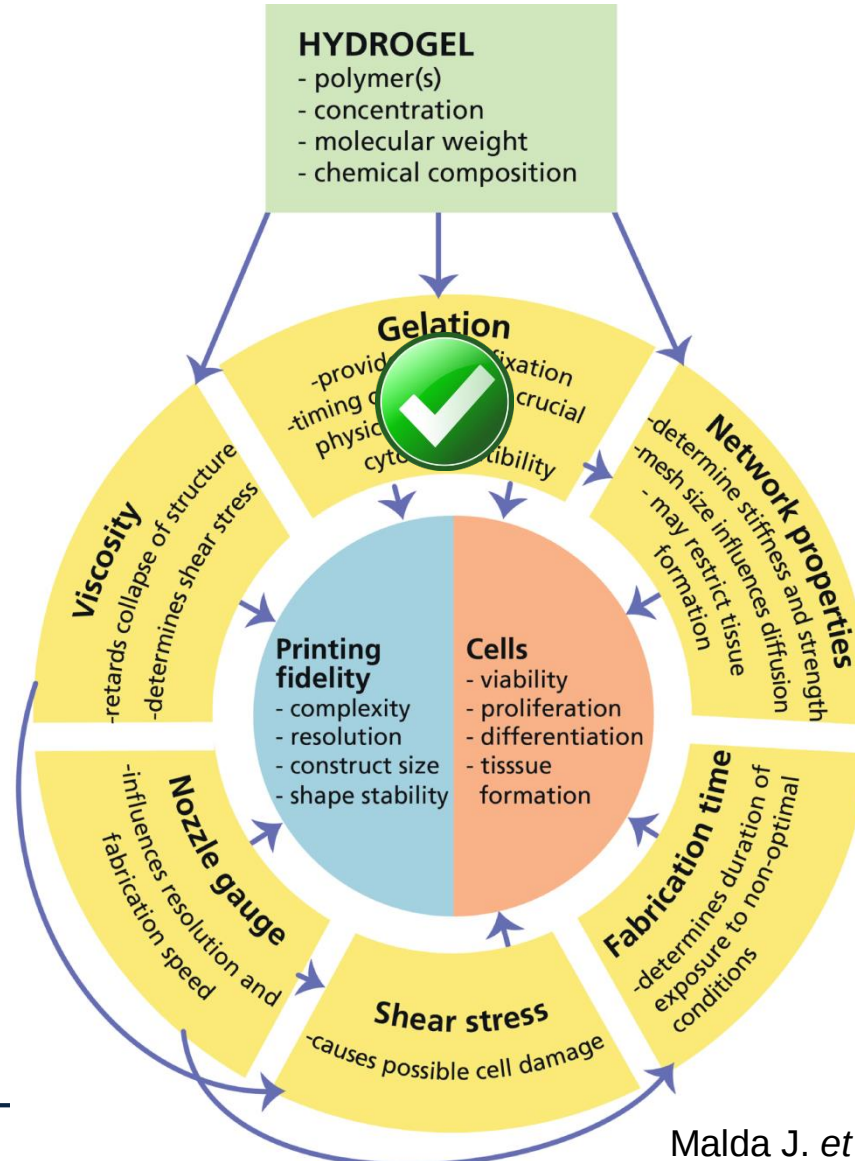
# Extruder mit Spritze



# 3D Drucker

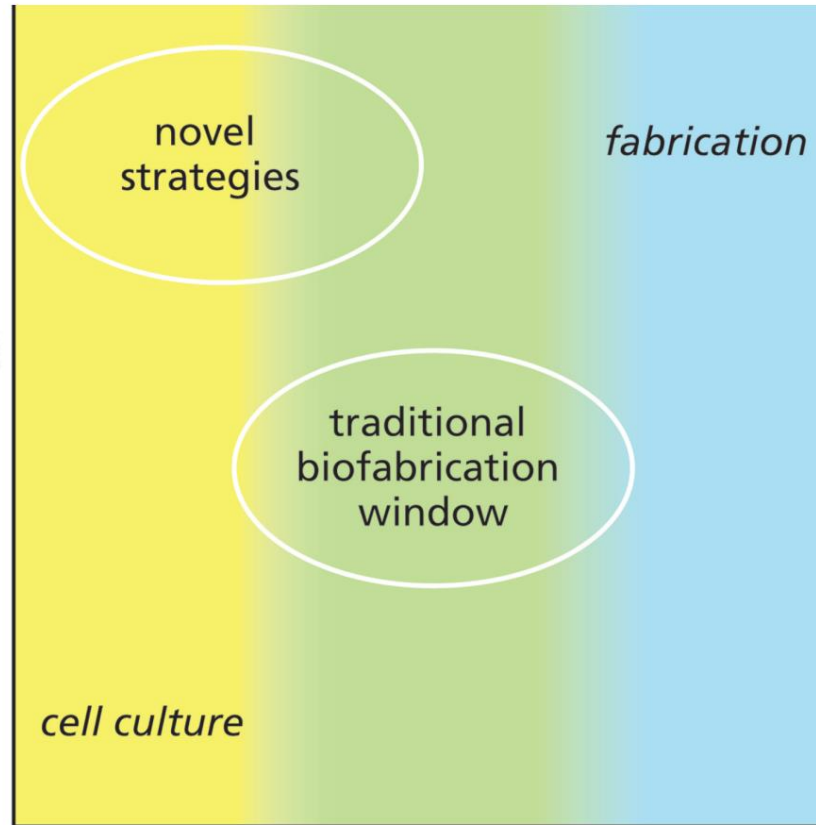
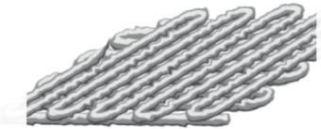
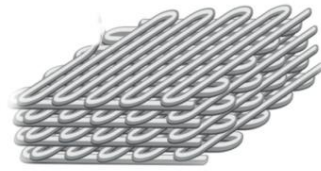


# Anforderungen an Druck und Zellen

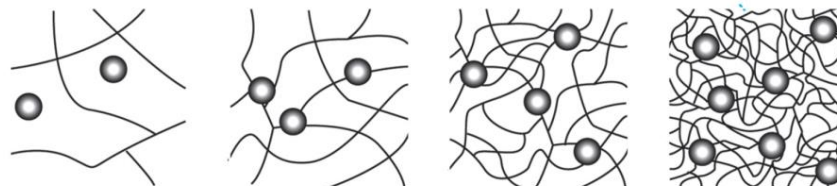


# Fabrication Window

shape fidelity



1 kPa Elastizitätsmodul

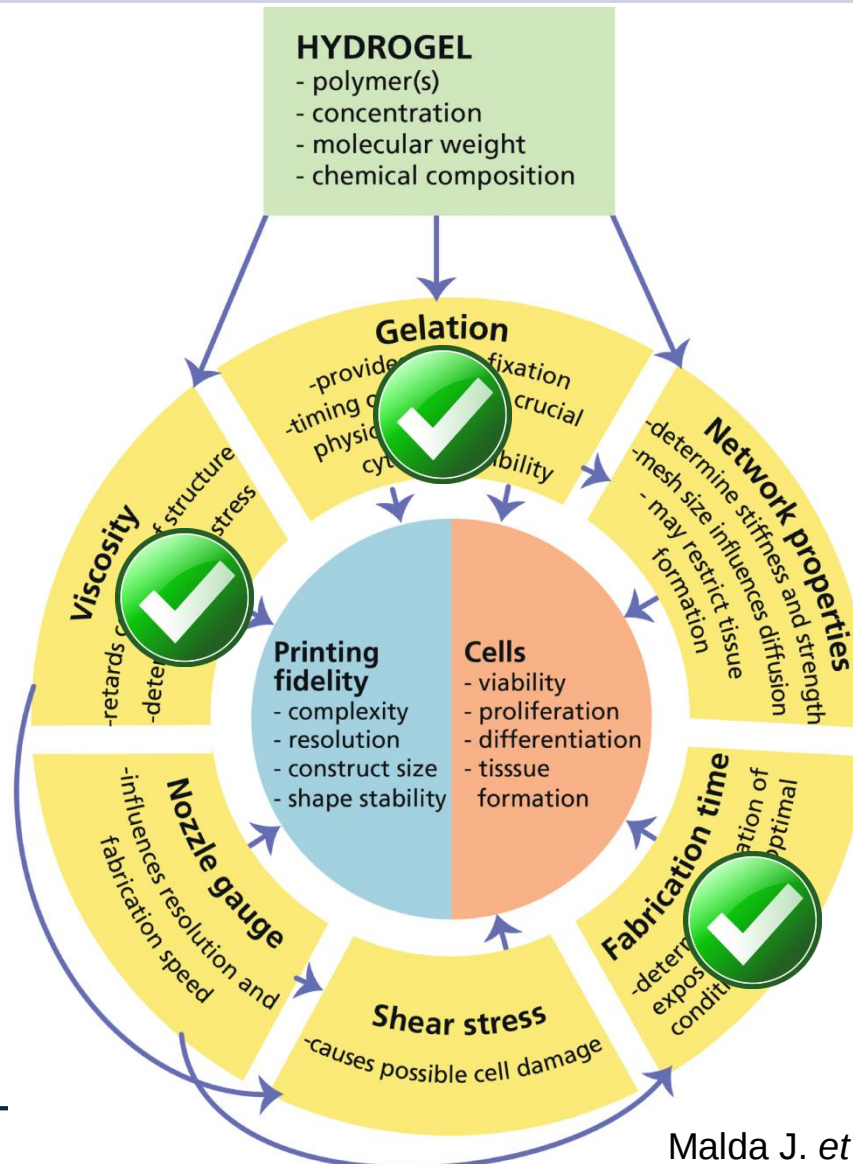


polymer concentration, crosslink density, stiffness

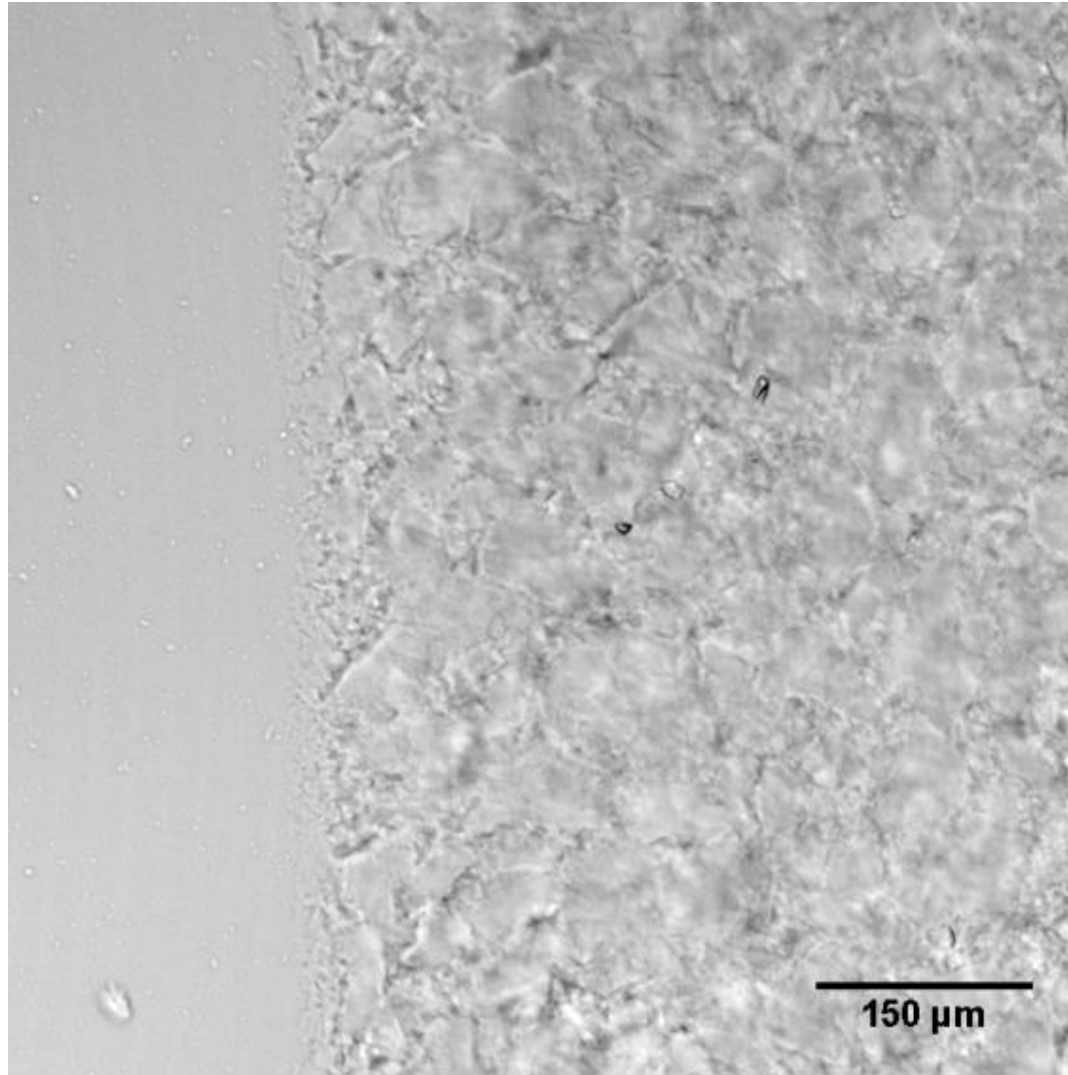
# 3D Bioprinting

- Druck von geformtem Hydrogel
- mit eingebetteten Zellen
- in Zellkulturmedium
- hohe Druckgeschwindigkeit
- kein Schwellen/Schrumpfen
- hohe Stabilität
- hohe Präzision (100  $\mu\text{m}$ )

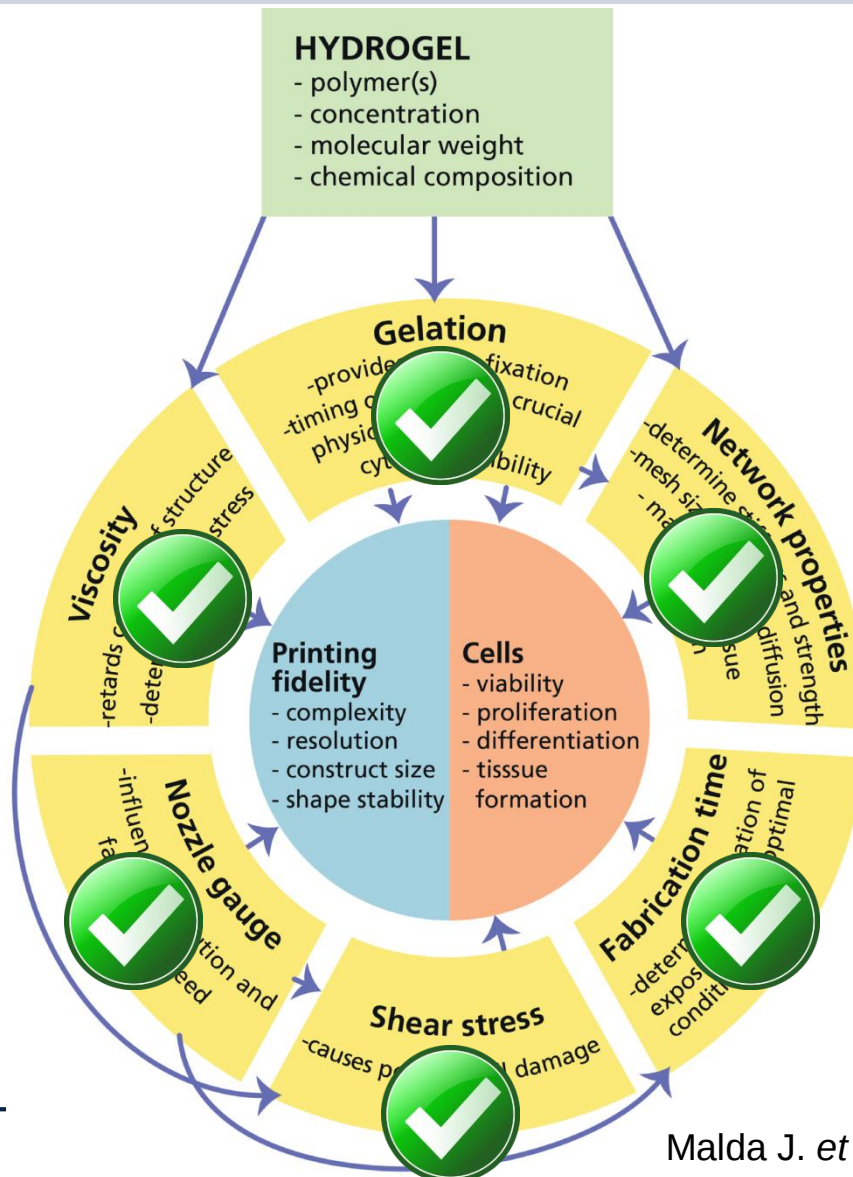
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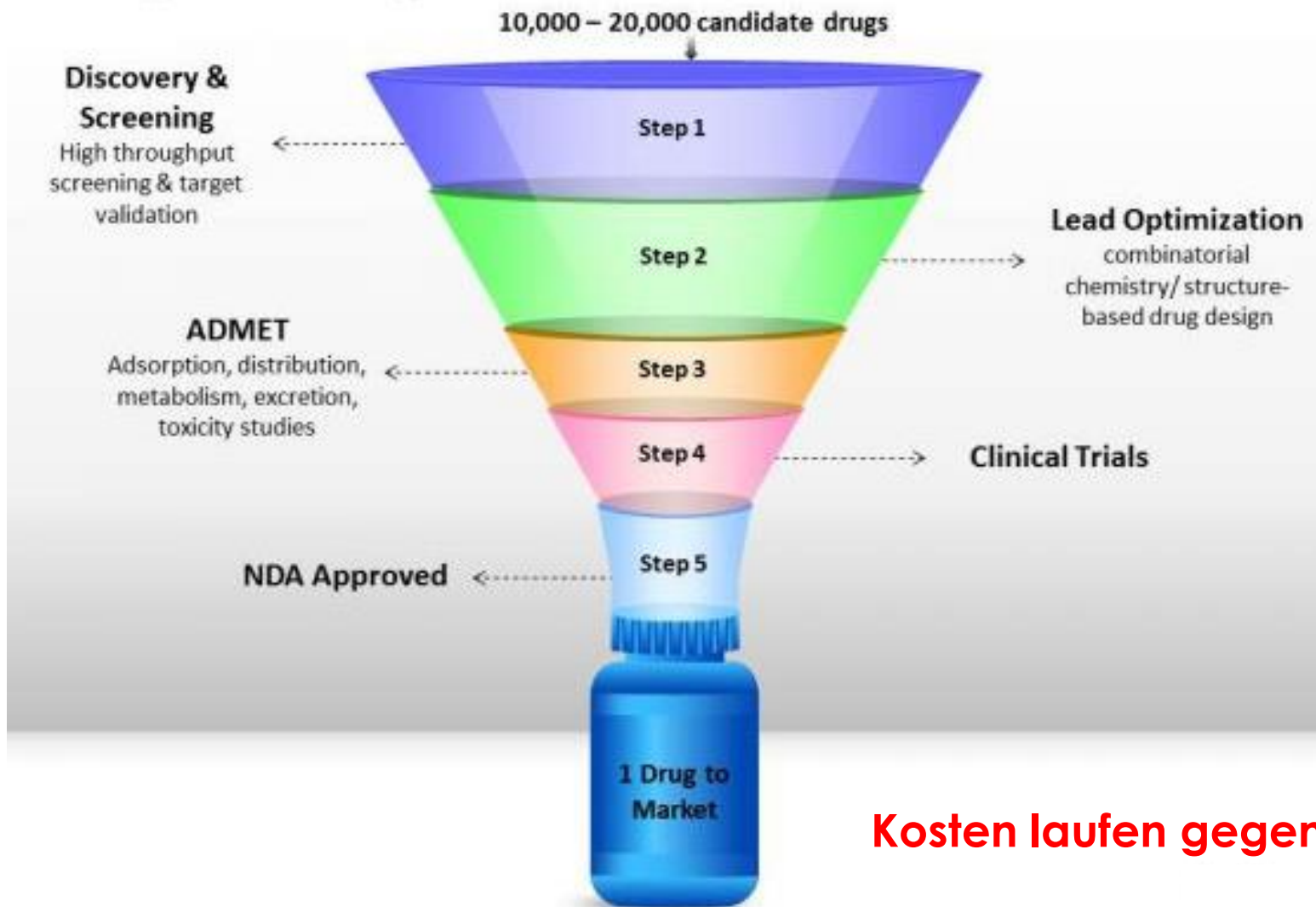
# 200 $\mu\text{m}$ Nadelinnendurchmesser



# Anforderungen an Druck und Zellen

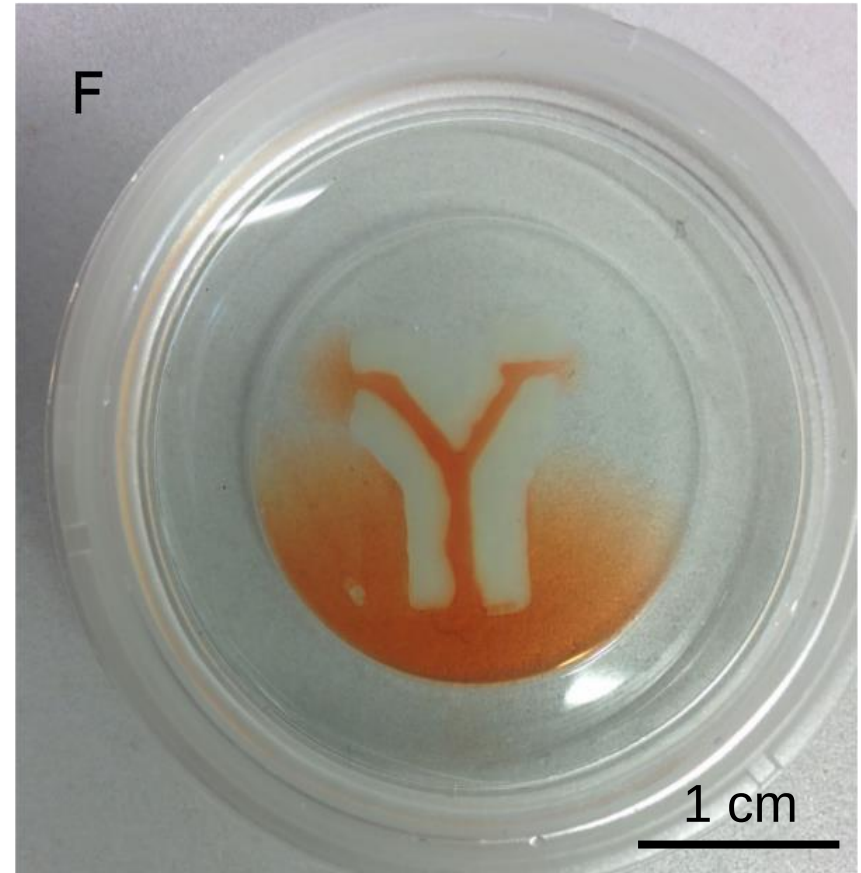


# Medikamentenentwicklung



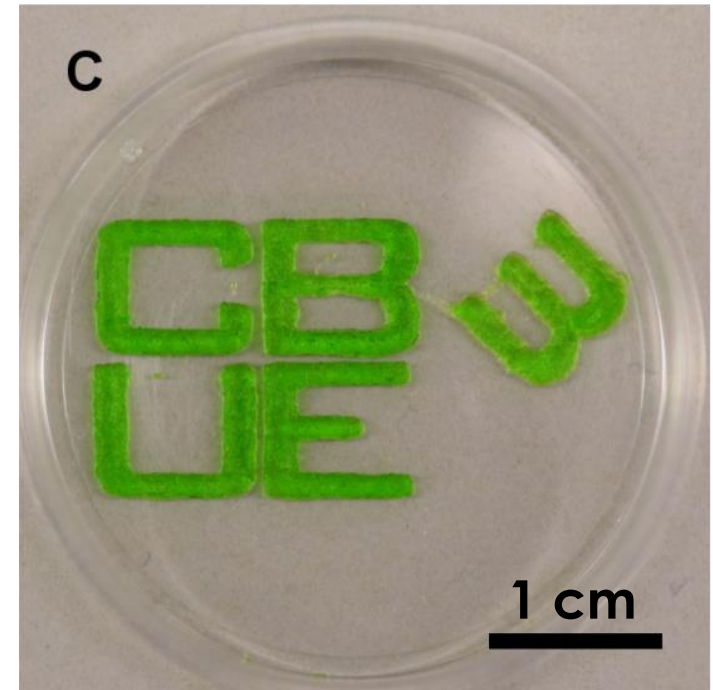
**Kosten laufen gegenläufig!**

# Stabile Kanalstrukturen



# Zusammenfassung und Ausblick

- Neue Biotinte (Hydrogel) – gut geeignet zum drucken
  - 3D Drucker für kleine Volumen, hohe Genauigkeit und Geschwindigkeit
  - Anwendung in Pharmazie
- 
- Bessere 3D Aufnahmen
  - 3D Gradienten
  - Anschlüsse für 3D Struktur



## **Dr. Zhang**

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