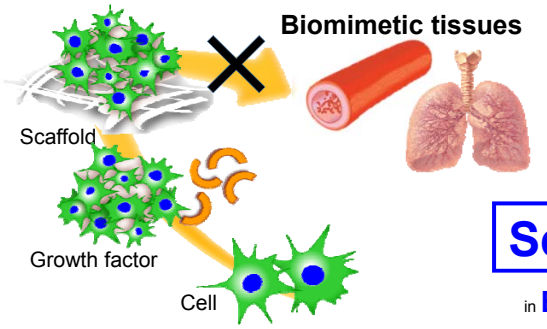
Bionic Synthesizerによる血管様多層組織の弾性繊維形成評価

○山岸由佳[1], 益田泰輔[1], 松崎典弥[2], 明石満[2], 横山詩子[3], 新井史人[1]

1. 名古屋大学大学院　工学研究科, 2. 大阪大学大学院　工学研究科,
3. 横浜市立大学大学院　医学研究科

バイオアセンブラの新しい知見：生体模倣力学刺激が自己組織的に血管を造る

Background & Concept



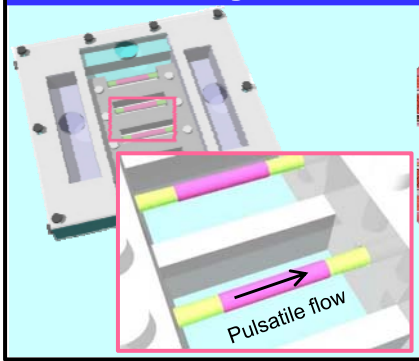
Only assembling from cells
- Low cell density
- Low elasticity
- Different structures…

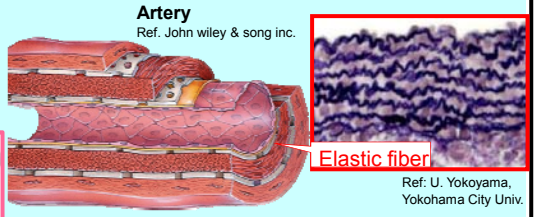
Not Biomimetic

Self-organization

in **Biomimetic Environment**
- Culture condition
- Mechanical, chemical stimulus
- Position

Bionic Synthesizer





Biomimetic Structure
Biomimetic Strength
Biomimetic Stimulus

Purpose

○**Fabrication of tubular tissues with high stiffness and high cell density having 0.8 MPa (native blood vessel)**

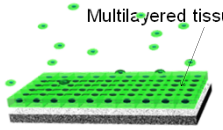
○**Circulation culture in 3D structure mimicking *in-vivo* environments**

Fabrication

BEL method using residual stress
(**Bio-assembly by Expansion and Lamination**)

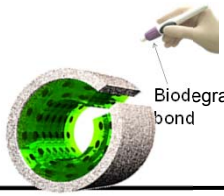
1. Expansion

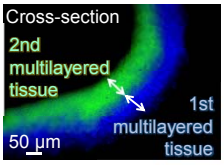
2. Lamination



M. Matsusaki et al. *Adv. Mater*, 2011.

3. Assembly

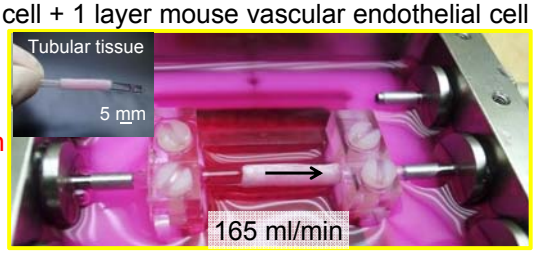




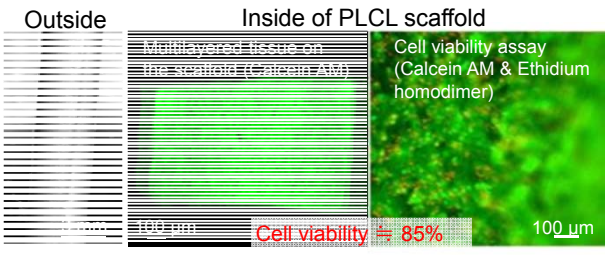
Experiments

Culture condition

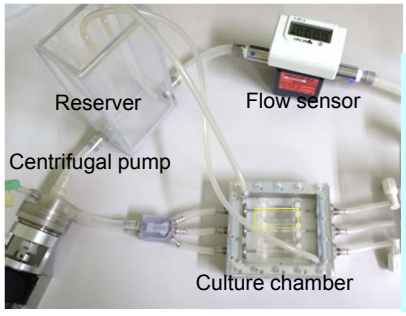
- 10 layer mouse smooth muscle cell + 1 layer mouse vascular endothelial cell
- DMEM with 1% FBS
- PLCL substrate coated with Fibronectin and collagen
- Circulation flow rate: 165 ml/min
- Pressure: Δ800 Pa



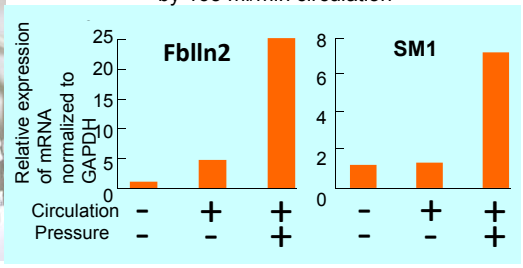
Observation of fabricated tissue



Circulation culture system



Shear stress : 1 Pa,
by 165 ml/min circulation



Conclusions

- We fabricated tubular tissues with high elasticity and high cell density, 3 mm in diameter and 10 mm in length.
- Long-term circulation culture system was fabricated.
- Expression of FibIln2 and SM1 were increased by circulation with pulsatile pressure.

Reference

□ Yuka Yamagishi, et al., “Bionic synthesizerによる血管様多層組織の弾性繊維形成評価”, 1P24, 29th Cheminas

Contact Person: Taisuke Masuda
E-mail: masuda@mech.nagoya-u.ac.jp,
URL: http://www.biorobotics.mech.nagoya-u.ac.jp/
TEL: 052-789-5026, FAX : 052-789-5027

Acknowledgment:
This work is partially supported by Scientific Research from Ministry of Education, Culture, Sports, Science and Technology (23106002) and the Nagoya University Global COE program for Education and Research of Micro-Nano Mechatronics.