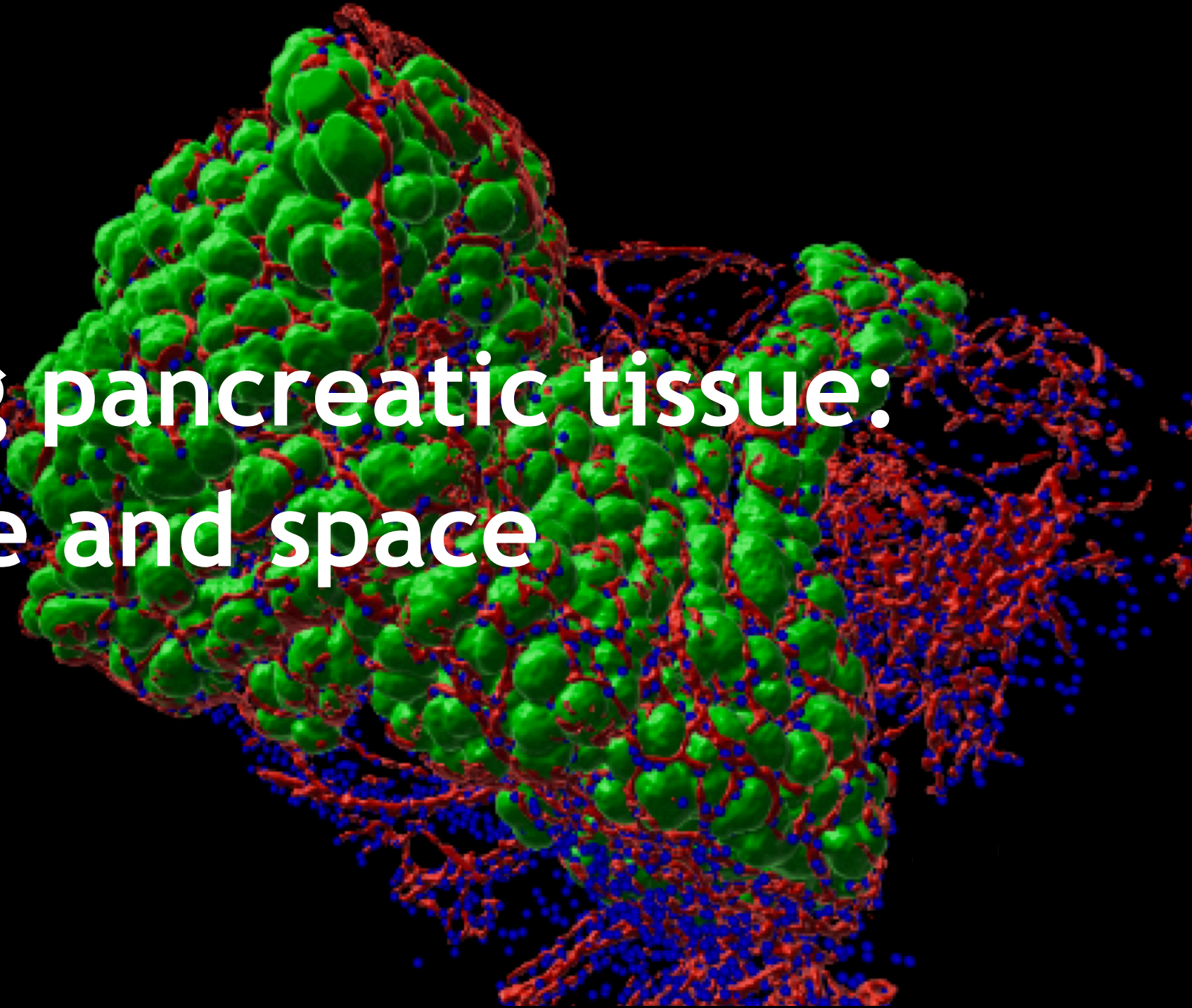


# Engineering pancreatic tissue: cells in time and space

A 3D visualization of pancreatic tissue engineering. It shows a cluster of green, spherical cells arranged in a somewhat regular pattern. These cells are interconnected by a network of red and blue lines, representing the extracellular matrix or vascular network. The overall structure is complex and multi-dimensional, illustrating the spatial and temporal aspects of tissue engineering.

Francesca M. Spagnoli

EIC | ERC Workshop

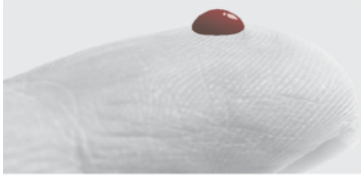
29.06.2021



<https://www.pan3dp-project.eu/>

**KING'S**  
*College*  
**LONDON**

# Pancreatic Diseases



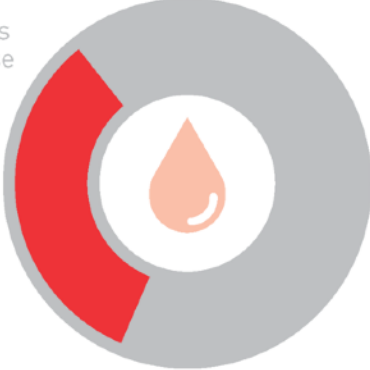
## DIABETES

**DIABETES IS ON THE RISE**


**422 MILLION** adults have diabetes

**3.7 MILLION** deaths due to diabetes and high blood glucose


**1.5 MILLION** deaths caused by diabetes





**THAT'S 1 PERSON IN 11**



[www.who.int/diabetes/global-report](http://www.who.int/diabetes/global-report) #diabetes



## PANCREATIC CANCER

Pancreatic cancer mortality rates continue to rise throughout Europe. The median survival time for someone diagnosed with pancreatic cancer in Europe is just 4.6 months, with patients losing 98% of their healthy life expectancy at the point of diagnosis.

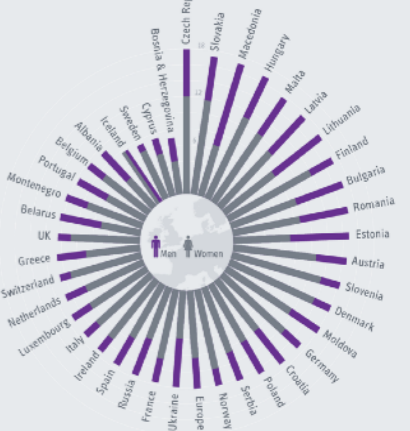
### SYMPTOMS

- ABDOMINAL PAIN & BACK
- CHANGE IN BOWEL HABITS
- NAUSEA
- WEIGHT LOSS
- JAUNDICE
- NEW ONSET DIABETES

### RISK FACTORS

- FAMILY HISTORY
- SMOKING
- HEAVY ALCOHOL CONSUMPTION
- DIABETES
- OBESITY
- PANCREATITIS

### INCIDENCE PER 100,000 POPULATION

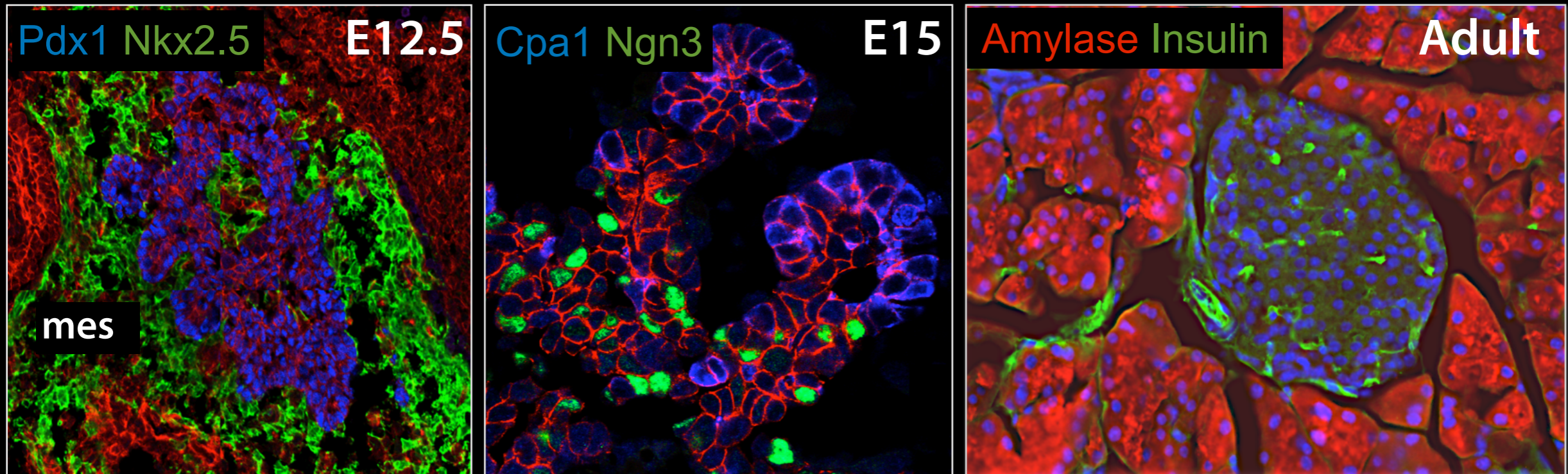


International Agency for Research on Cancer: <https://www.iarc.fr/en/press-releases/2015/05/01/>  
 Caraka et al, 2015, "Systematic Review of the Burden of Pancreatic Cancer in Europe: Real-World Impact on Survival, Quality of Life and Costs." DOI: 10.1007/s13009-015-0754-9  
 Helyar J, Pedersen L, Bray F. More deaths from pancreatic cancer than breast cancer in the EU by 2017. *NEJM Oncology*, August 2016.

[www.ueg.eu](http://www.ueg.eu)

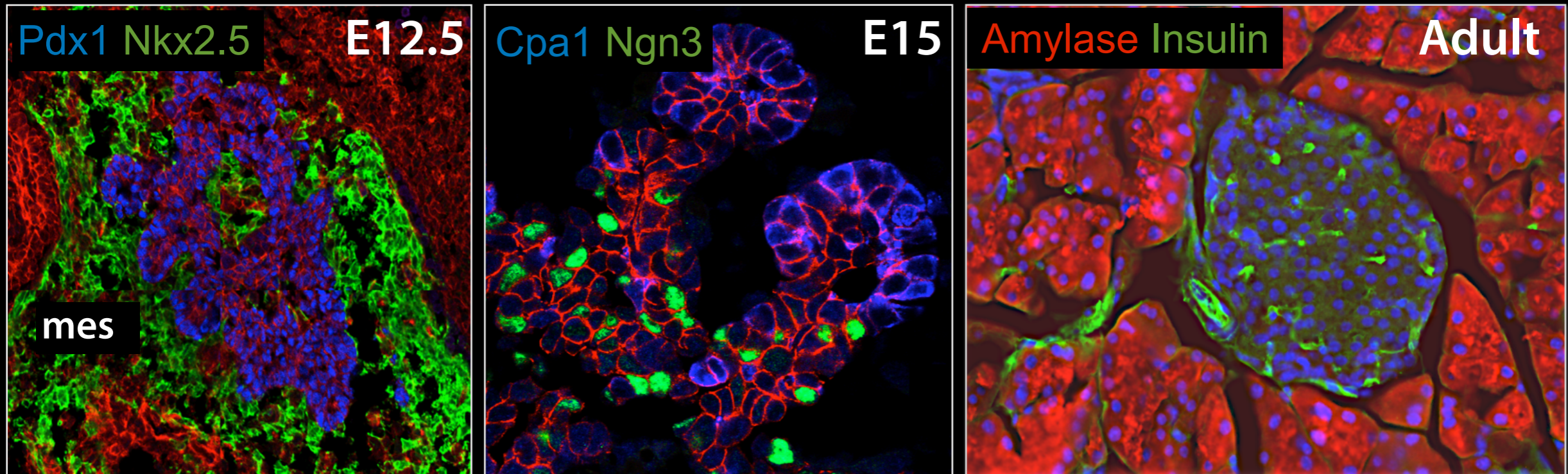
> Islet transplantation is a functional therapy to cure diabetes

# Engineering cells with a developmental logic



Rodriguez-Seguel et al. *Genes Dev.* 2013  
Petzold, Naumann, Spagnoli FM. *Development* 2013  
Cerdá-Esteban et al. *Nat Commun.* 2017  
Escot et al. *Nat Commun.* 2018  
Cozzitorto et al. *Dev Cell* 2020  
Willnow et al. *Nature* in press

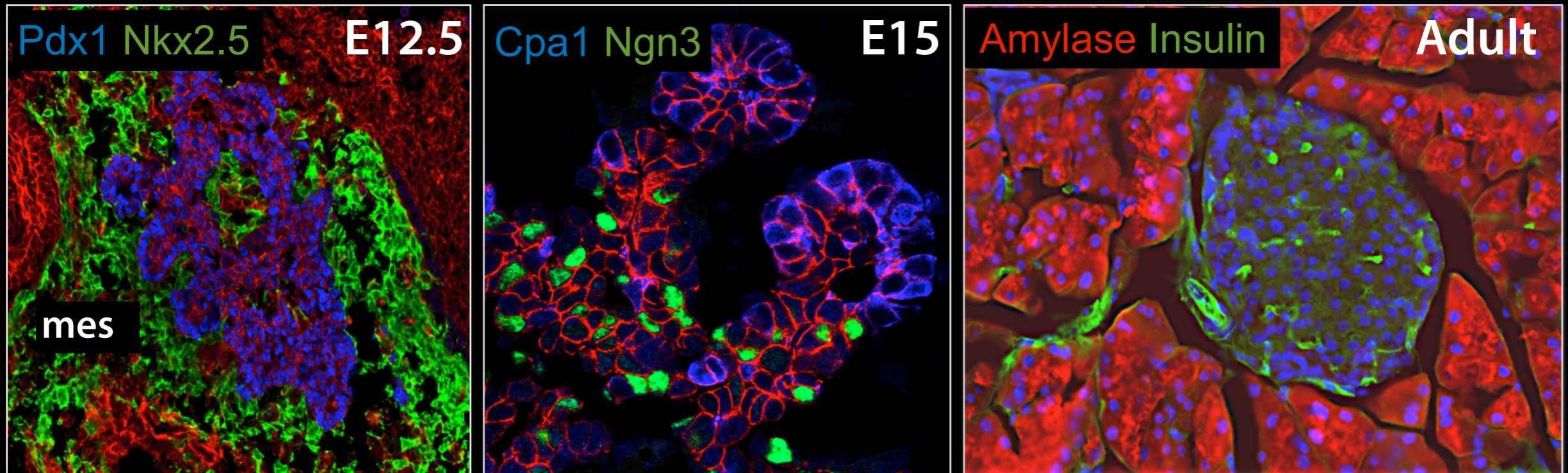
# Engineering cells with a developmental logic



> Defining autologous renewable sources of pancreatic cells (ERC)

Rodriguez-Seguel et al. *Genes Dev.* 2013  
Petzold, Naumann, Spagnoli FM. *Development* 2013  
Cerdá-Esteban et al. *Nat Commun.* 2017  
Escot et al. *Nat Commun.* 2018  
Cozzitorto et al. *Dev Cell* 2020  
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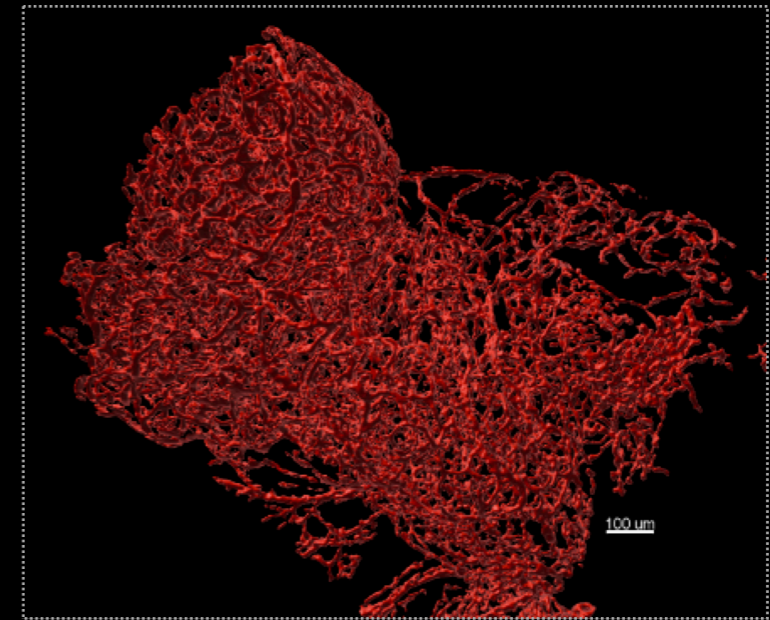
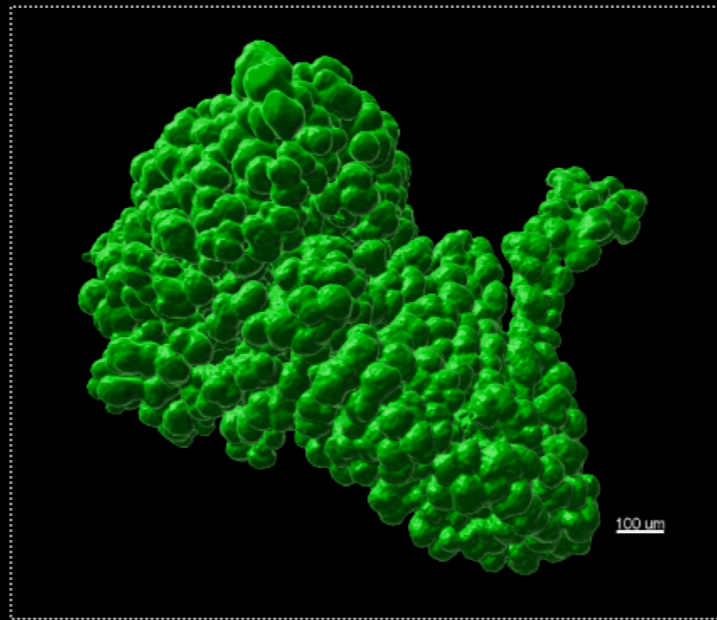
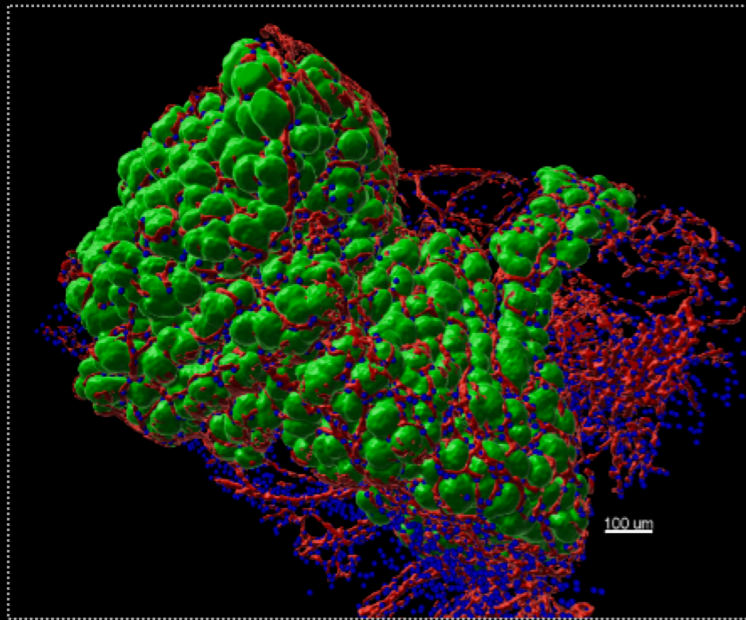
# Engineering cells with a developmental logic



- > Defining autologous renewable sources of pancreatic cells (ERC)
- > Mimicking the microenvironment to make *more and better* pancreatic cells

Rodriguez-Seguel et al. *Genes Dev.* 2013  
Petzold, Naumann, Spagnoli FM. *Development* 2013  
Cerdá-Esteban et al. *Nat Commun.* 2017  
Escot et al. *Nat Commun.* 2018  
Cozzitorto et al. *Dev Cell* 2020  
Willnow et al. *Nature* in press

# Bioprinting with a developmental logic

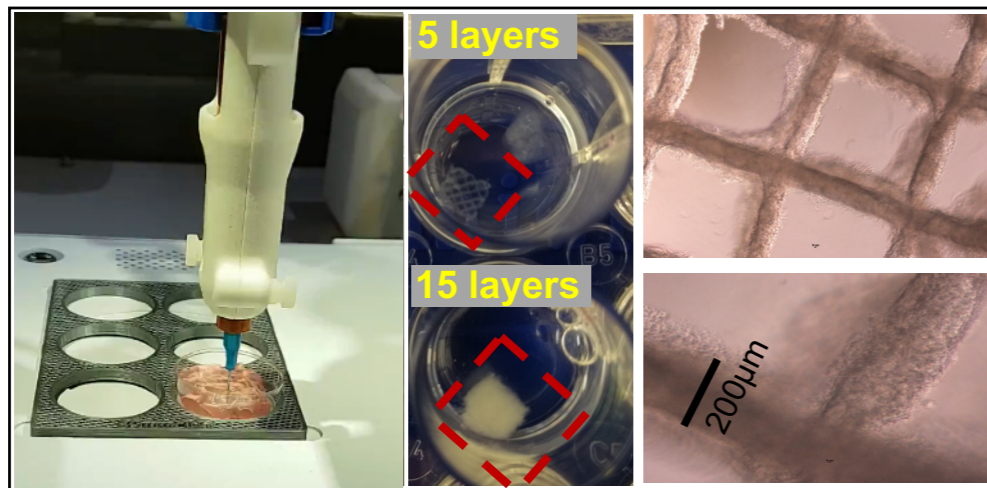
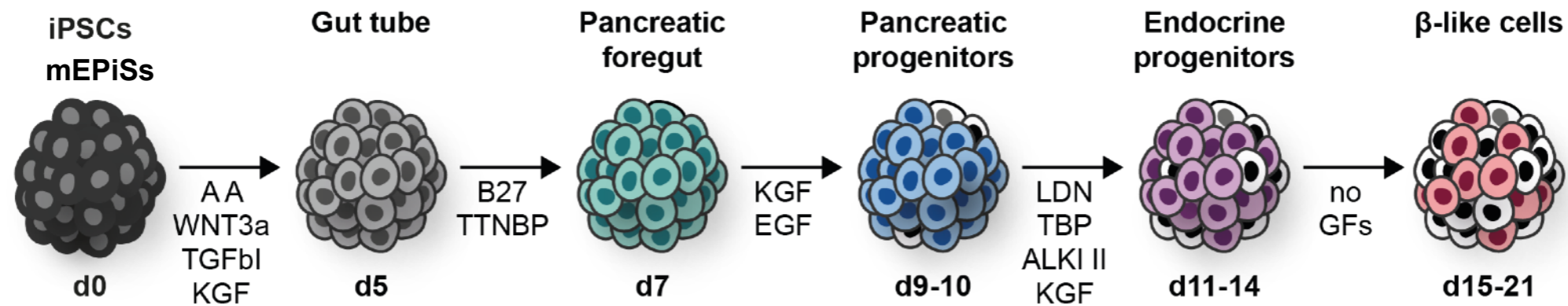


## Objectives:

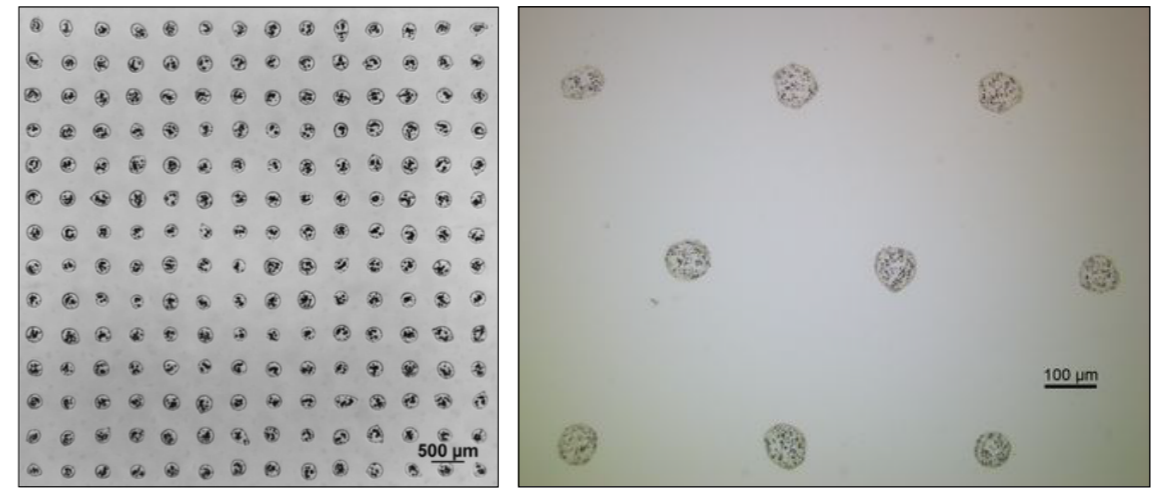
1. To build an atlas of 3D architecture of the developing pancreas
2. To develop bioprinting technology for engineering vascularized pancreatic tissue units
3. To establish conditions for in vitro differentiation of the bioprinted pancreatic tissue

<https://openbis-pancreas-atlas.ethz.ch/>

# Developing bioprinting processes

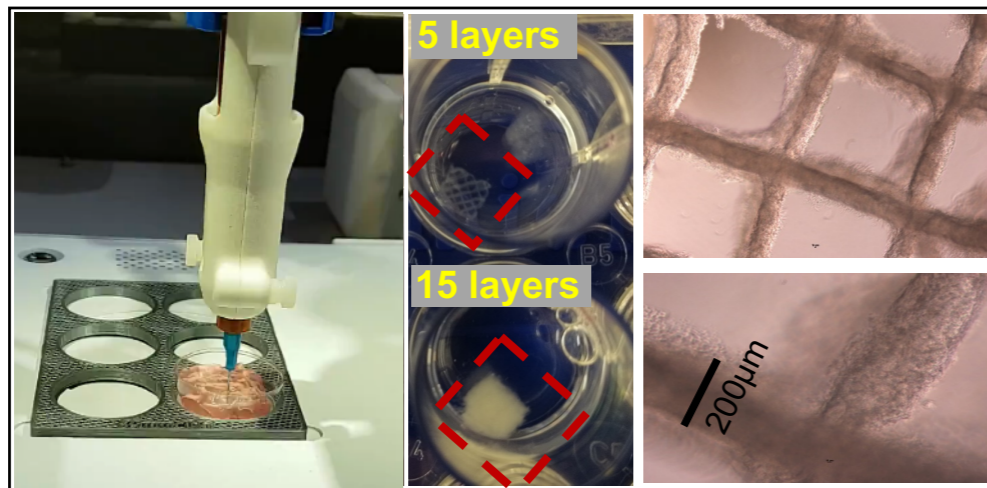
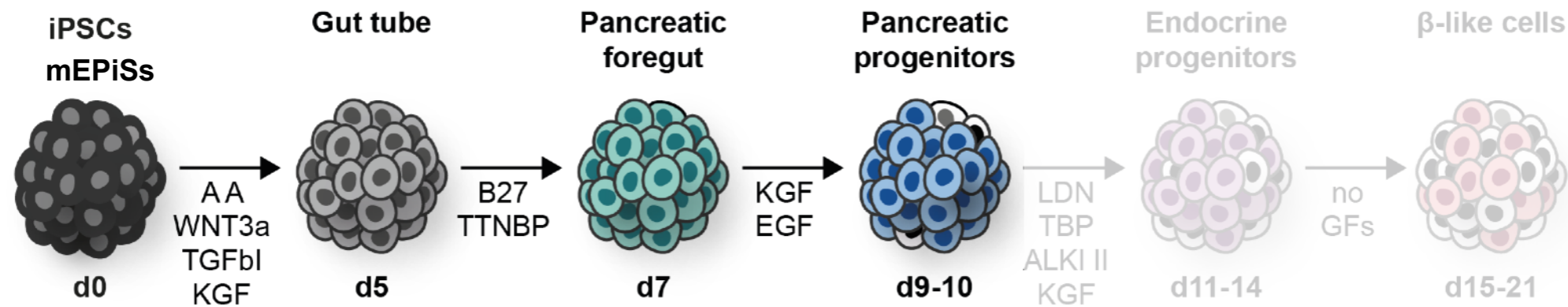


Extrusion PP printed in Fibrin + ECM

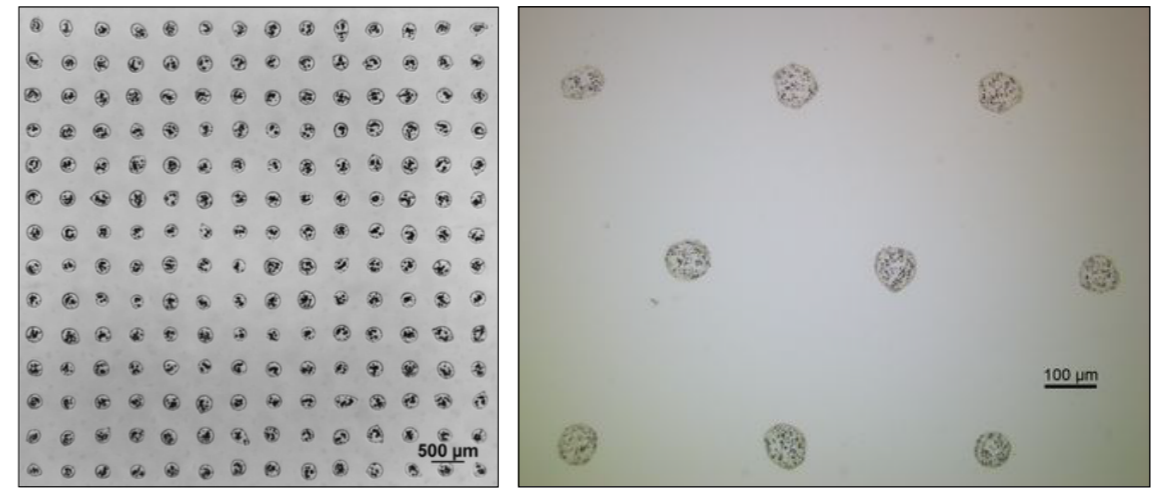


LAB PP printed droplet in Fibrin + ECM

# Developing bioprinting processes



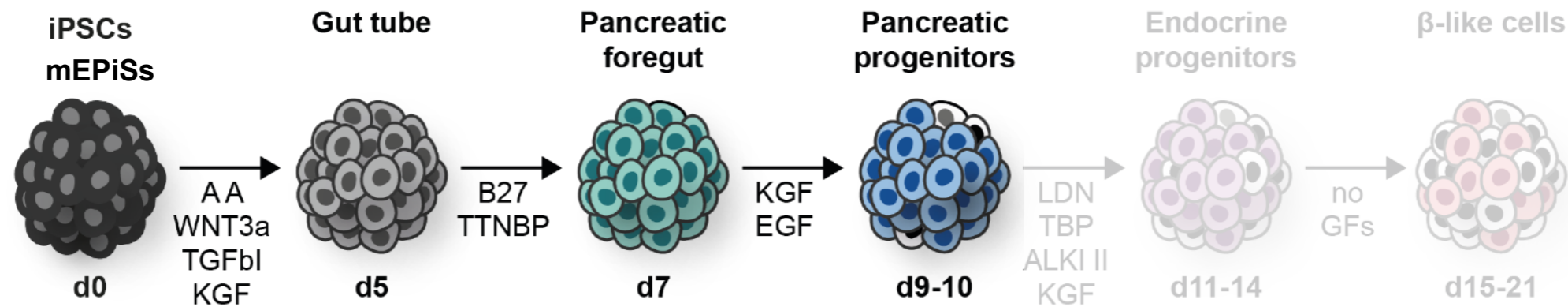
Extrusion PP printed in Fibrin + ECM



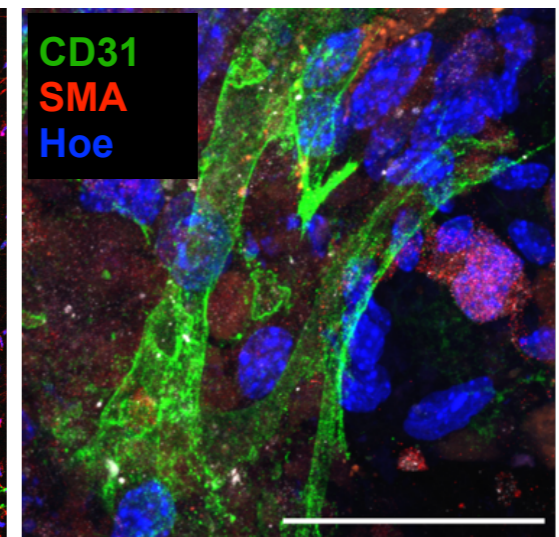
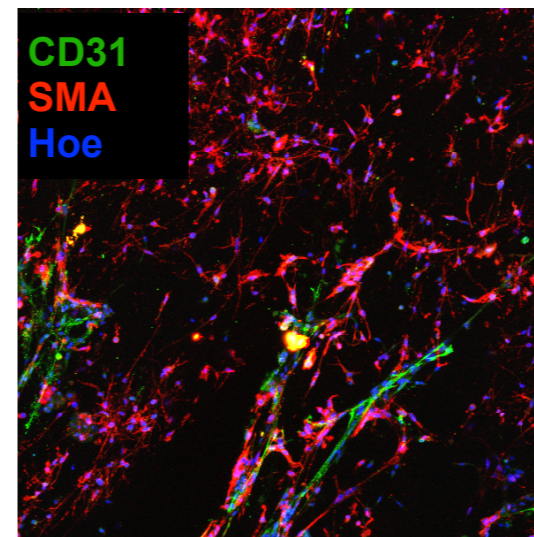
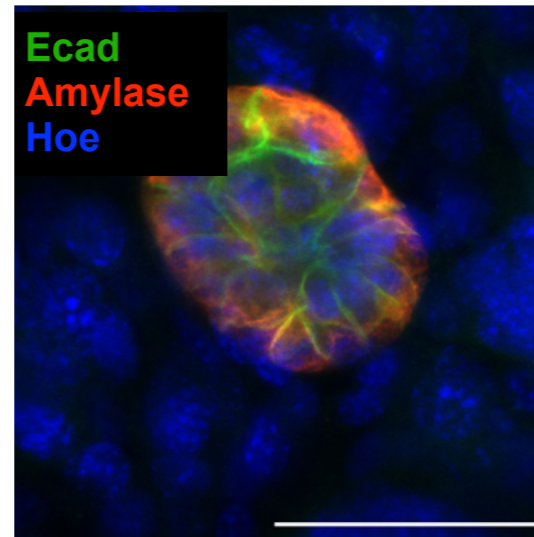
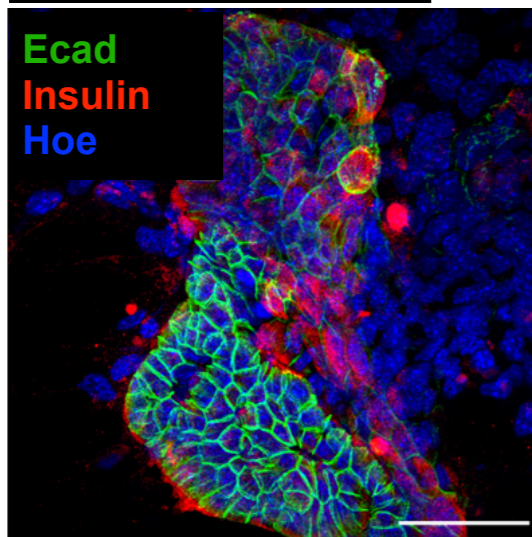
LAB PP printed droplet in Fibrin + ECM



# Developing bioprinting processes



d14 after bioprinting

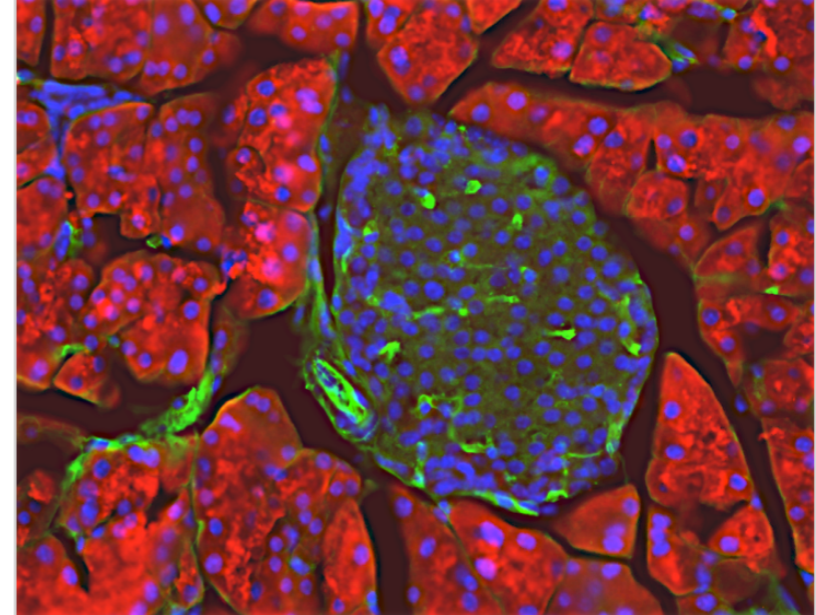


# Long-Term Vision

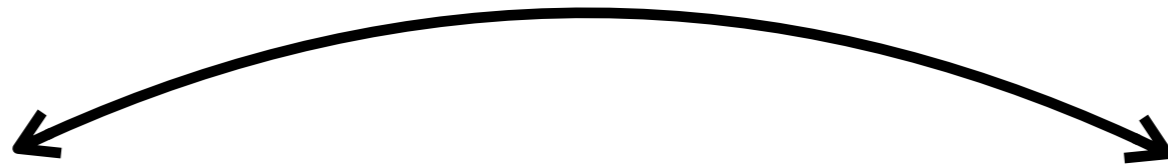
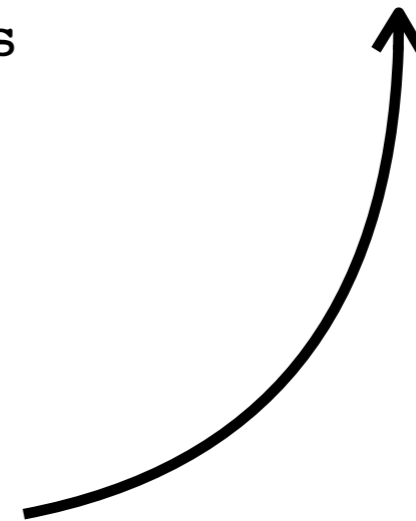
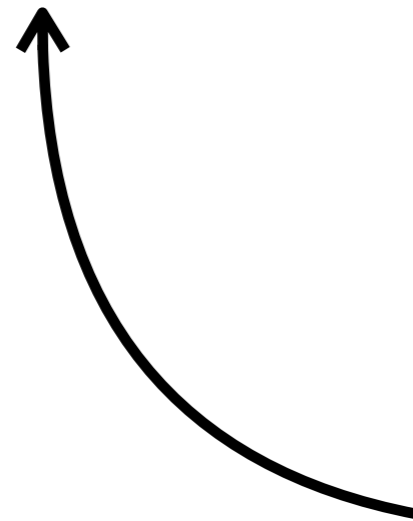
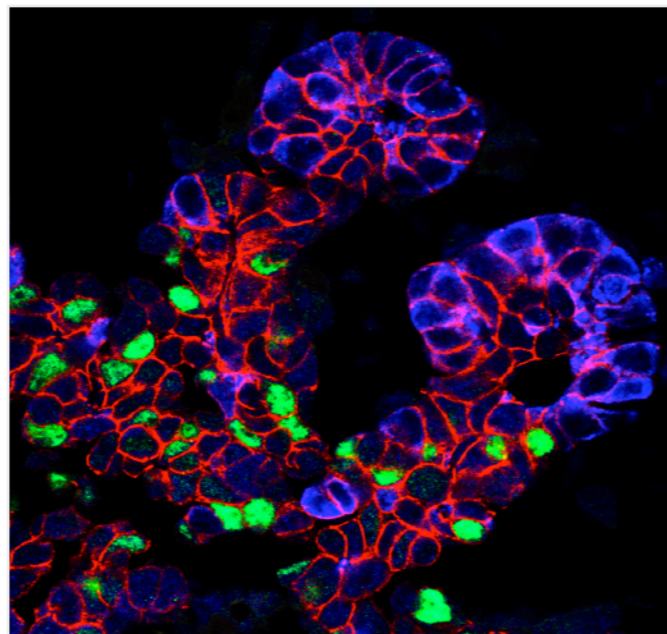
Regenerative Medicine



Tissue Homeostasis & Diseases



Developmental Processes



# The Lab.

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Cristina Garrone

Abigail Isaacson

Laura Mueller

Silvia Ruzittu

David Willnow

Heather Wilson



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