

# Resilience and innovation: learning from brilliant failures

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# Aim for the moon, climb the ladder step by step

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# DISCLOSURE SLIDE

Shareholder and consultant to CardiacBooster

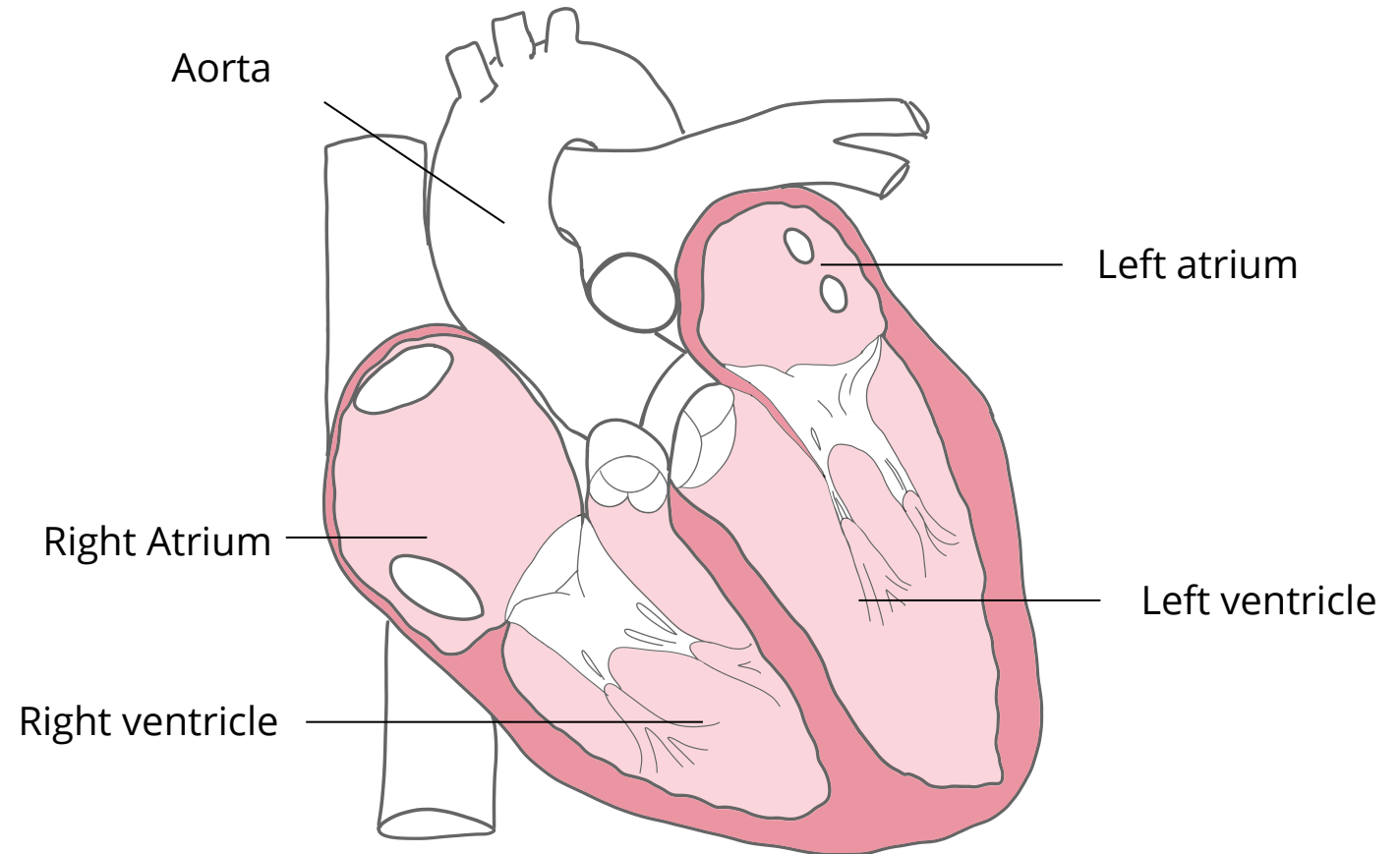


# **UNMET NEED: (ACUTE) HEART FAILURE**

We can put a man on the moon, but can't fix a simple 4 chamber pump?

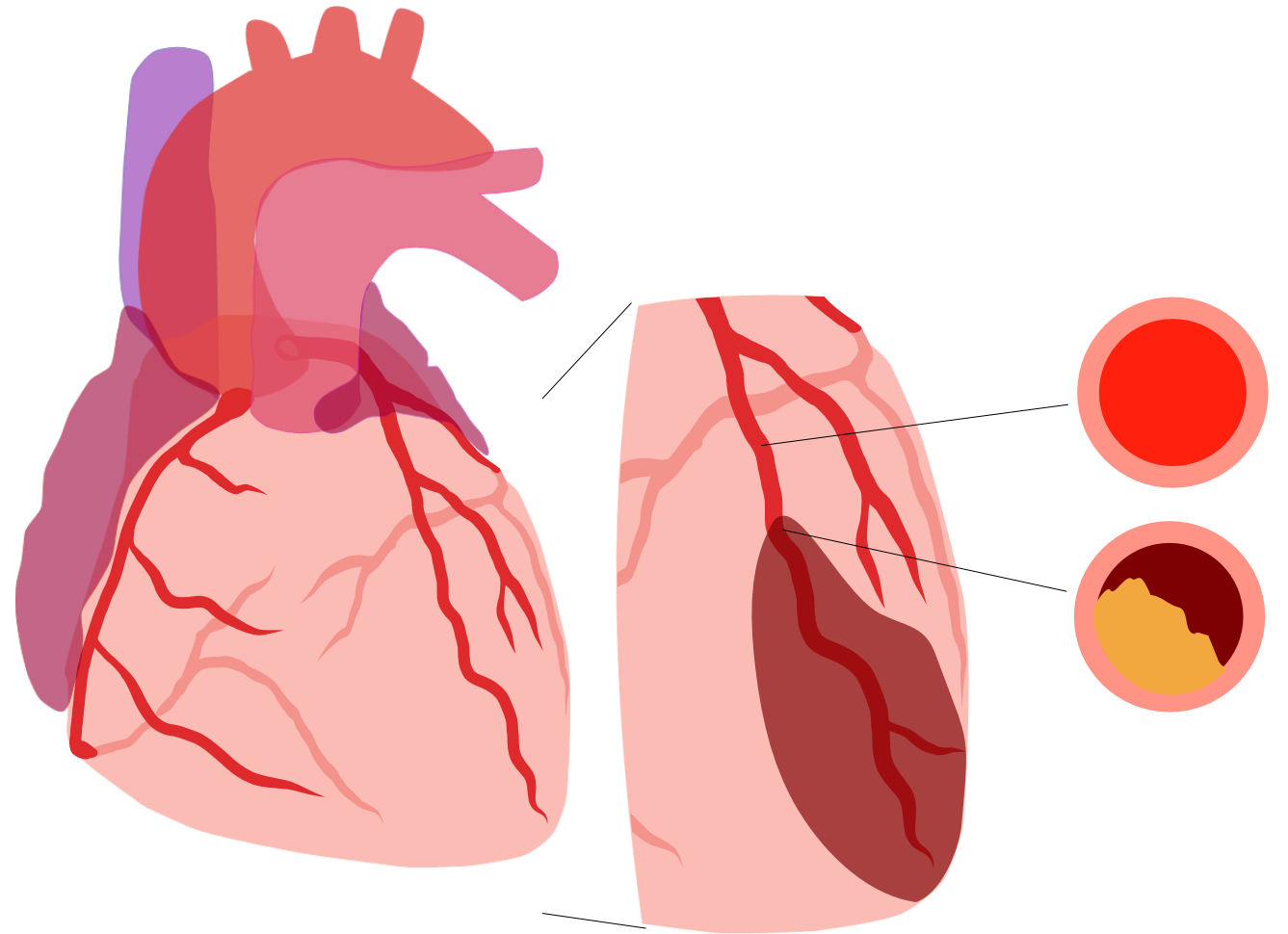
# THE HEART AS A PUMP

- Two atria and two ventricles
- Large and small circulation
- Contraction (systole) AND relaxation (diastole)
- Pumps 5 liters per minute at rest.. A life time long
- Delivers about 1 Watt of hydrolic energy



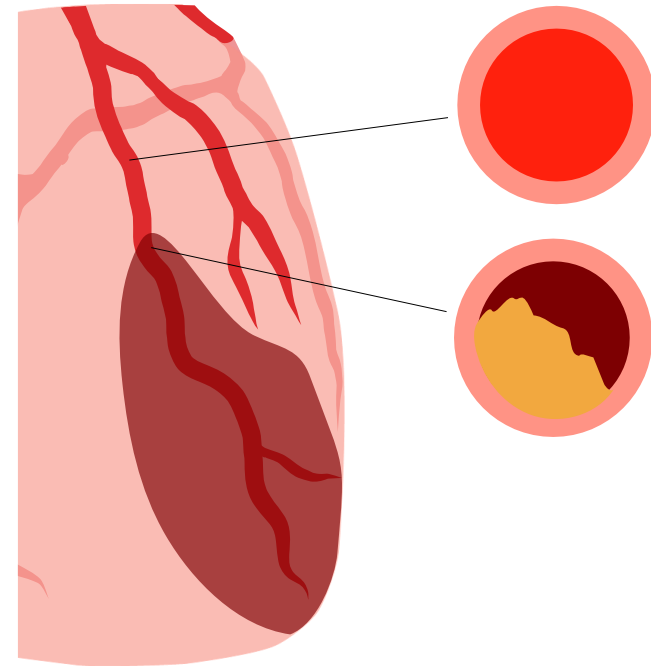
## THE HEART AS AN ORGAN

- Consumes energy, need blood
- Has its own blood supply, coronary arteries
- There may be a disturbance of supply by of an obstructive lesion in the coronary artery
- Myocardial tissue loses its contractility and relaxing capacity
- In case of a large infarction....



## WHAT CAN WE DO?

- Limit the damage, restore blood flow
- Support the heart with medication that increase heartrate or contractility
- (Partly) overtake the pump function, mechanical circulatory support



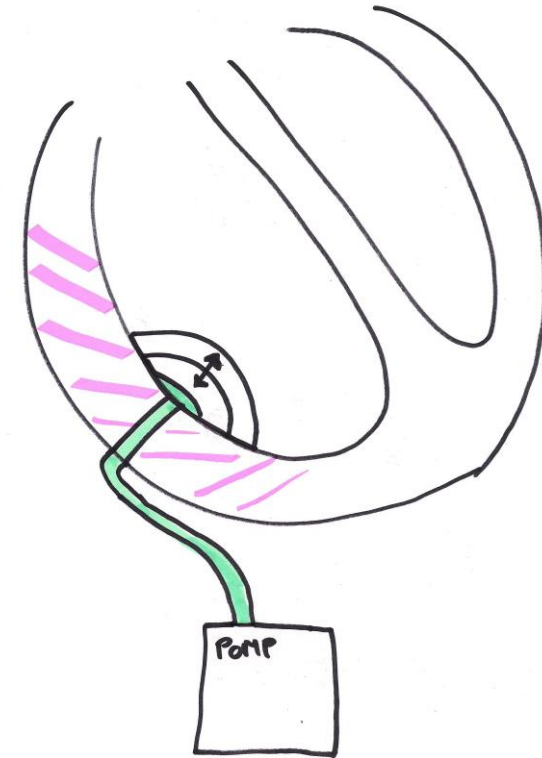
# This should be easy!

Only the muscle is dead we can leave the valves as they are?

Just remove scarred tissue, replace with artificial muscle.

Time the 'inflation' with the muscle contraction.

HET HART HULPJE



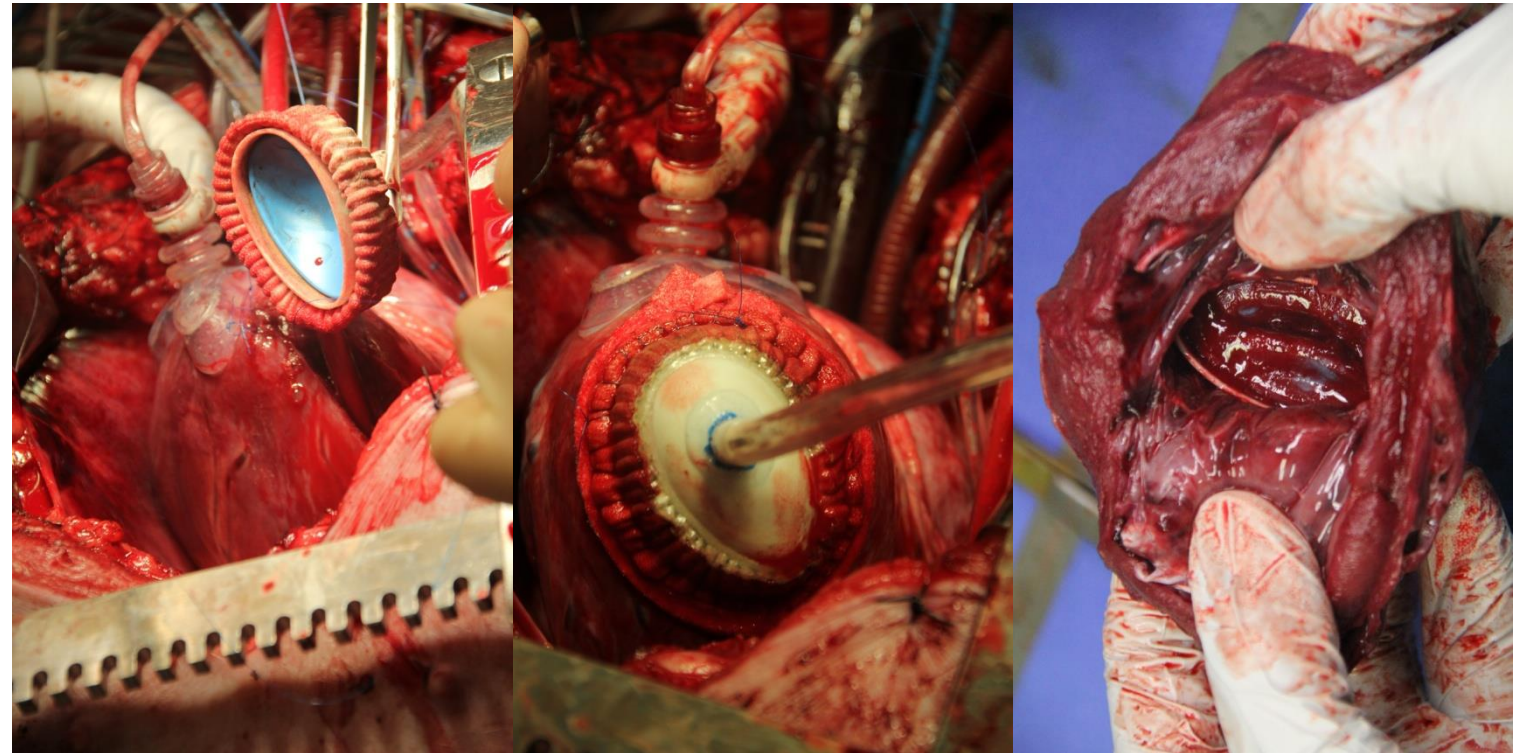
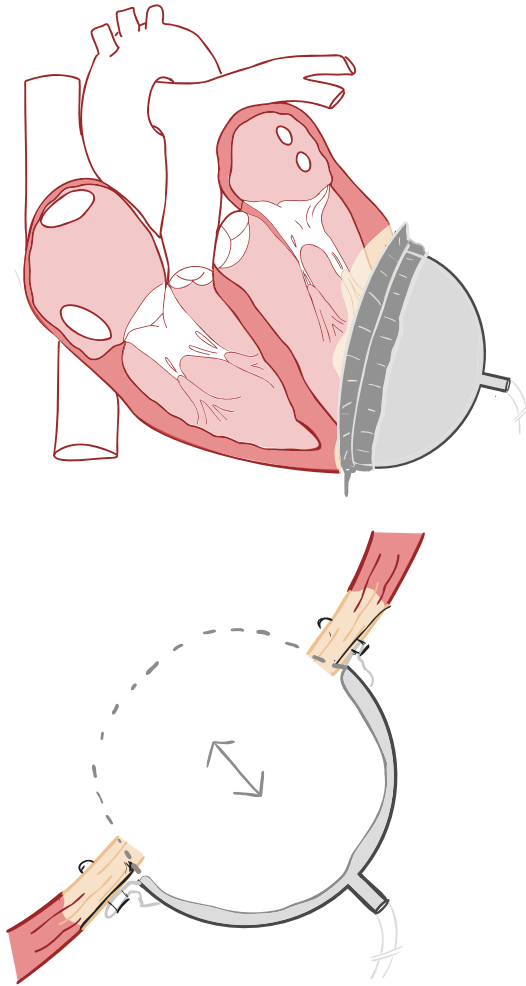
*First drawing of the concept 2009.*



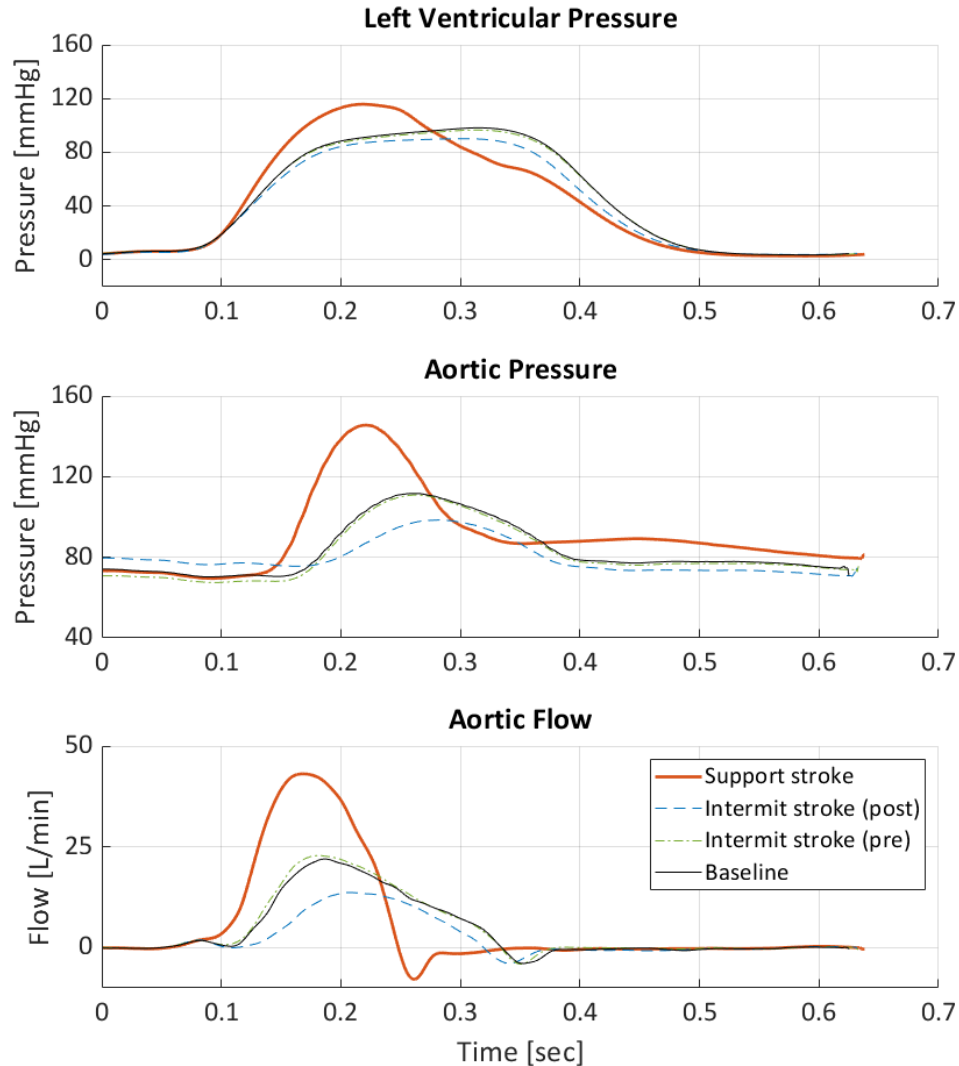
## FIRST PROTOTYPES IN THE 'LAB'



# IN-VIVO: CONCEPT VOOR DE LANGE TERMIJN – OPERATIEF GEPLAATSTE POMP-ONDERSTEUNING



# LEFT VENTRICULAR MEMBRANE PUMP



- In a ventricular aneurysm model, the active membrane support is feasible
- Directional push increased the stroke volume, most clearly on the 1:3 support.

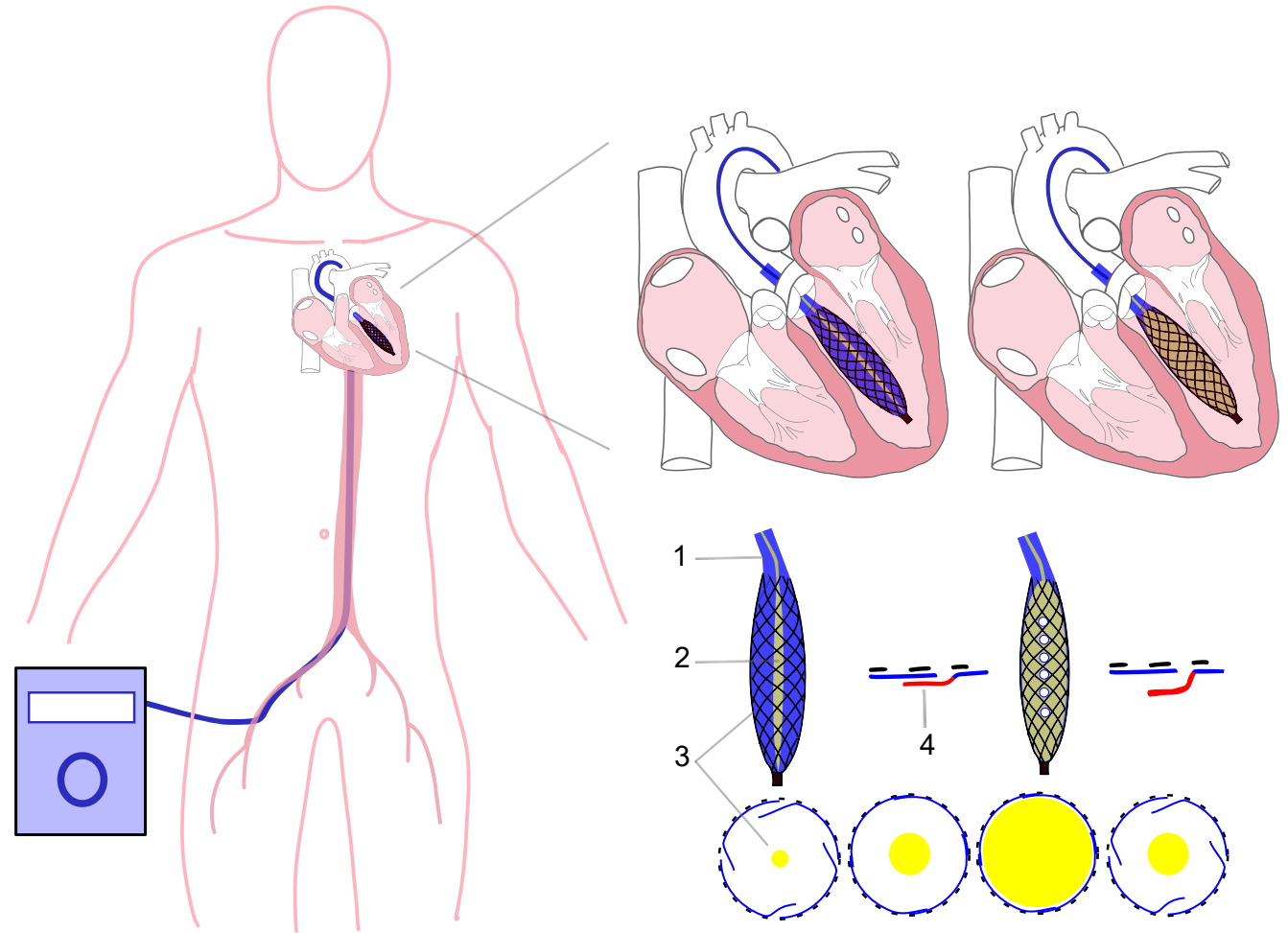
	Pre-support	Support
Stroke volume	57 (9)	80 (16)
Q <sub>peak</sub>	23 (0)	43 (0)
Sytolic Aortic Pressure	98 (13)	122 (24)
Diastolic Aortic Pressure	69 (1)	71 (1)
Meam Aortic Pressure	78 (3)	88 (7)
Pols pressure	30 (14)	51 (25)
LVSP	85 (12)	105 (11)
LVDP	6,4 (2,8)	6,0 (3,1)
dP/dT max	819 (187)	1229 (231)
Cardiac Power	0,86 (0,03)	1,32 (0,05)

## FROM SURGICAL TO CATHETER-BASED SOLUTION

- Unmet need: 50% survival in cardiogenic shock (no clinical validated competitor, at the time)
- Large patient population (large market, higher return)
- Straightforward clinical path (short timelines, lower cost)

## NEW PHASE: HIGH FREQUENCY SYSTEM

- Smaller
- Trans aortic valve
- Complete balloon coverage



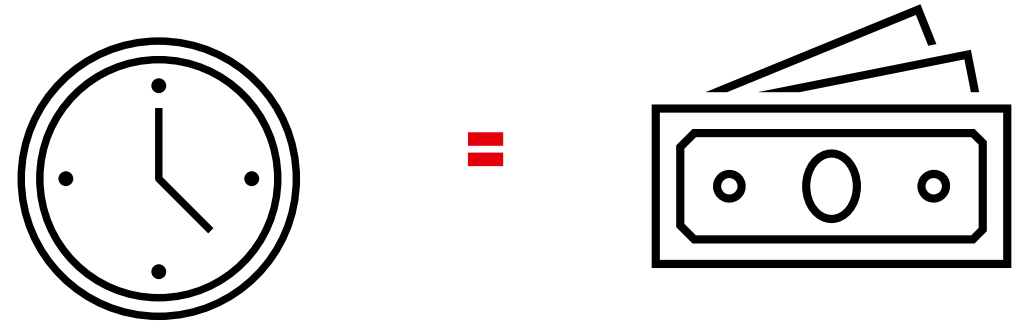
# BUILDING A COMPANY

Turn a concept into a business



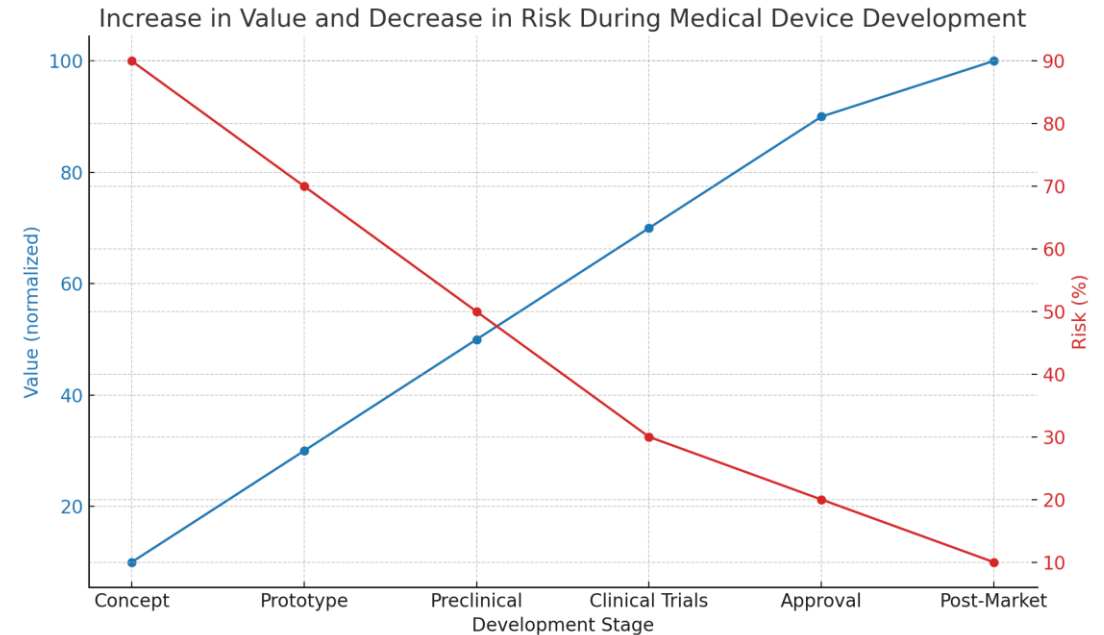
## BUILDING A COMPANY

- **Fundraising: a start-up is always fundraising**
  - Investors (Venture capital)
  - Grants
- **Building the company**
  - Finding a place
  - Assembling a team
  - And all the rest
- **Technical continuation**
  - Working towards value infliction points

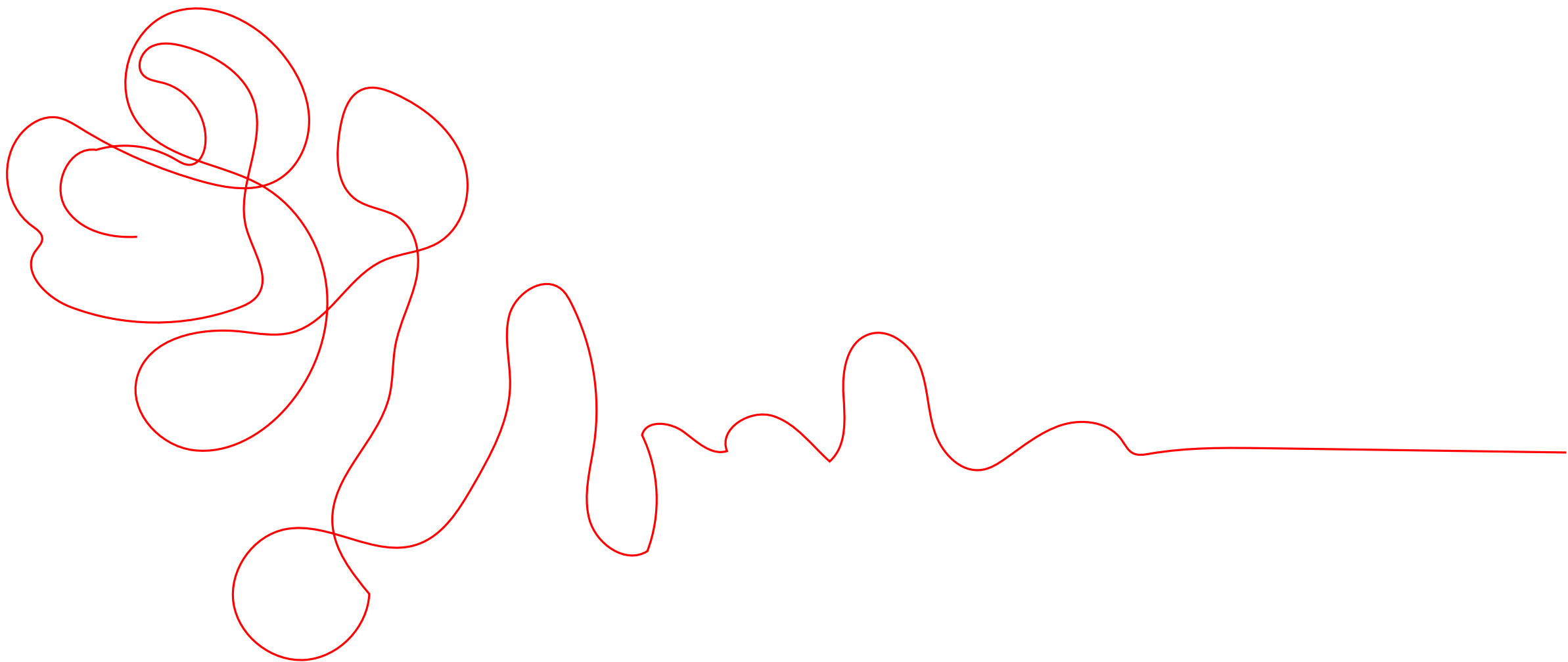


# TECHNICAL WORK: TRANSITION FROM RESEARCH TO PRODUCT DEVELOPMENT

- Unmet need: What is the problem you want to solve?
- Stakeholder requirements: What is your customer (payer) looking for?
  - Who is the end-user?
  - Who will cover the development: subsidy/investment?
- De-risk the project and to secure the next (funding) step







# Let's build a better world, together

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