

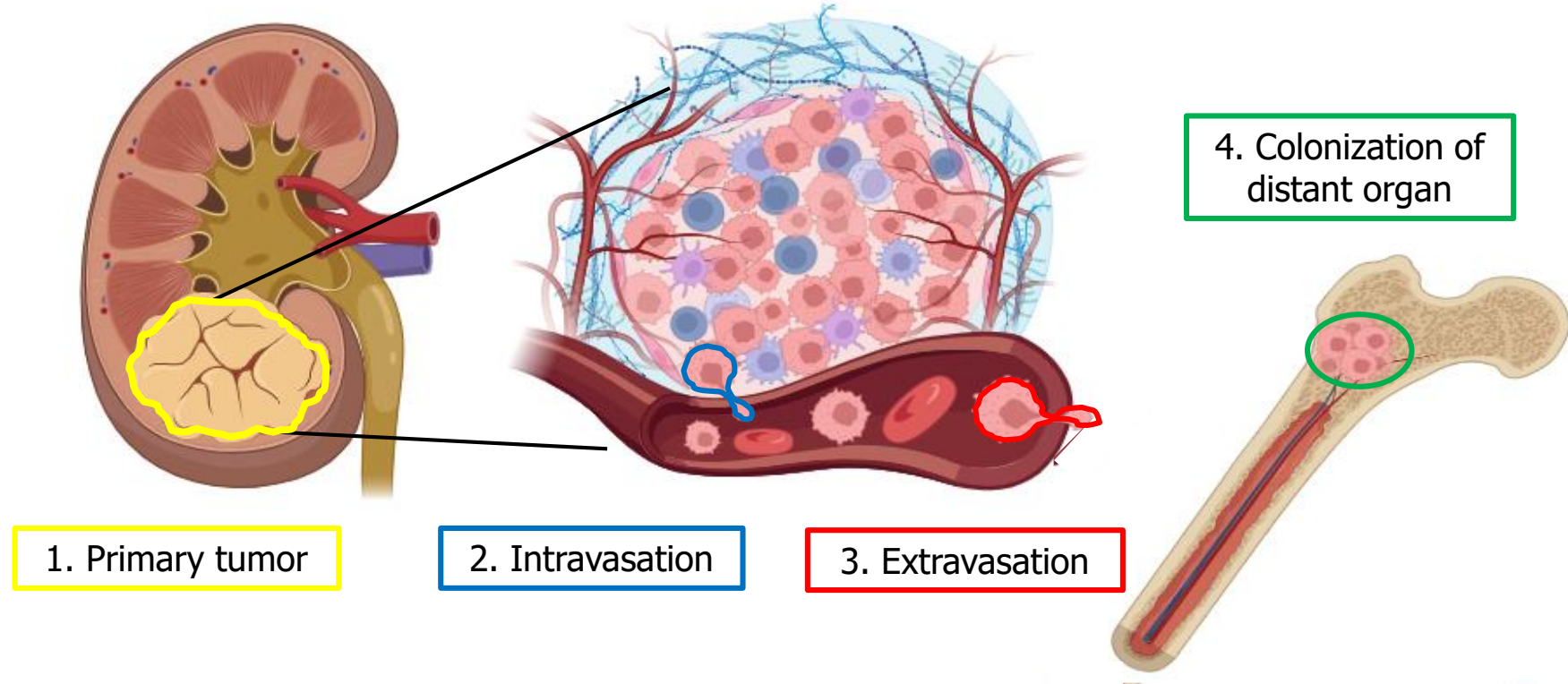


Development of a biomimetic bone-on-chip to study kidney cancer metastasis : ONCOTRAP

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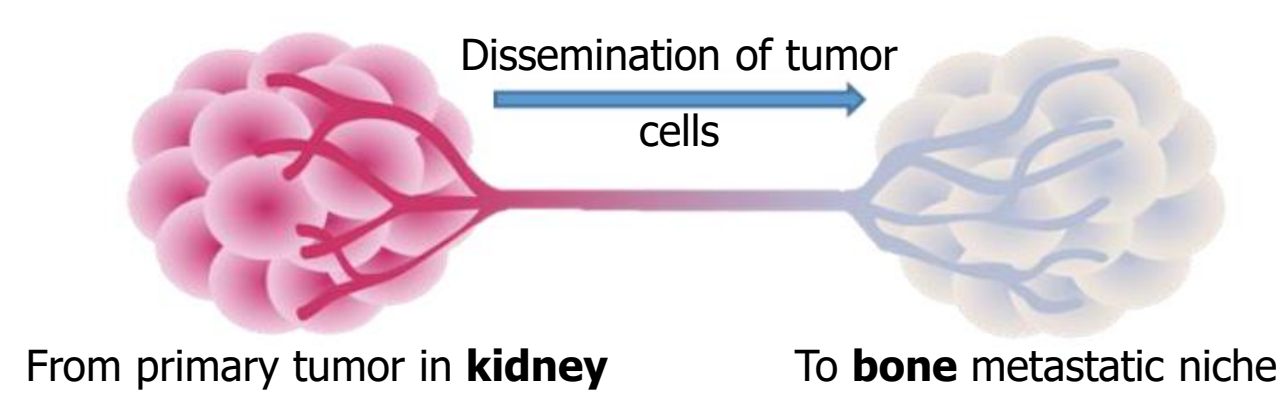
INTRODUCTION

BONE METASTASIS



- ✗ One of the three most frequent sites for metastasis
- ✗ Very poor prognosis (<10%), inefficient treatments
- ✗ **Kidney primary cancer : 30%** of patients are **metastatic** at diagnosis

METASTASIS-ON-CHIP

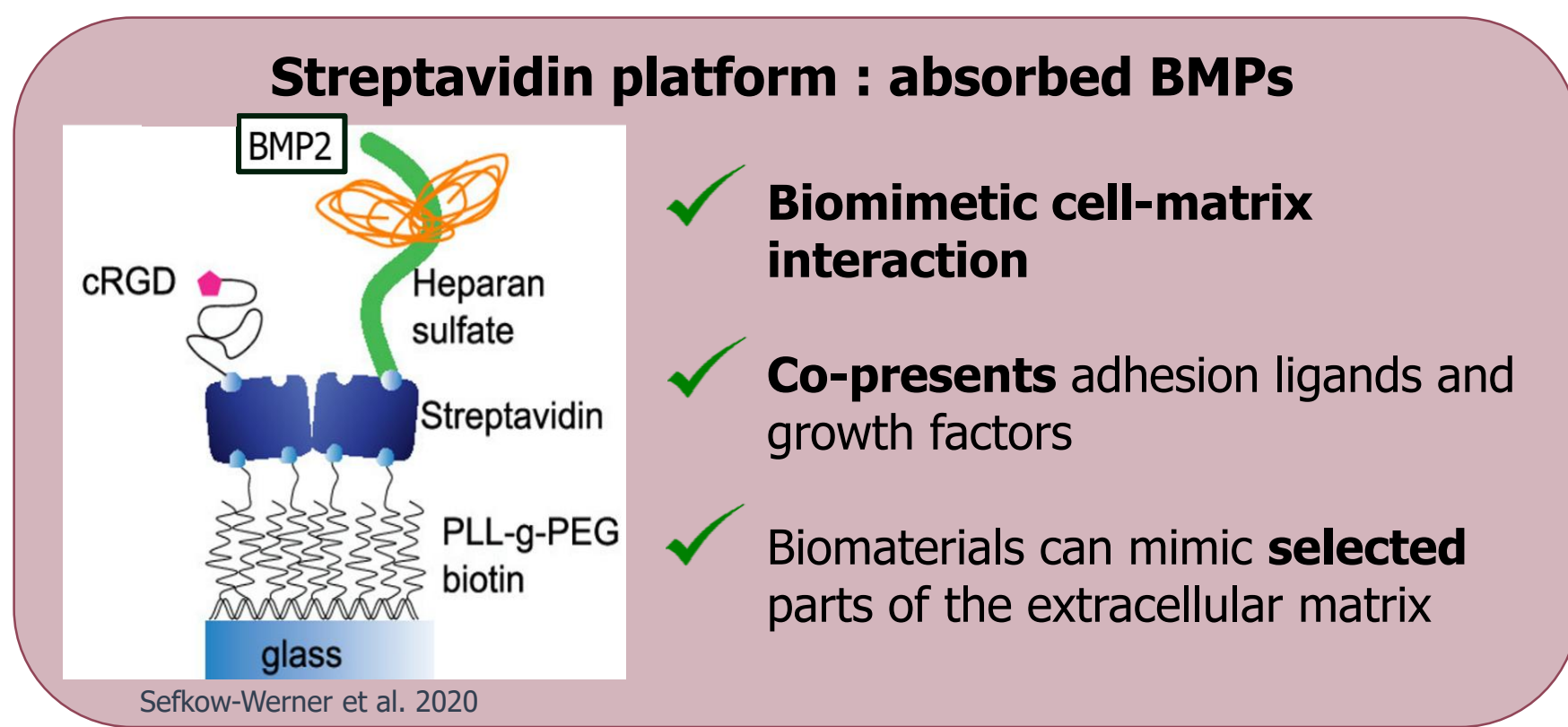


- ✓ Predict the metastatic potential of cancer cells
- ✓ Study patient cancer cells **invasion in bone niche**

METHODS

CREATION OF THE BONE NICHE

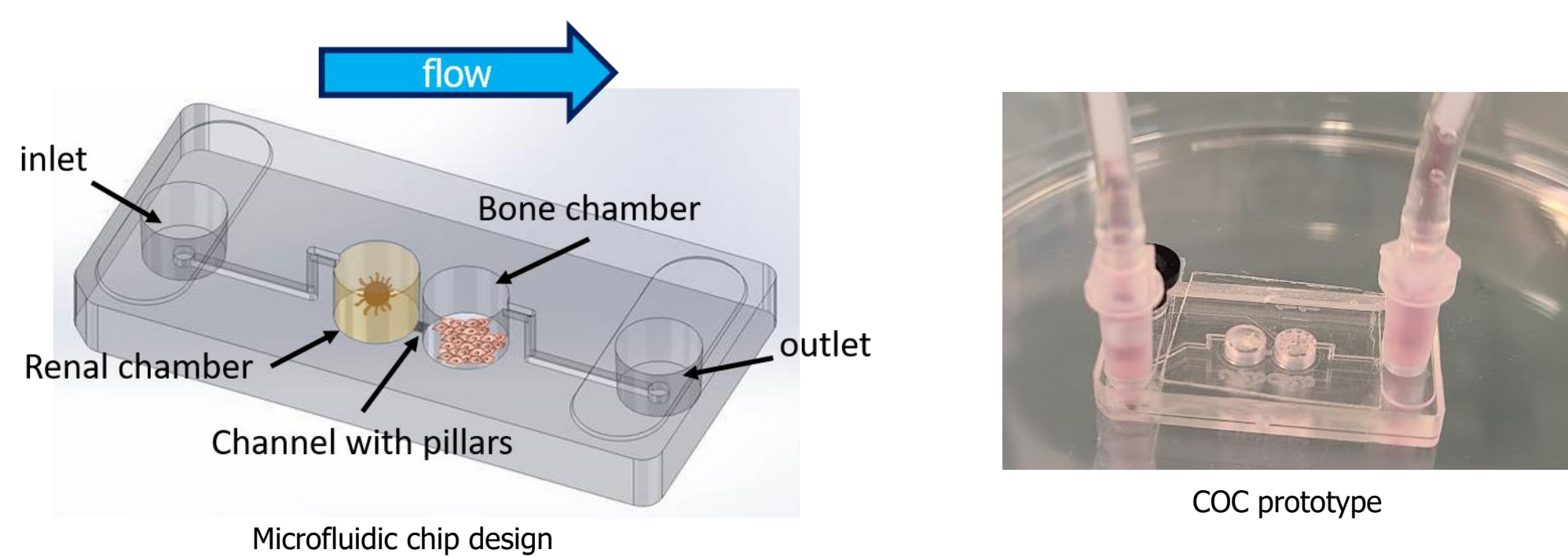
- **Cellular model** : human Periosteum-Derived Stem Cells (**hPDSC**), can differentiate into osteoblasts in the presence of **BMP2** (Bone Morphogenetic Protein)



MICROFLUIDIC CHIP

A microfluidic chip made of 2 chambers (Ø = 4mm) in COC to welcome :

- **Renal chamber** : **786-O mcherry** spheroid
- **Bone chamber** : monolayer **hPDSC** +/- BMP2 stained with PKH67



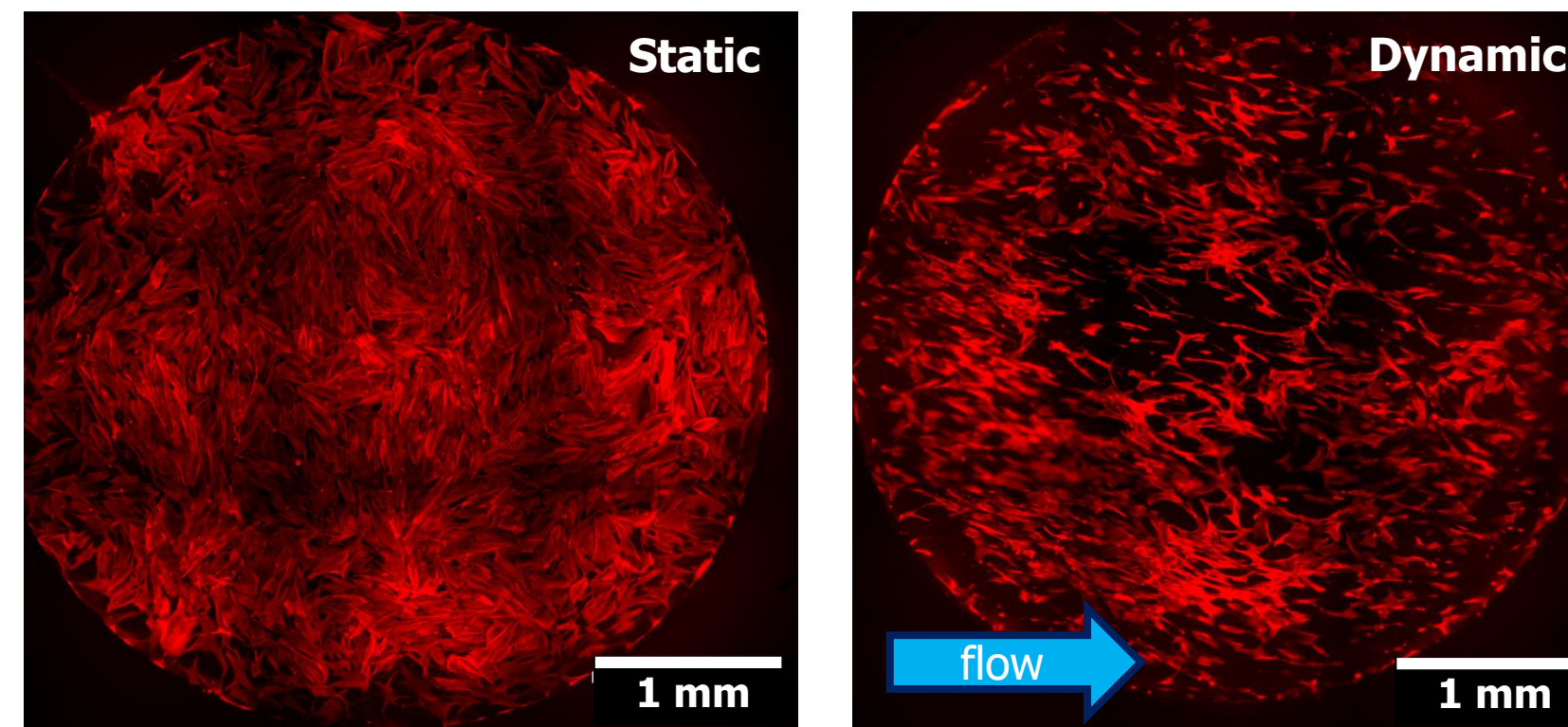
CONCLUSION

- ✓ Cells responded to the microfluidic flow by orienting their actin filaments in the direction of the flow.
- ✓ hPDSCs are a good human cell model to built a bone niche on a microfluidic device since they differentiate into osteoblasts.
- ✓ Study of kidney cancer cells invasion in bone niche in microfluidic chip during 31 days and extraction of parameters.
- ✓ Control precisely in space the functionalization of the biomimetic platform in the bone chamber.

RESULTS

DYNAMIC CULTURE CONDITION

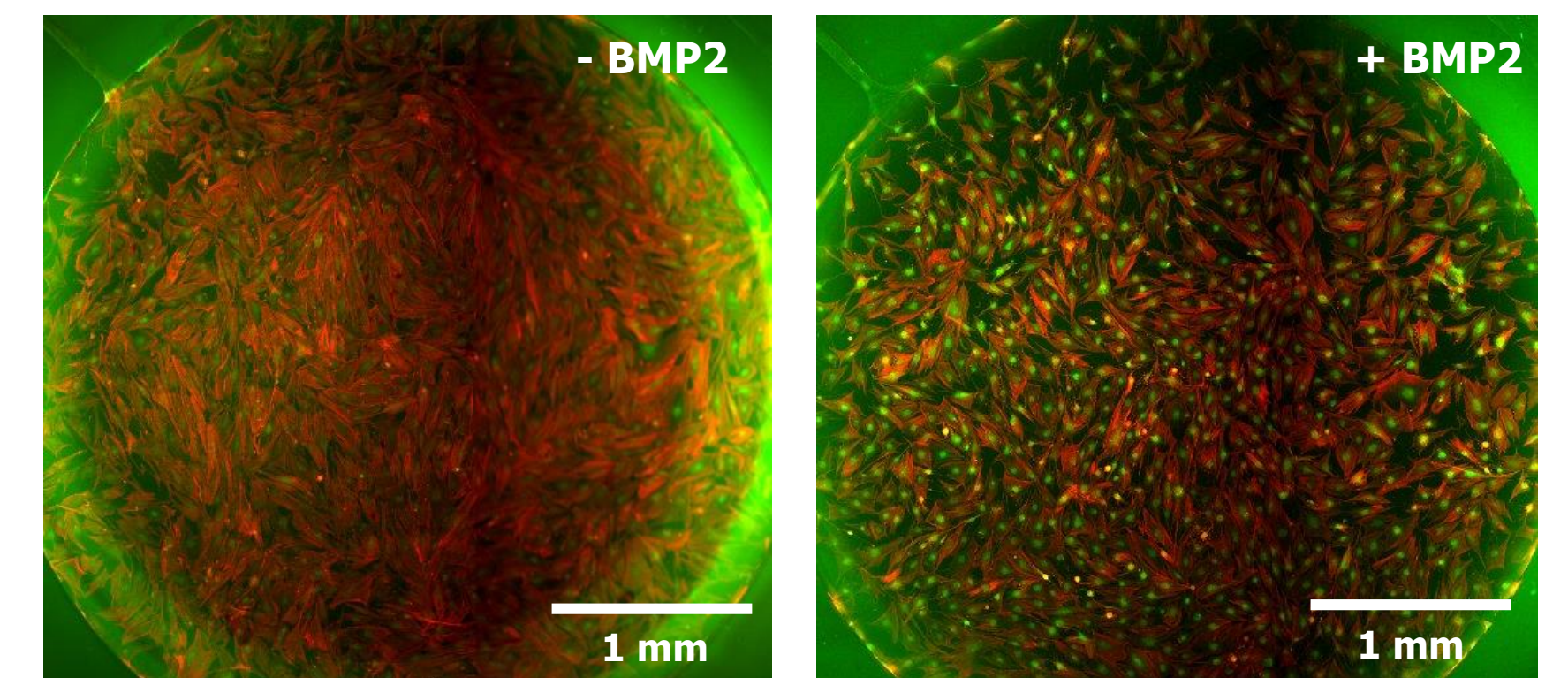
→ **Aim** : see the influence of flow and shear stress on hPDSC morphology



➔ **Bone cells are oriented along the flux**

THE BONE NICHE

→ **Aim** : differentiate stem cells in the microfluidic device to obtain the bone niche

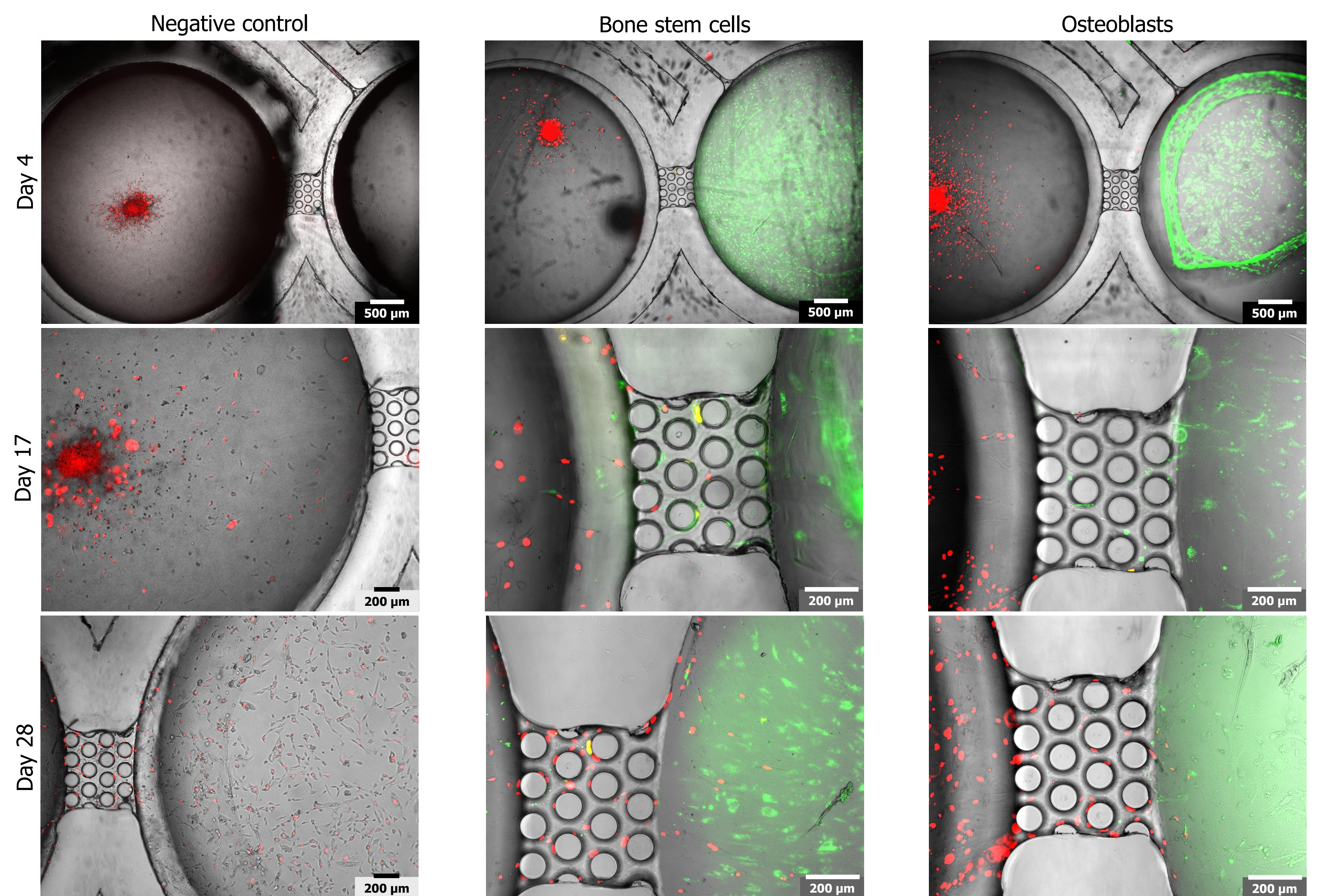


➔ Successful osteoblasts differentiation **in the bone chamber**. The osteoblast niche is ready after 5 days of BMP2 treatment.

ONCOTRAP : METASTASIS-ON-CHIP

→ **Aim** : study the tropism of renal cancer cells towards bone

- Preliminary: a **786-O spheroid** and **hPDSC cells** have been seeded in the same microfluidic device for 31 days.



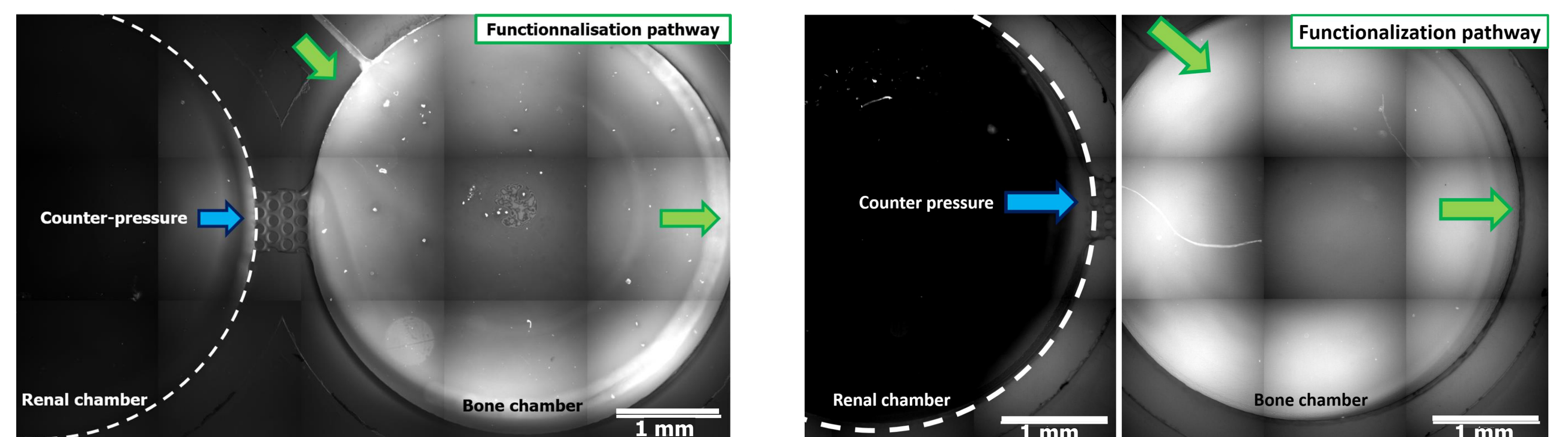
Cancer cells speed in the pillary channel :

- Negative control condition → 250 µm/day
- Bone stem cells condition → 50 ± 6 µm/day
- Osteoblasts condition → 82 ± 4 µm/day

➔ **Bone cells** seem to reduce invasion speed compare to negative control. More biological tests are expected to better explain this phenomenon.

PERSPECTIVE : BIOMIMETIC MATERIAL

→ **Aim** : design a biomimetic material to present BMP2 to cells as *in vivo* on our tissues



➔ Successful building up of the **Streptavidin platform in the bone chamber**

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