Retina-on-chip:

#378

Designing a PDMS-based Microfluidic Chip with 2 µm-thick Membranes for Culture of iPSC-Derived Retinal Pigment Epithelium

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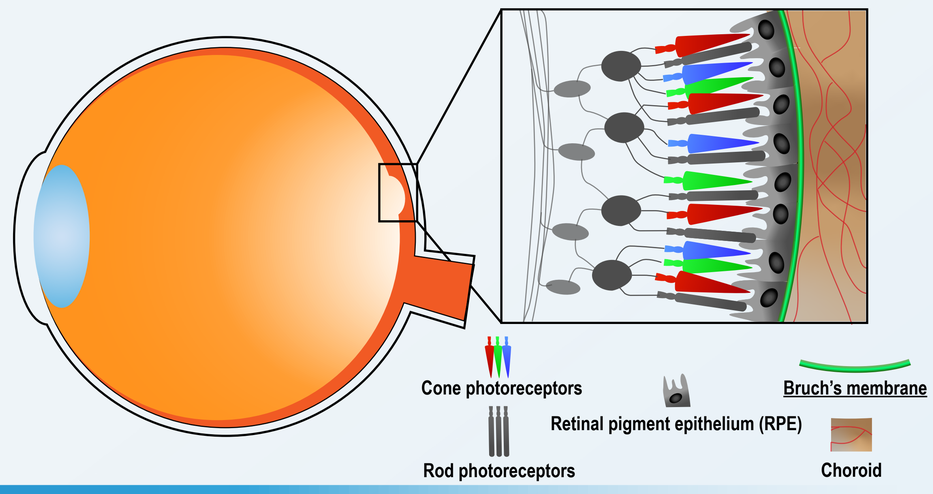
Background

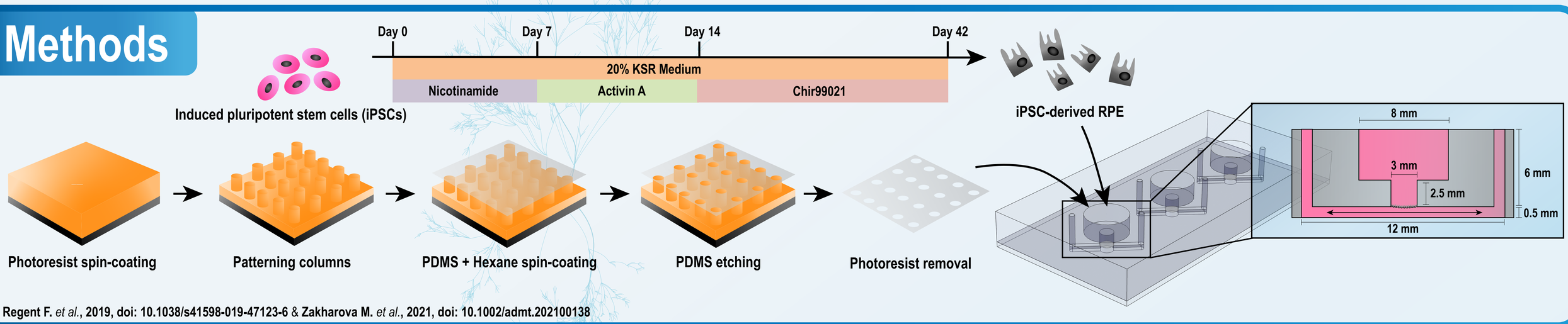
- Inherited retinal diseases (IRDs) are progressive diseases with early age of onset
- IRDs may lead to photoreceptor cell death which are cells that are part of the human's highly organized retina [1]
- Within the retina, the RPE is separated from the choroid by the Bruch's membrane
- The Bruch's membrane provides structural and functional support for the RPE [2]
- Current *in vitro* models of the outer-retinal blood barrier lack the possibility for a long-term culture of RPE while maintaining physiological characteristic of the Bruch's membrane



Aim of the project

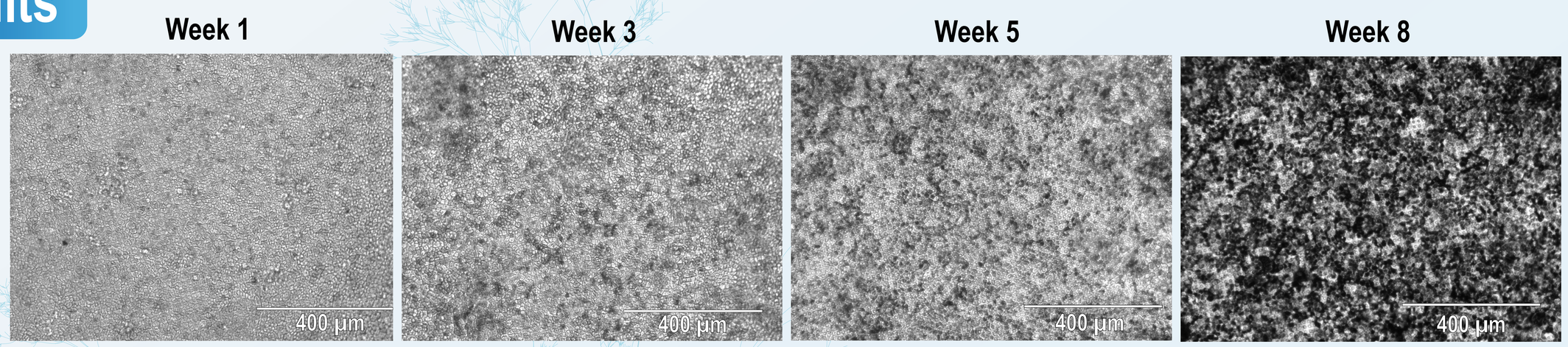
Demonstrate that thin synthetic membranes, that have similar thickness of the basal laminae in the human retina, can support long-term culture of iPSC-derived RPE monolayers inside microfluidic chips

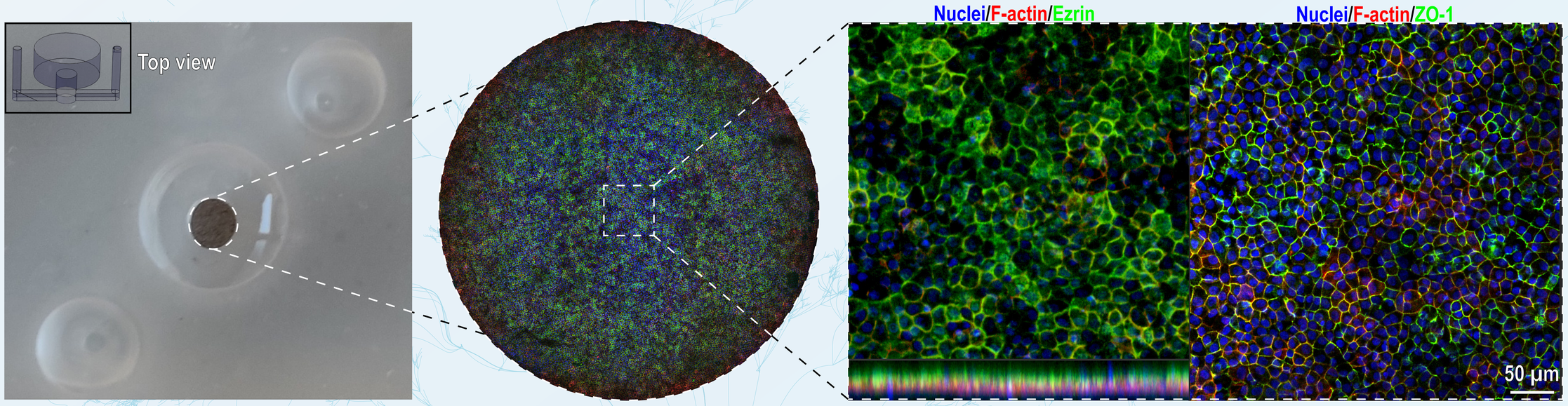
Methods



Regent F. *et al.*, 2019, doi: 10.1038/s41598-019-47123-6 & Zakharova M. *et al.*, 2021, doi: 10.1002/admt.202100138

Results





Discussion & Conclusion

- Successful cultivation and maturation of iPSC-RPEs on thin membranes on chip
  - Increased pigmentation over time
  - High expression of tight-junction marker (ZO-1) and apical marker (Ezrin) after 8 weeks
- Ongoing work:
  - Quantification of pigmentation and marker expression over time
  - Barrier integrity measurements using permeability assays and transepithelial electrical resistance (TEER) measurements

Future perspectives

- Include a (functional) vascular network below the iPSC-RPE
- Disease modeling using patient-derived iPSCs

References

[1] Hildebrand & Fielder, 2011, doi: 10.1007/978-3-642-12041-1_2

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[4] Regent F. *et al.*, 2019, doi: 10.1038/s41598-019-47123-6

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