

Venom-controlled fibrin architecture revealed by SANS/USANS regulates fibroblast differentiation

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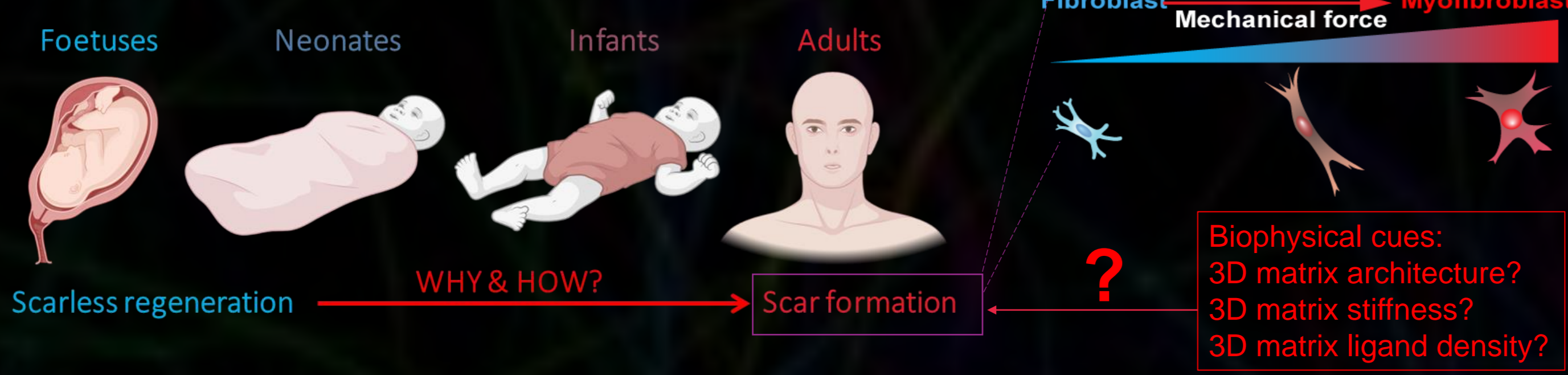
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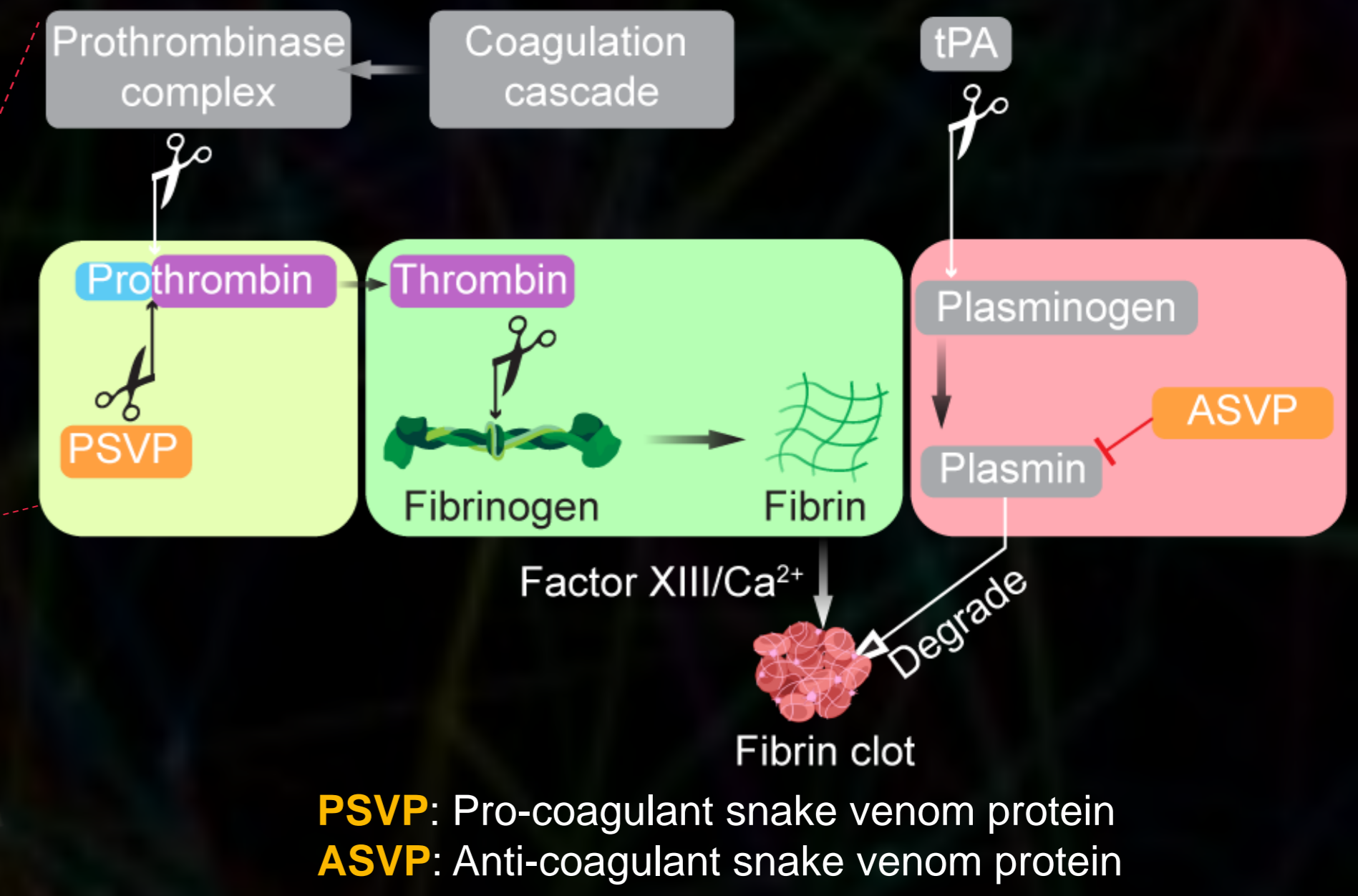
Fibroblast differentiation in wound healing

- Fibroblast-to-myfibroblast differentiation plays a central role in wound healing. Myfibroblast is responsible for wound closure and scar formation [1].
- Both mechanical force and biochemical cue TGF- β 1 are needed to trigger the fibroblast differentiation [2].
- Fibrin is the provisional matrix formed after injury, delivering key cues to wound healing. How the biophysical cues (architecture, stiffness, ligand density) of matrices influence fibroblast differentiation is still unknown [3-4].

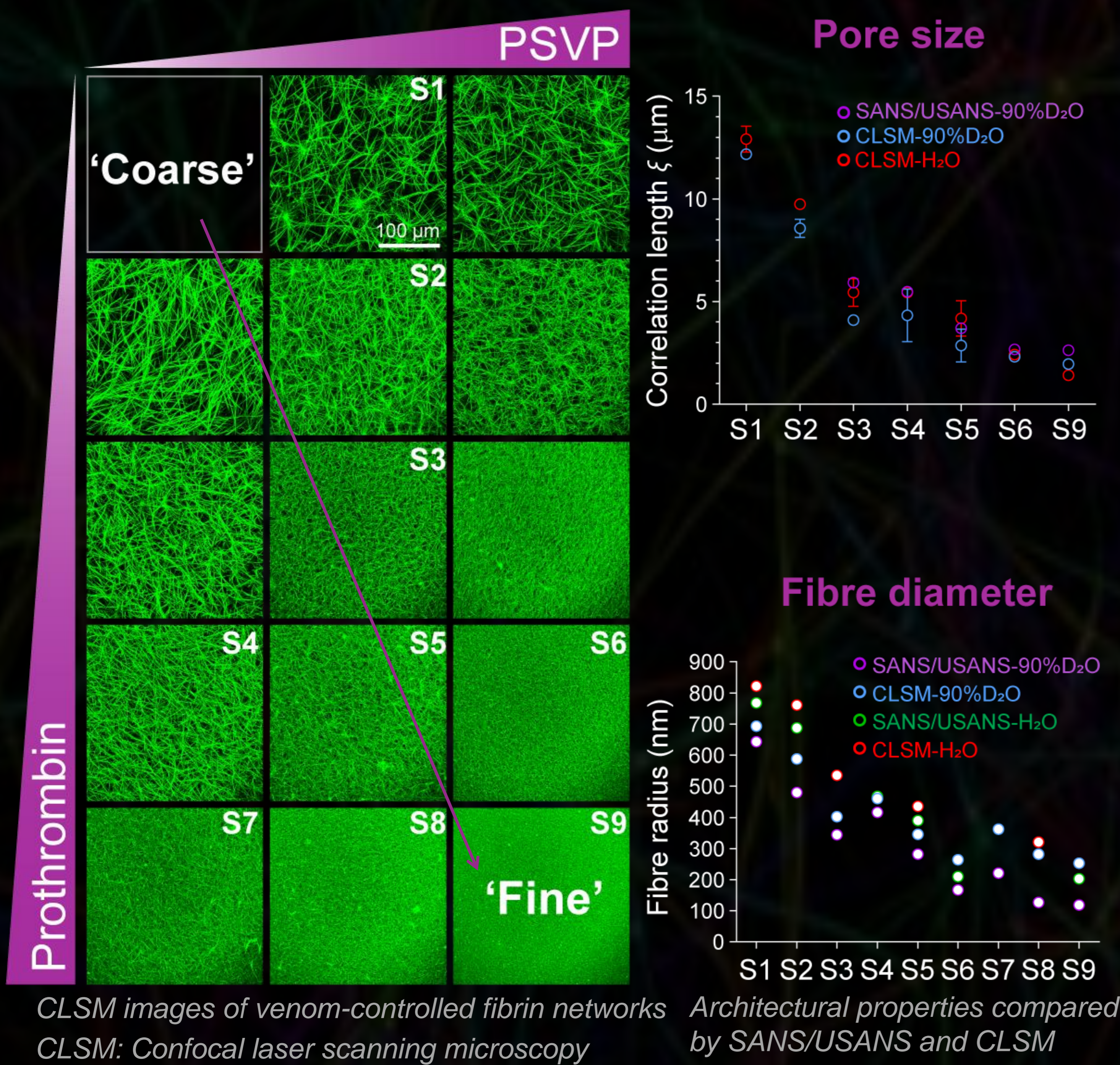


Snake-venom-controlled fibrin polymerization

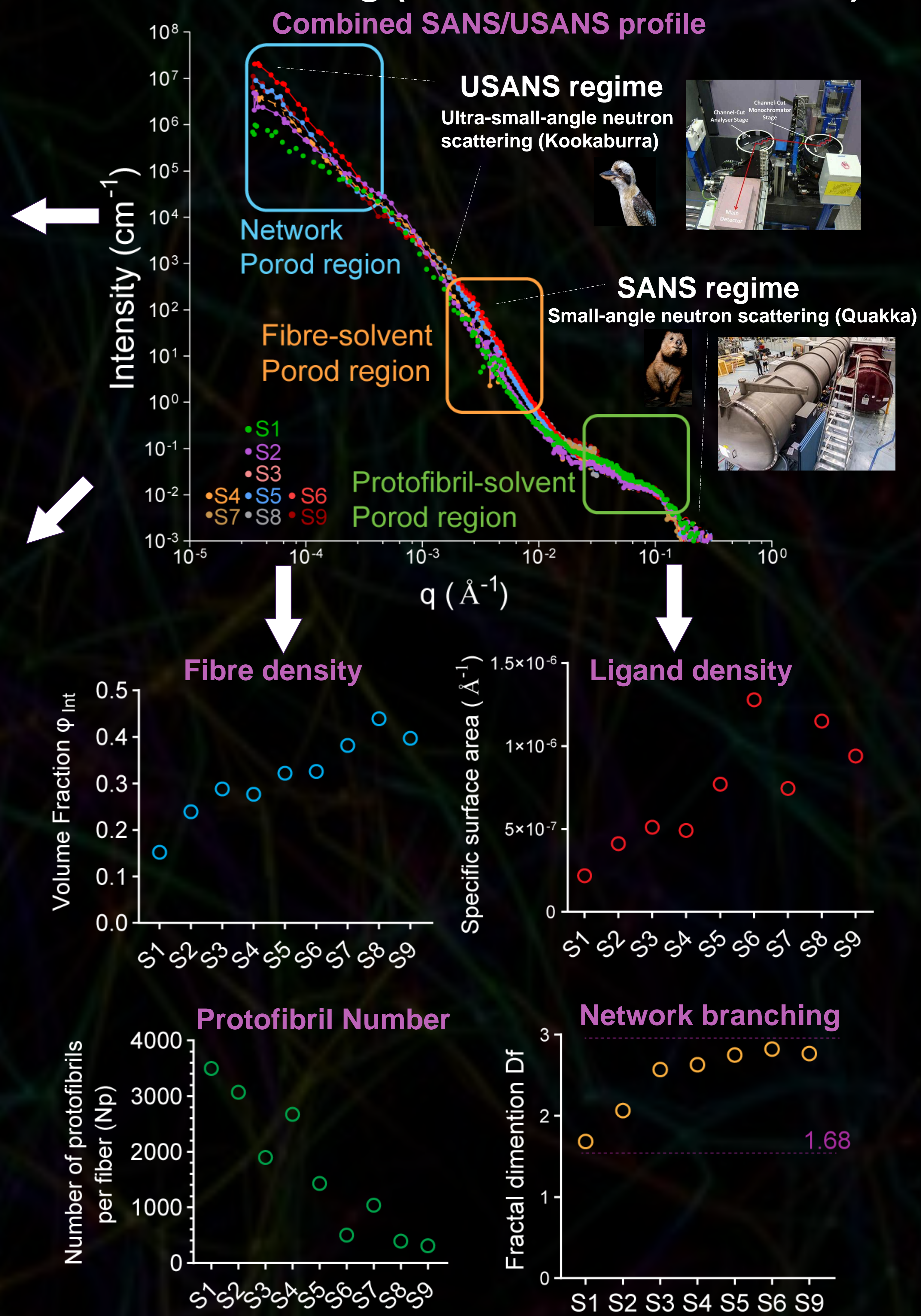
- PSVP activates prothrombin to form thrombin. Thrombin then initiates fibrinogen to form the fibrin networks.
- ASVP stabilizes fibrin networks by inhibiting fibrinolysis.
- Fibrin stiffness can be tuned by controlling FXIII/Ca²⁺-induced crosslinking within the fibres [5].
- However, the architectural properties (pore size, diameter, fibre density, surface areas, etc) cannot be accessed or characterized accurately by traditional methods.



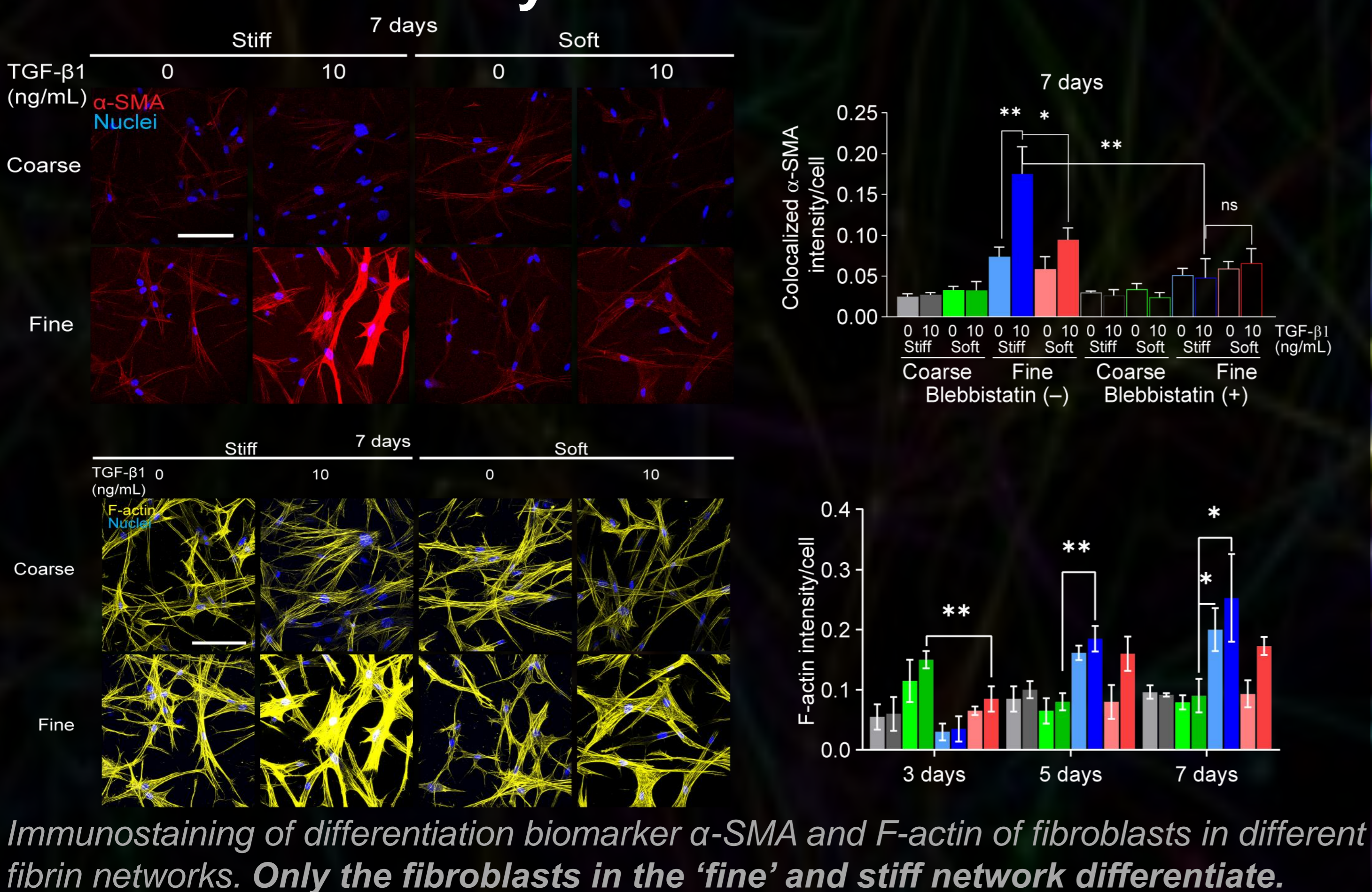
Snake-venom-controlled fibrin 3D architecture



Neutron scattering (combined SANS/USANS)



Fibrin architecture regulates fibroblast-to-myfibroblast differentiation



Conclusions

- Combined SANS/USANS provides a whole range of architectural information of the novel venom-controlled fibrin networks from the internal protofibril, single fibre to the fibrin network.
- 3D fibrin architecture verified by SANS/USANS influences fibroblast differentiation. This is a new method to regulate cellular behaviours and provides a potential tool to achieve the scarless wound healing in adults.

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- SANS and USANS images adapted from ANSTO website.
- Quokka and Kookaburra images from Wallpapercave.com



AIBN Australian Institute for Bioengineering and Nanotechnology