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# Stimuli responsive biohydrogels based on enzyme-assisted self-assembly

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Cells are complex chemical systems able to respond to their environment through sequential cascades of transformations finely controlled in space and over time. These processes often lead to localized self-assembly of fibrous structures<sup>1</sup> (actin fibers (figure 1), microtubule spindles....). These self-assembly processes are usually initiated and controlled by localized enzymatic reactions.

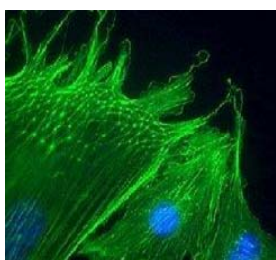


Figure 1 : Actin fibers whose self-assembly is initiated at focal-adhesions

Since 5 years our group is interested surface localized self-assembly initiated by enzymes. In this case enzymes are deposited on surfaces and these enzymes transform peptides from a non-self-assembling state into a self-assembling one which leads to the formation of gel localized near the surface.<sup>2, 3, 4</sup> Our goal here is to go one step further in the development of adaptive systems triggered by a unique external stimulus. **We will design hydrogels containing enzymes able to trigger the self-assembly of peptides (figure 2).**

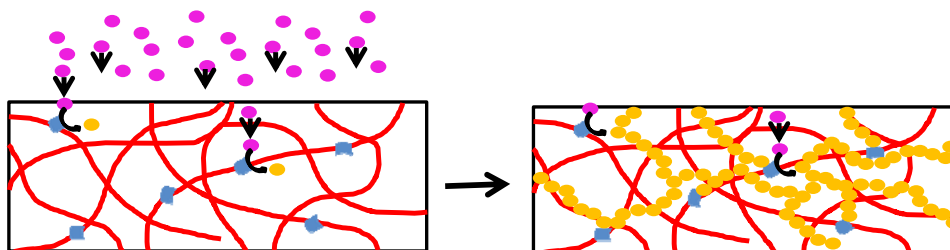


Figure 2: schematic representation of our project : non self-assembly peptides (purple) diffuse with a host hydrogel (red) in the presence of enzymes (blue). They then undergo a transformation into a self-assembling state (yellow) and self-assemble.

These hydrogels should be non-interacting with cells. We will investigate the self-assembly processes taking place within these gels when brought in contact with peptides present in solution in a non-self-assembling state. We expect the formation of a peptide self-assembled network present in the host hydrogel. This will be investigated by rheology, colloidal probe atomic force microscopy, cryo-scanning electron microscopy and spectroscopic techniques. This work will be done in collaboration with biologists which will investigate how these new types can be used for cell culture and in particular stem cell culture. Indeed, it is expected that cells interact mostly with the supramolecular self-assembled network which eventually allows controlling cell fate. Our approach, resulting from the interplay between enzymatic reactions, self-assembly processes hydrogels constitutes an important step in the field of adaptive systems towards biomaterial applications..

## References

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