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Biomimicry at the molecular level: Molecularly imprinted polymers as synthetic antibodies for bioanalysis, biosensing and bioimaging

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Abstract:

Biomimicry is the general term covering any approach aimed at reproducing artificially essential properties of one or more biological systems. This is done in order to exploit natural mechanisms or materials for direct applications in different technological domains, in particular in materials science. At the molecular level, one example of biomimetic materials is molecularly imprinted polymers (MIPs).

MIPs are synthetic receptors that specifically recognize molecular targets [1]. They are highly cross-linked polymers that are synthesized through the polymerization of monomers bearing suitable functional groups, in the presence of the target molecule acting as a molecular template. This templating induces three-dimensional binding sites in the cross-linked polymer network that are complementary to the template in terms of size, shape and chemical functionality. The plastic antibody can then recognize and bind its target with an affinity and selectivity similar to a biological antibody.

We present new approaches allowing for the synthesis of micro and nanosized MIPs by controlled/living radical polymerization and spatially controlled localized photopolymerization. This allows for example to obtain protein-size, soluble MIP nanogels with a homogeneous size distribution [2]. They show specific binding of their targets, small organic molecules or proteins [3], with a nanomolar affinity and a good selectivity. Since MIPs are compatible with standard micro and nanofabrication techniques, they can also be obtained in any other physical form, and at the same time interfaced with other materials including transducers. The use of these functional nanomaterials for chemical and biosensing [4-7] and for bioimaging [8] will be discussed.

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References:

[1] K. Haupt, A.V. Linares, M. Bompart, B. Tse Sum Bui, *Topics in Current Chemistry* 325, 1-28 (2012); doi: 10.1007/128_2011_307.
[2] P. Çakir, A. Cutivet, M. Resmini, B. Tse Sum Bui, K. Haupt, *Advanced Materials* 25, 1048-1051 (2013); doi: 10.1002/adma.201203400.
[3] S. Ambrosini, S. Beyazit, K. Haupt, B. Tse Sum Bui, *Chemical Communications* 49, 6746-6748 (2013); doi: 10.1039/c3cc41701h.
[4] M. Bompart, Y. De Wilde, K. Haupt, *Advanced Materials* 22, 2343-2348 (2010); doi: 10.1002/adma.200904442
[5] X-A. Ton, B. Tse Sum Bui, M. Resmini, P. Bonomi, I. Dika, O. Soppera, K. Haupt, *Angewandte Chemie International Edition* 52, 8317-8321 (2013); doi: 10.1002/anie.201301045.
[6] Y. Fuchs, O. Soppera, A. G. Mayes, K. Haupt, *Advanced Materials* 25, 566-570 (2013); doi: 10.1002/adma.201203204.
[7] L.P. Chia Gomez, A. Spangenberg, X. Ton, Y. Fuchs, F. Bokeloh, J. Malval, B. Tse Sum Bui, D. Thuau, C. Ayela, K. Haupt, O. Soppera, *Advanced Materials* 28, 5931-5937 (2016); doi: 10.1002/adma.201600218.
[8] M. Panagiotopoulou, Y. Salinas, S. Beyazit, S. Kunath, L. Duma, E. Prost, A.G. Mayes, M. Resmini, B. Tse Sum Bui, K. Haupt, *Angewandte Chemie International Edition* 55, 8244-8248 (2016); doi: 10.1002/anie.201601122.

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