New molecularly imprinted nicotine receptors

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Researchers from the National Environmental Engineering Research Institute in Nehru Marg, India have added another piece to the puzzle of how to synthetize an artificial nicotine receptor. Nicotine - the infamous principal component of tobacco - is responsible for smoking addition due to specific receptors in the brain that trigger the dopamine reward system. One of the most long-lasting goals of biomedical science and technology is to design and synthesize efficient artificial receptors that would point to new avenues in the treatment of addiction. Recent advances in materials chemistry clearly demonstrate that the development of such robust synthetic materials, which can partially mimic biological receptors, is possible.

In the article "Molecularly Imprinted Polymer Receptors for Nicotine Recognition in Biological Systems" published in *Molecular Imprinting* - an open access journal by Versita - Reddithota Krupadam and his colleagues have developed molecularly imprinted polymers as synthetic receptors for nicotine. These molecular imprinted polymers (MIPs) have potential applications for analysis in biological systems such as clinical detection of nicotine in blood and serum, as well as in the development of treatment therapies for nicotine addicted patients.

The authors succeeded in developing highly selective MIP receptors for nicotine with levels of selectivity similar to those of natural molecules such as acetylcholine esterase (AChE). The developed nicotine affinity-polymers were able to recognize nicotine in biological buffers, which indeed is a significant improvement, compared to previous research. Additionally, when compared to natural receptors that show high binding

at only pH 7.6 - these receptors were effective in a wide range of pH between 6.8 and 8.2.

The authors studied the binding mechanisms between nicotine and MIP receptors by UV spectroscopy and computer aided molecular simulations in order to understand the nature of interactions between functional monomers and nicotine in pre-polymerization systems. Their studies create a starting point in the development of basic procedures for the optimization of nicotine binding in biological buffers, since strong nicotine-MIP interaction typically require the use of nonpolar organic solvents during the imprinting process.

Although the authors managed to formulate polymeric receptors with specificity to nicotine, they also emphasize that these can only work in nonpolar conditions, which differ substantially from endogenous environment.

It is yet to be confirmed whether these MIPs can be used as direct alternatives to natural receptors (e.g. in drug screening applications) but they could be very useful as recognition elements for key niche applications such as in biomedical assays and sensors.

More information: Reddithota J. Krupadam/ Avinash Venkatesh/ Sergy A. Piletsky, "Molecularly Imprinted Polymer Receptors for Nicotine Recognition in Biological systems", Molecular Imprinting. Volume 1, Pages 27–34, ISSN (Online) 2084-8803, DOI: 10.2478/molim-2012-0004 , January 2013