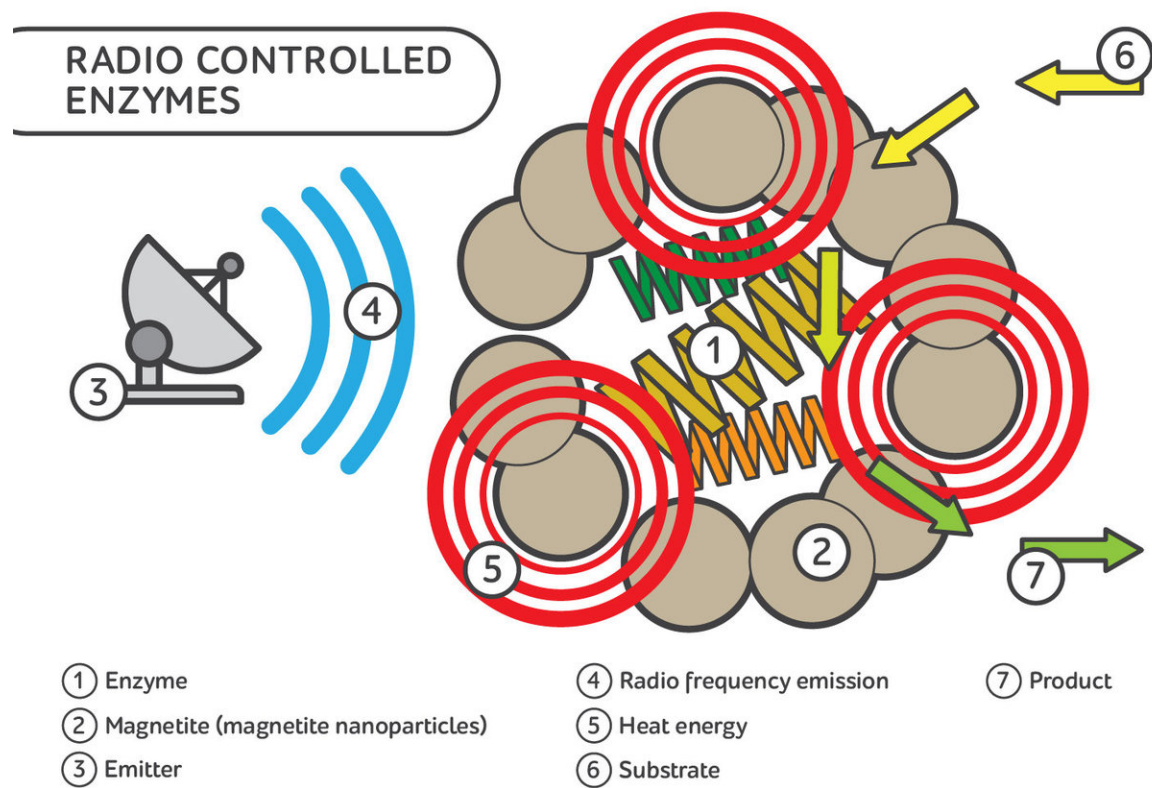


Scientists developed enzymes with remote control

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The new system's scheme. Credit: ITMO University

Scientists have developed a method to enhance the activity of enzymes by using radio frequency radiation. The method requires a special complex of enzymes and magnetic nanoparticles. The particles can

adsorb radio emission and convert it to heat, resulting in the acceleration of enzymatic processes by more than four times. The method can be used to create radio-controlled biochemical systems and adjust metabolism in living organisms. The results are published in *ACS Biomaterials Science & Engineering*.

Enzymes are involved in a variety of reactions in living organisms, and their effectiveness depends on a variety of conditions. Although [enzyme](#) activity is usually controlled chemically, researchers from ITMO University have showed that this can be done remotely using physical methods such as [radio](#) frequency fields.

To make radio-controlled enzymes, the scientists synthesized a special complex in which an enzyme is enclosed in a rigid porous framework of magnetite nanoparticles. Whenever the radio field is applied, the nanoparticles adsorb [radio emission](#) and heat up, passing additional energy to the enzyme and resulting in the enzymatic reaction rate acceleration. An experiment conducted on a model enzyme, carbonic anhydrase, demonstrated that the reaction rate can be increased by more than four times.

"There are very few studies out there that explore enzyme manipulation through the radio waves. We were the first to increase the activity of a non-thermostable enzyme. Typically, these enzymes change the conformation at high temperatures and then stop working. But placed within the rigid framework of nanoparticles, the enzyme is stabilized from structure rearrangements as the nanoparticles mechanically restrict the enzyme mobility," says Andrey Drozdov, member of ITMO University's SCAMT Laboratory.

There are two key parameters among the advantages of the radio emission used in the work. Such radio waves can easily pass through tissues, and they are harmless. Thus, by using the radio frequency field,

researchers can control the activity of enzymes in the body and adjust cell metabolism. In the near future, the [scientists](#) plan to try out this method on other enzymes in an attempt to influence the vital activity of bacteria or cells.

Since this topic has a lot of potential, further work will focus on using the technique with other enzymes, as well as in living cells. For example, it is still unclear whether it is possible to make bacteria or cells divide more often or, on the contrary, to stop their division.

More information: Yulia I. Andreeva et al, Enzymatic Nanocomposites with Radio Frequency Field-Modulated Activity, *ACS Biomaterials Science & Engineering* (2018). [DOI: 10.1021/acsbiomaterials.8b00838](#)

Provided by ITMO University

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