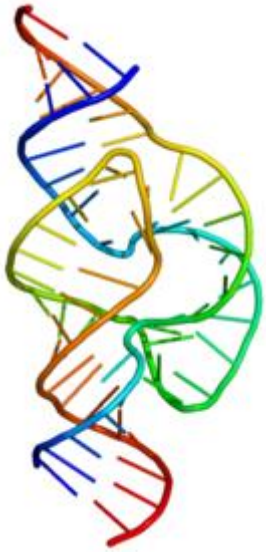
Ribozyme



Structure of hammerhead ribozyme

A **ribozyme** (**ribo**nucleic acid en**zyme**) is an RNA molecule that is capable of catalyzing specific biochemical reactions, similar to the action of protein enzymes. The 1982 discovery of ribozymes demonstrated that RNA can be both genetic material (like DNA) and a biological catalyst (like protein enzymes), and contributed to the RNA world hypothesis, which suggests that RNA may have been important in the evolution of prebiotic self-replicating systems. Also termed *catalytic RNA*, ribozymes function within the ribosome (as part of the large subunit ribosomal RNA) to link amino acids during protein synthesis, and in a variety of RNA processing reactions, including RNA splicing, viral replication, and transfer RNA biosynthesis. Examples of ribozymes include the hammerhead ribozyme, the VS ribozyme, Leadzyme and the hairpin ribozyme.
Investigators studying the origin of life have produced ribozymes in the laboratory that are capable of catalyzing their own synthesis under very specific conditions, such as an RNA polymerase ribozyme.
Some ribozymes may play an important role as therapeutic agents, as enzymes which target defined RNA sequences for cleavage, as biosensors, and for applications in functional genomics and gene discovery.[4]

Abzyme

An **abzyme** (from antibody and enzyme), also called *catalytic antibody,* is a monoclonal antibody with catalytic activity. Molecules which are modified to gain new catalytic activity are called synzymes. Abzymes are usually artificial constructs, but are also found in normal humans (anti-vasoactive intestinal peptide autoantibodies) and in patients with autoimmune diseases such as systemic *lupus erythematosus*, where they can bind to and hydrolyze DNA. Abzymes are potential tools in biotechnology, e.g., to perform specific actions on DNA. However, to date abzymes display only weak, modest catalytic activity and have not proved to be of any practical use. They are, however, subjects of considerable academic interest. Studying them has yielded important insights into reaction mechanisms, enzyme structure and function, catalysis, and the immune system itself.

Isozyme

Isozymes (also known as **isoenzymes** or more generally as **Multiple forms of enzymes**) are enzymes that differ in amino acid sequence but catalyze the same chemical reaction.
Isozymes can be defined isoforms of enzymes.
These enzymes usually display different kinetic parameters (e.g. different K_M values), or different regulatory properties.
The existence of isozymes permits the fine-tuning of metabolism to meet the particular needs of a given tissue or developmental stage.
In many cases, they are coded for by homologous genes that have diverged over time. Although, strictly speaking, allozymes represent enzymes from different alleles of the same gene, and isozymes represent enzymes from different genes that process or catalyse the same reaction, the two words are usually used interchangeably.

Isozymes may result from point mutations or from insertion-deletion events that affect the DNA coding sequence of the gene. As with any other new mutations, there are three things that may happen to a new allozyme:

1 . It is most likely that the new allele will be non-functional — in which case it will probably result in low fitness and be removed from the population by natural selection.
2. Alternatively, if the amino acid residue that is changed is in a relatively unimportant part of the enzyme (e.g., a long way from the active site), then the mutation may be selectively neutral and subject to genetic drift.
3. In rare cases, the mutation may result in an enzyme that is more efficient, or one that can catalyse a slightly different chemical reaction, in which case the mutation may cause an increase in fitness, and be favoured by natural selection.

An example of an isozyme is **glucokinase**, a variant of hexokinase which is not inhibited by glucose 6-phosphate. Its different regulatory features and lower affinity for glucose (compared to other hexokinases), allows it to serve different functions in cells of specific organs, such as control of insulin release by the beta cells of the pancreas, or initiation of glycogen synthesis by liver cells. Both of these processes must only occur when glucose is abundant, or problems occur.

The enzyme **Lactate Dehydrogenase** is made of two(H-form and M-Form) different sub units, combines in different Permutations and Combinations in depending on the tissue in which it is present (Heart, Erythrocyte, Brain, Kidney, Skeletal Muscle and Liver)

Differences among isoforms are usually subtle (particularly between *allozymes* which are often neutral variants). This subtlety is to be expected, because two enzymes that differ significantly in their function are unlikely to have been identified as *isozymes*.

The **cytochrome P450** isozymes play important roles in metabolism and steroidogenesis.
The multiple forms of phosphodiesterase also play major roles in various biological processes. Although more than one form of these enzymes have been found in individual cells, these isoforms of the enzyme are unequally distributed in the various cells of an organism. From the clinical standpoint they have been found to be selectively activated and inhibited, an observation which has led to their use in therapy

Zymogen

A **zymogen** (or **proenzyme**) is an inactive enzyme precursor.
To become an active enzyme a zymogen requires a biochemical change such as a hydrolysis reaction revealing the active site, or changing the configuration to reveal the active site.
The biochemical change usually occurs in a lysosome where a specific part of the precursor enzyme is cleaved in order to activate it. The inactivating piece which is cleaved off can be a peptide unit, or can be independently folding domains comprising more than 100 residues.
Although they limit the enzyme's ability, these n-terminal extensions of the enzyme or a "prosegment" often aid in the stabilizing and folding of the enzyme they inhibit.
The pancreas secretes zymogens partly to prevent the enzymes from digesting proteins in the cells in which they are synthesised. Enzymes like pepsin are created in the form of pepsinogen, an inactive zymogen. Pepsinogen is activated when chief cells release it into HCl which partially activates it. Another partially activated pepsinogen completes the activation by removing the peptide turning the pepsinogen into pepsin.
Accidental activation of zymogens can happen when the secretion duct in the pancreas is blocked by a gallstone resulting in acute pancreatitis.
Examples of zymogens are:
Angiotensinogen
Trypsinogen, Chymotrypsinogen and Pepsinogen
Most proteins in the coagulation system
Some of the proteins of the complement system