

Effector (biology)

In biochemistry, an **effector molecule** is usually a small molecule that selectively binds to a protein and regulates its biological activity. In this manner, effector molecules act as ligands that can increase or decrease enzyme activity, gene expression, or cell signaling. Effector molecules can also directly regulate the activity of some mRNA molecules (riboswitches).

In some cases, proteins can be considered to function as effector molecules, especially in cellular signal transduction cascades.

The term *effector* is used in other fields of biology. For instance, the effector end of a neuron is the terminus where an axon makes contact with the muscle or organ that it stimulates or suppresses.

Examples

Allosteric effectors can bind to regulatory proteins involved in RNA transcription in order to change its activity.^[1] In this way activator proteins become active to bind to the DNA to promote RNA Polymerase and repressor proteins become inactive and RNA polymerase can bind to the DNA.

Bacterial effector proteins are injected by bacterial cells, usually pathogens, into the cells of their host. The injection is mediated by specialized secretion systems, e.g. the type III secretion system (TTSS or T3SS).^[2]

Fungal effectors are secreted by pathogenic or beneficial fungi into and around host cells by invasive hyphae to disable defense components or facilitate colonization. Protein secretion systems in fungi involve the Spitzenkörper.^[3]

Plant pathogenic fungi use two distinct effector secretion systems^[4] and each secretory pathway is specific to an effector family:

- **apoplastic effectors** : proteins which stay into the apoplast, they are translocated and accumulated into a distinct compartment enclosing the growing hypha named the EIHM (extra-invasive hyphal membrane).
- **cytoplasmic effectors** : proteins which enter the host cytoplasm, they are accumulated into a complex plant-derived structure named the biotrophic interfacial complex (BIC) and they are later translocated across the EIHM inside the plant cell. It has been shown that cytoplasmic effectors can move through a few layers of plant cells, probably a way to prepare them for hyphal invasion.

Types

- Enzyme activator
- Enzyme inhibitor

References

1. Anthony J.F. Griffiths (2012). *Introduction to genetic analysis* (10. ed.). New York, NY: Freeman. pp. 410–411. ISBN 978-1-4292-7634-4.
2. Cambronne, E. D.; Roy, C. R. (2006). "Recognition and Delivery of Effector Proteins into Eukaryotic Cells by Bacterial Secretion Systems" (<https://doi.org/10.1111%2Fj.1600-0854.2006.00>