

Amplification, integration, and mutual communication ("cross-talk") of signal paths

Amplification

Amplification is the amplification of a signal. Takes place on **the second messengers** level . A molecule of a signaling substance (e.g. hormone, growth factor, cytokine) binds to one cell receptor. However, this one receptor activates the formation of a large number of molecules of the second messenger (second signaling molecule).^[1]

Why is not a large amount of the hormone formed, but only the second messenger? More possibilities can be imagined. If we wanted to make many hormones, we would also need many receptors. It is certainly more economical to use a small amount of hormone and receptors and then amplify this signal with simple, inexpensive compounds directly in the cell as needed by the individual cell or tissue. For at least this reason, this option would be evolutionarily preferred. And why do we need to amplify? If we use a relatively small amount of hormones, without amplification we will elicit an equally small response. This may not be enough for the signal to take place successfully. E.g. when we need a signal to reach the nucleus and find its transcription factors, we cannot rely on just a few molecules.

Integration and mutual communication

Integration means integration into a whole. We must realize that the signaling cascade does not occur in isolation. It is not separated from the rest of the cell. Similar to metabolic pathways, signaling pathways are deeply interconnected and communicate with each other. That is, the signal is not only transmitted vertically within one signal path, but also horizontally between paths. This is called **cross-talk** .^[1]

Why are signaling cascades so richly interconnected? The events in the cell are extremely complicated, but thanks to cross-talk, even one signaling molecule can trigger very complex changes that are needed for an adequate response.

Reference

1. MATOUŠ, Bohuslav. *Základy lékařské chemie a biochemie*. Praha: Galén, c2010. ISBN 9788072627028.