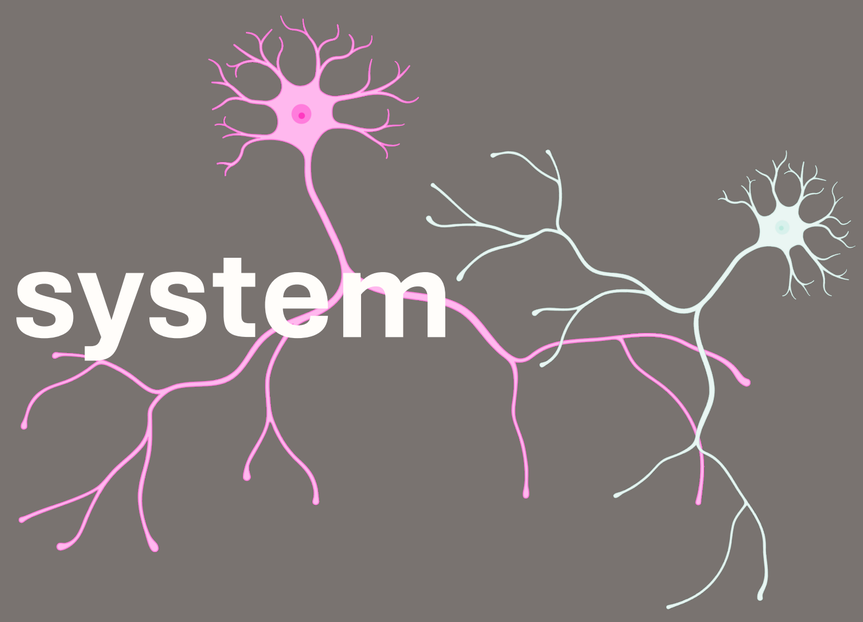
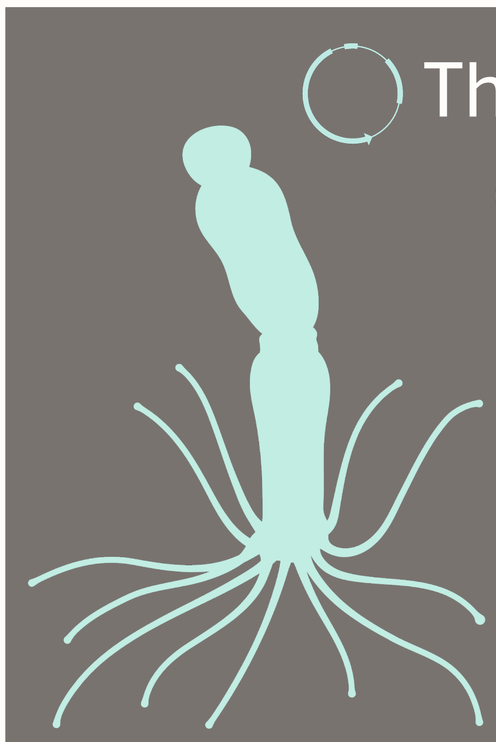
Nervous system



With the ability to regenerate

After complete ablation.



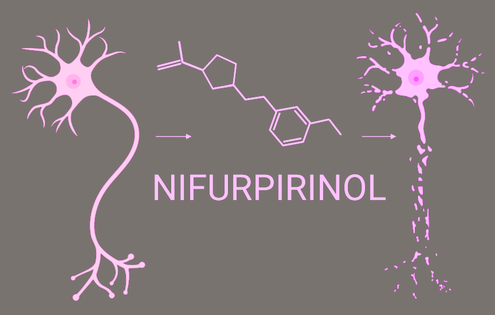
The starlet sea anemone *Nematostella vectensis* can completely regenerate the nervous sytem within 25 days

Humans, as with other mammals, have a poor ability to regenerate, and with our neural cells being particulariliy bad at regenerating. If we damage any of our neural cells, the likelyhood of permanent damage is significant. Though, this is not the case for all organisms. The starlet sea anemone *Nematostella vectensis,* is a great example of such an organism. *Nematostella vectensis* has a high regenerative ability with a capacity of regenerating a whole body axis in less than a week, and their nervous system within 25 days. Understanding the molecular mechanisms behind the neuronal regeneration and development in *Nematostella* is of highest interest for understanding the evolutionary origin of our own nervous system. Understanding this is of great importance, being that *Nematostella vectensis* belongs to the sister taxa of bilatilarians and our nervous systems share a common origin.

In this study, we are using a transgenic line, making it possible to chemically trigger the apoptosis of neural cells, leading to a complete ablation of the nervous system in *Nematostella*. Here, we observe the number and location of neuronal regeneration, 4 days after complete ablation of the nervous system.

How does one remove a nervous system?

Ablation of the nervous system in *Nematostella vectensis* is made possible by the creation of a transgenic line. By the use of a promoter called *Elav1*, that is only active in neurons, coupled to a gene, coding for the synthesis of an enzyme normally found in *E.coli*, called Nitroreductase, was inserted into embryos of *Nematostella*. A fluorescent protein was also inserted into the animals DNA via the same plasmid, making it possible to observe the neurons with a fluorescent microscope. When exposed to a specific antibiotic, Nifurpirinol, the Nitroreductase converts it to a toxic compound leading to the apoptosis of Nitroreductase expressing cells – neurons. As a result, the complete ablation of neural cells can be observed after 3 days of nifurpirinol treatment.



What did we find?

Distribution of regenerating neurons

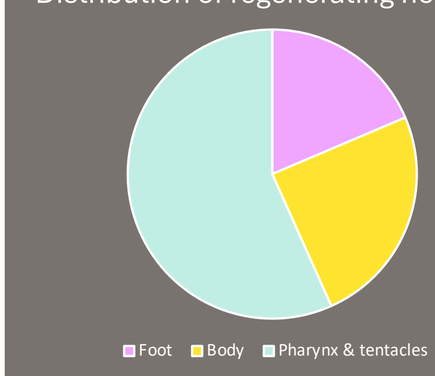


Figure 1. Illustration of the distribution of regenerating neurons observed 4 days after complete ablation of nervous system

Number of neurons after 4 days

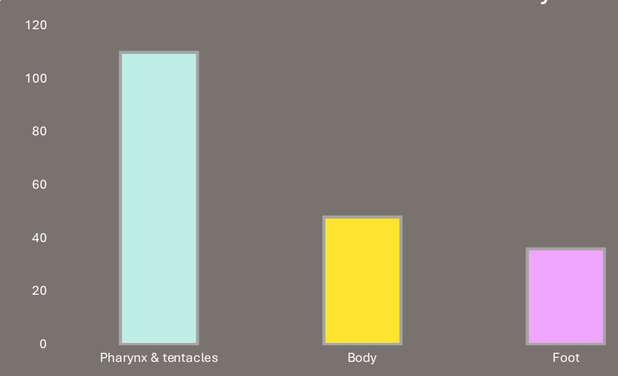
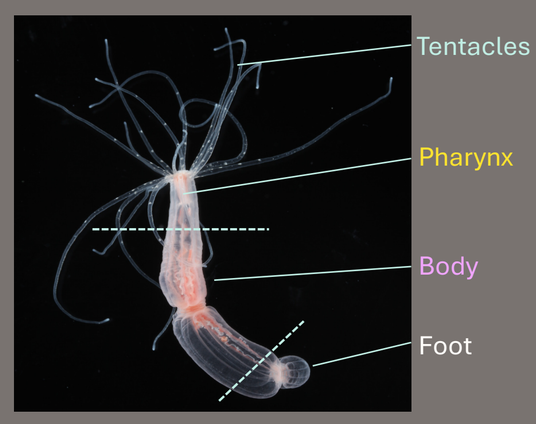


Figure 2. Graph showing the number of regenerating neurons 4 days after complete ablation of nervous system.

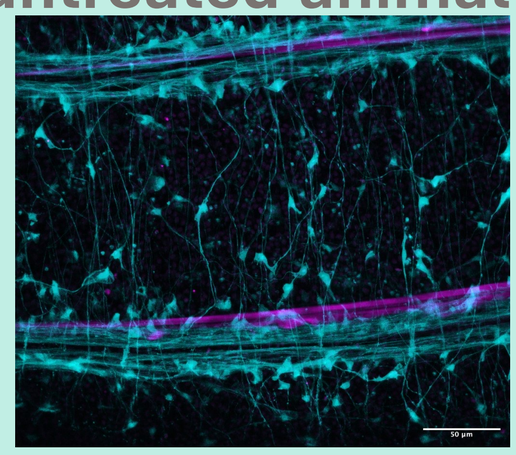
4 days after finished treatment with Nifurpirinol and the successful ablation of the nervous system we could observe neurons already starting to regenerate. As figure 1. illustrates it appears as though early regeneration is more prominent in the Pharynx & tentacles in comparison with the foot where the least amount of neurons could be observed.



Based on our experiments we can conclude that...

- Treatment with Nifurpirinol led to cell-specific ablation of the nervous system.
- Regeneration of neurons were present already at day 4 after nervous system ablation.
- Regeneration of neurons appears to be more prominent in the pharynx & tenctacles than in the body and foot at day 4 after complete ablation.

Neurons in untreated animal



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