The Intelligent Plant: Electrophysiology of the Venus Flytrap

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The flytrap is a carnivorous plant. We want to find out if the flytrap can be triggered by a self-generated external action potential. Therefore, we measured the electrical action potentials that lead to closing the flytrap. Other aspects were to measure the closing speed of the catches, to find out how the action potentials spread over the leaves and where the plant's motor closure cells are located. We developed a high-precision positioning system and a digital pulse generator for closing the flytrap. To create an analogue action potential, we have developed a programmable microprocessor system. Using a high-speed camera, we measured the closing speed of the leaves and the propagation speed of the action potentials. Finally, we examined the propagation velocity on both leaves to find out where the motor closure cells are located. We found out that the propagation velocity of an action potential is about 10.7 cm/s. The maximum closing speed of the flytrap leaves is around 10 mm/s. To close the flytrap by an external signal, a negative digital pulse of at least 1.25 volts is necessary. To close the flytrap with an analogue action potential, a signal of at least 1 volt is necessary. Measurements on both leaves of the flytrap show that motor closure cells are also located on both catch leaves. For the first time we succeeded in closing the flytrap by using an analogue external action potential. Our investigation has clearly shown that motor closure cells are also located on the catch leaves.