

The Beginning of Modern Neuroscience

The Galvani/Volta Debate

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The famous Debate

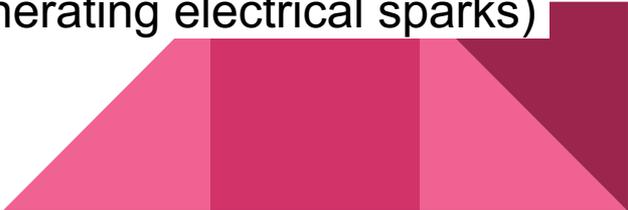


Historical background--electricity phenomenon

Systematic studies of electricity as "something" was just beginning in the 18th century in Europe. Some clues were eternally present.

- When rubbed with a piece of cloth or hair, hardened amber will attract small particles of dust, and indeed the Greek word for amber is "elektron".
- torpedo fish that lives in coastal areas uses electrical shocks for attack and defense behaviors.

The Leyden Jar (the first capacitor) had been invented in the 1740's, and reliable electrostatic friction machines (machines capability of generating electrical sparks) had recently just been invented as well.



Frog Experiments Intro

Interested in the possible connection between electricity and living beings, Galvani began studying "**electrophysiology**" in 1780.

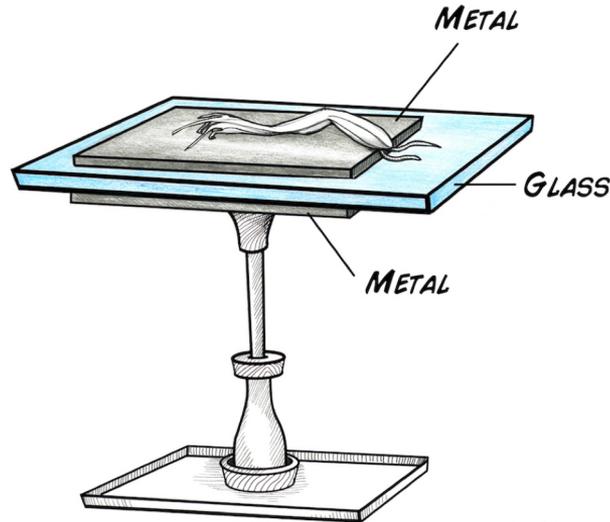
He was aware of previous experiments by other Italian scientist Tommaso Laghi, who observed in 1757 that electrical stimulation of nerves caused muscle contraction.

The majority of his experiments involved **connecting the frog legs to capacitors and metallic loops** during the 1780's, which are described in detail in his 1791 magnum opus.

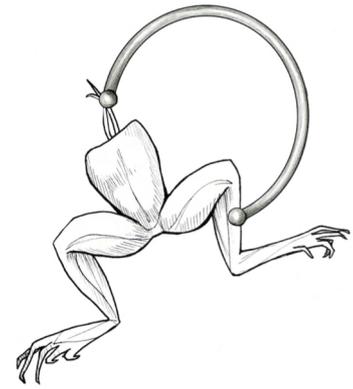


Frog experiments v 1.0

Beginning his general experiments on exactly November 6th, 1780 (noted from his lab book), he connected a type of capacitor - a "Franklin Square" (yes, an invention of [Benjamin Franklin](#)) to the nerve of a frog leg, causing the leg to famously twitch.



Frog experiments v 2.0



Next steps:

connecting nerve to muscle, or nerve to nerve, with metallic arcs and examining leg contraction.

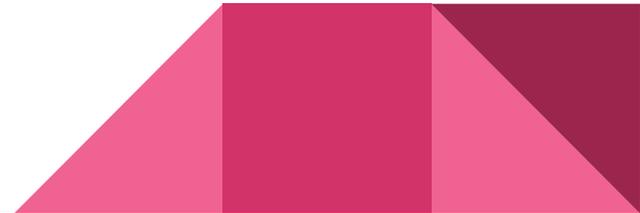
Results:

Frog legs twitches, which providing **evidence to Galvani's hypothesis that the nerve and muscle tissue itself was a generator of electrical energy that it used for its own proper functioning.**

Volta's findings and arguments

Volta importantly found that using using bimetallic arcs of two different metals **worked much better** in stimulating frog legs than arcs composed of just one metal, and he published this observation in 1792.

He believed that **Galvani's use of metallic arcs and organic tissue created a sort of electrical disequilibrium that caused contraction, and the animal did not generate its own electricity.**



Frog Experiments v 3.0

A further experiment in which he connected one severed nerve on one leg to another severed nerve on another leg, causing both legs to twitch.

The experiment was essential to show that **external metal wasn't needed to cause contraction and was his strongest evidence against Volta**. Galvani published this in 1794.



The modern answer to this debate is...

both Italian scientists were correct. Volta's suggestion that **two metals connected with a salty medium (the frog) could generate electricity** was correct. Galvani's suggestion was also correct.

