

# Recording Action Potentials from Earthworm Giant Axons

*Wayne L. Silver*

Department of Biology, Wake Forest University  
Winston-Salem, North Carolina 27109

(910) 759-5920, silver@wfu.edu

There are two major ways of increasing action potential conduction velocity: increasing the diameter of the axon and adding a myelin sheath to the axon. Since invertebrates do not have myelin they use large diameter fibers to convey information rapidly.

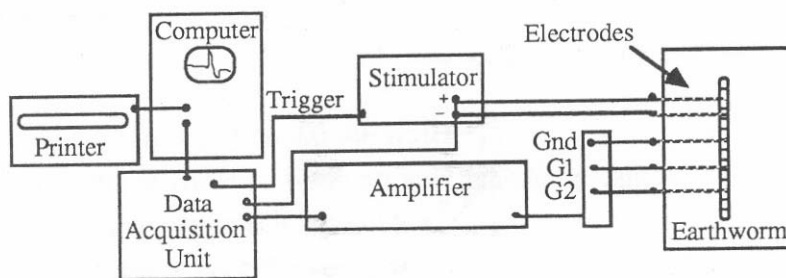
In this exercise action potentials are recorded extracellularly from the giant nerve fibers of the earthworm, *Lumbricus* sp. The earthworm nerve cord has three giant fibers: one medial giant and two lateral giants. These fibers monitor sensory input and rapidly send their output to motor neurons which cause longitudinal muscles to contract.

This exercise requires no surgery and can be used to examine a variety of action potential related concepts. It is an excellent introduction to instrumentation as well.

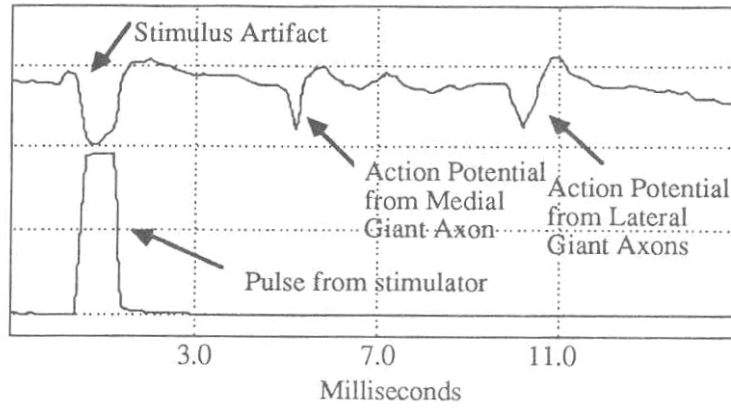
Earthworms are anesthetized by immersion in 15% ethanol for approximately 15 minutes and placed ventral side down in a dissecting pan. Five insect pin electrodes are simply placed into the earthworm along the midline as shown in Figure 1. Two of the electrodes are connected to a stimulator. The other three are connected to the input of an AC amplifier. The outputs of the amplifier and stimulator are connected to a recording device (e.g., an oscilloscope or a data acquisition system and computer). Figure 2 shows records taken from a computer screen.

Conduction velocity (V) can be determined by comparing the latency of the responses (T) with the distance (D) from the stimulating electrode (S-) to the first recording electrode. Two different distances are used so that conduction velocity  $(V) = (D2 - D1)/(T1 - T2)$ . Refractory periods can be determined by putting the stimulator in the twin pulse mode and changing the delay to provide different times between the two pulses.

This exercise was modified from one described by B. Oakley and R. Schafer (*Experimental Neurobiology: A Laboratory Manual*, University of Michigan Press, Ann Arbor, Michigan, 366 pages, 1984).



**Figure 1.** Schematic diagram of the set-up used to record action potentials extracellularly from earthworm giant fibers.



**Figure 2.** Computer printout showing oscilloscope traces of action potentials recorded extracellularly from earthworm medial and lateral giant axons. A stimulus pulse from the stimulator is also shown.