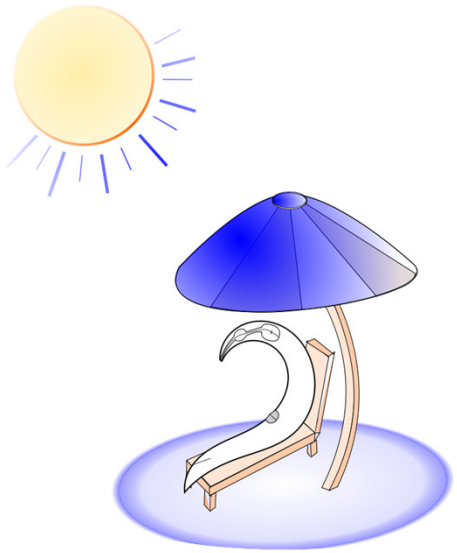
# Neural circuits for pharyngeal pumping and pumping modulation



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**MIT IAP**

# This is a *C. elegans* worm – See the pumping in the head?

2 mm

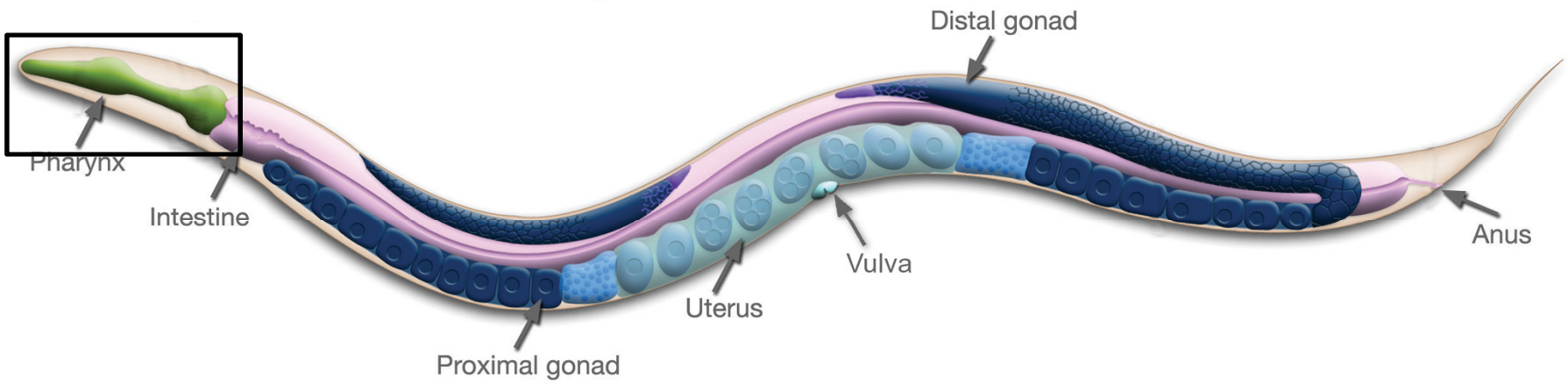
**Adult hermaphrodite**

**Video speed is real-time**

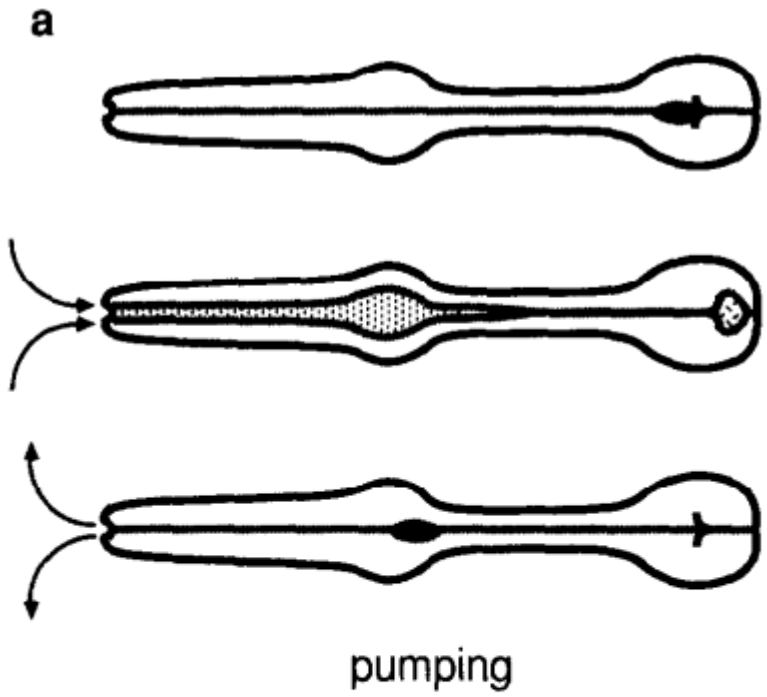
# C. elegans pumping – a closer, slower look

**Video speed is ¼ real-time**

# The pharynx pumps food into the intestine

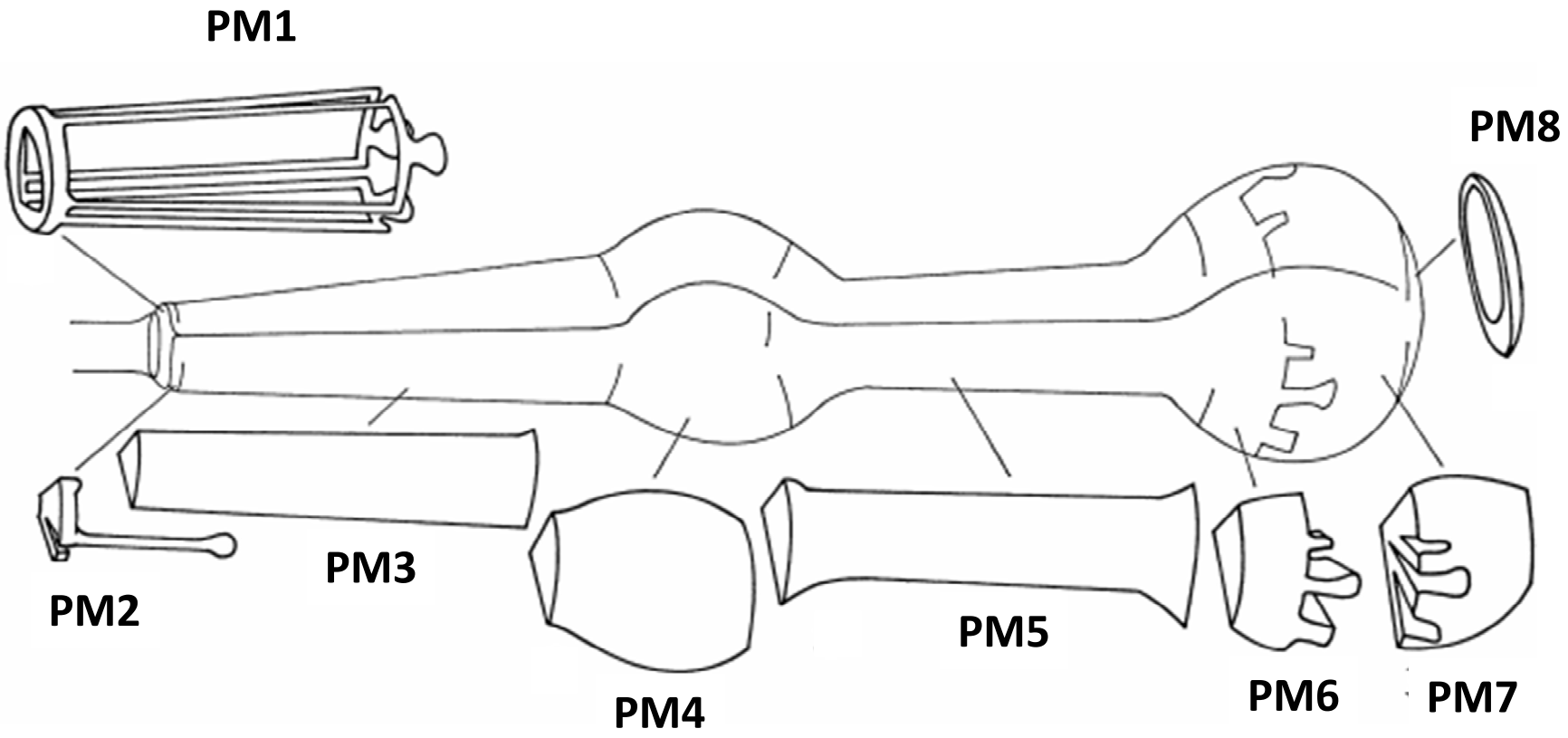


# The individual steps of the pump



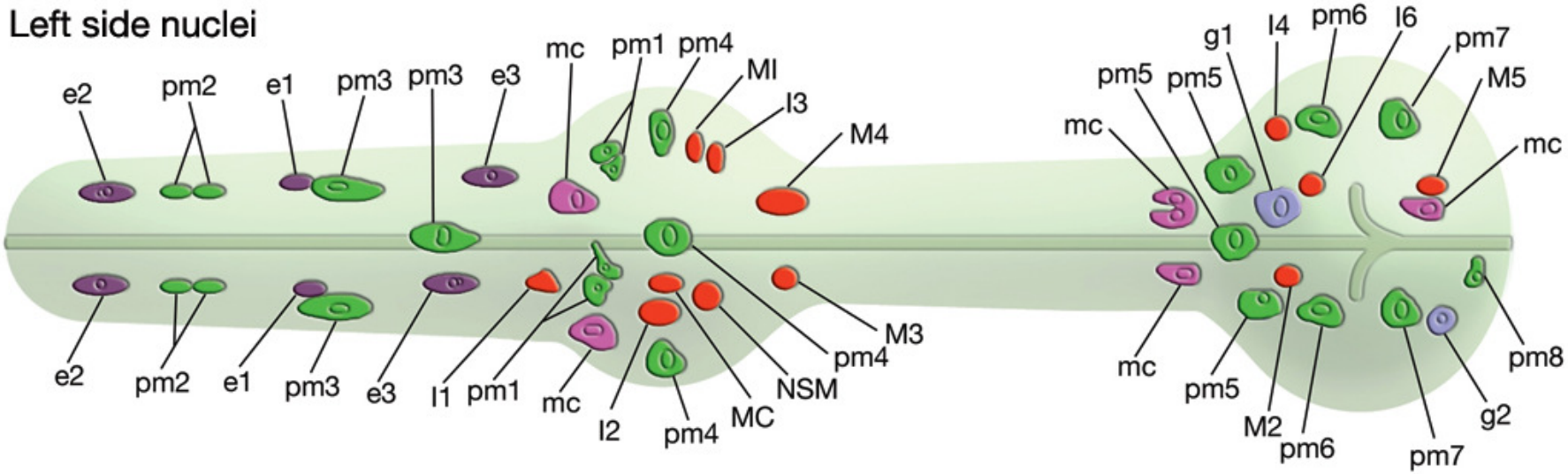

Avery & Horvitz 1989

# Muscles of the pharynx




Derived from Albertson & Thomson 1976

# All cell bodies in the pharynx

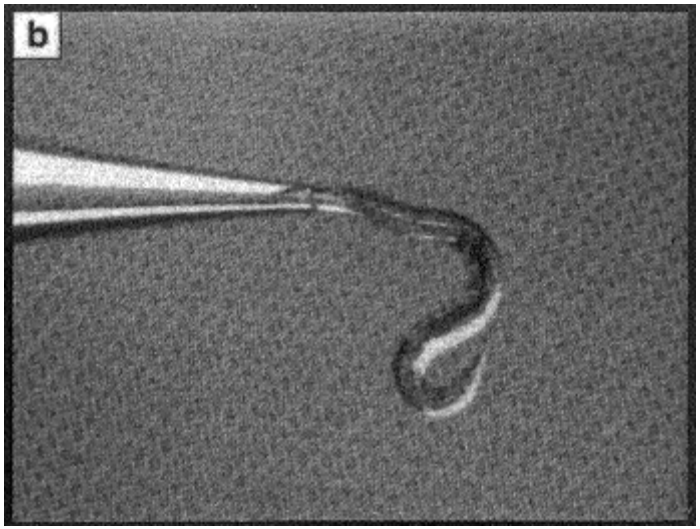


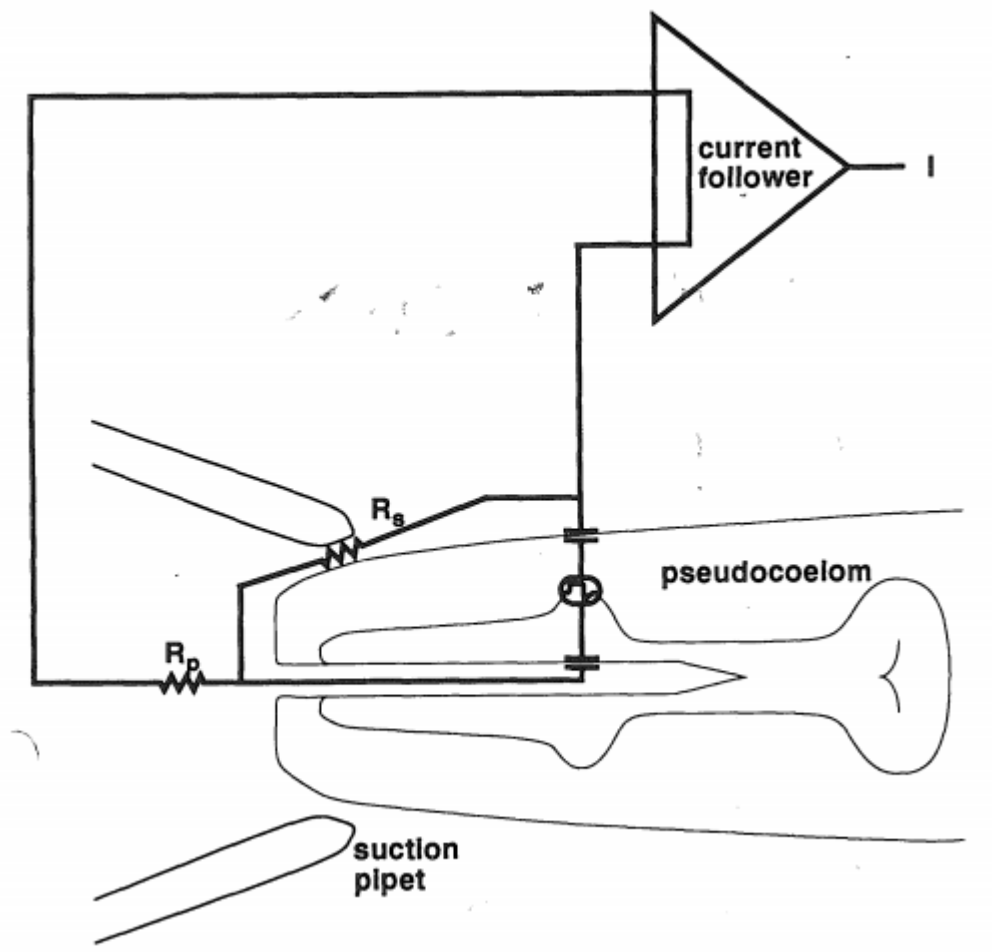

**Neurons**
**Muscle**
**Epithelial cells**
**Marginal cells**
**Gland cells**

**Original data from Albertson & Thomson 1976, schematic from WormAtlas.org**

# wormweb islands

# Electropharyngeogram (EPG)

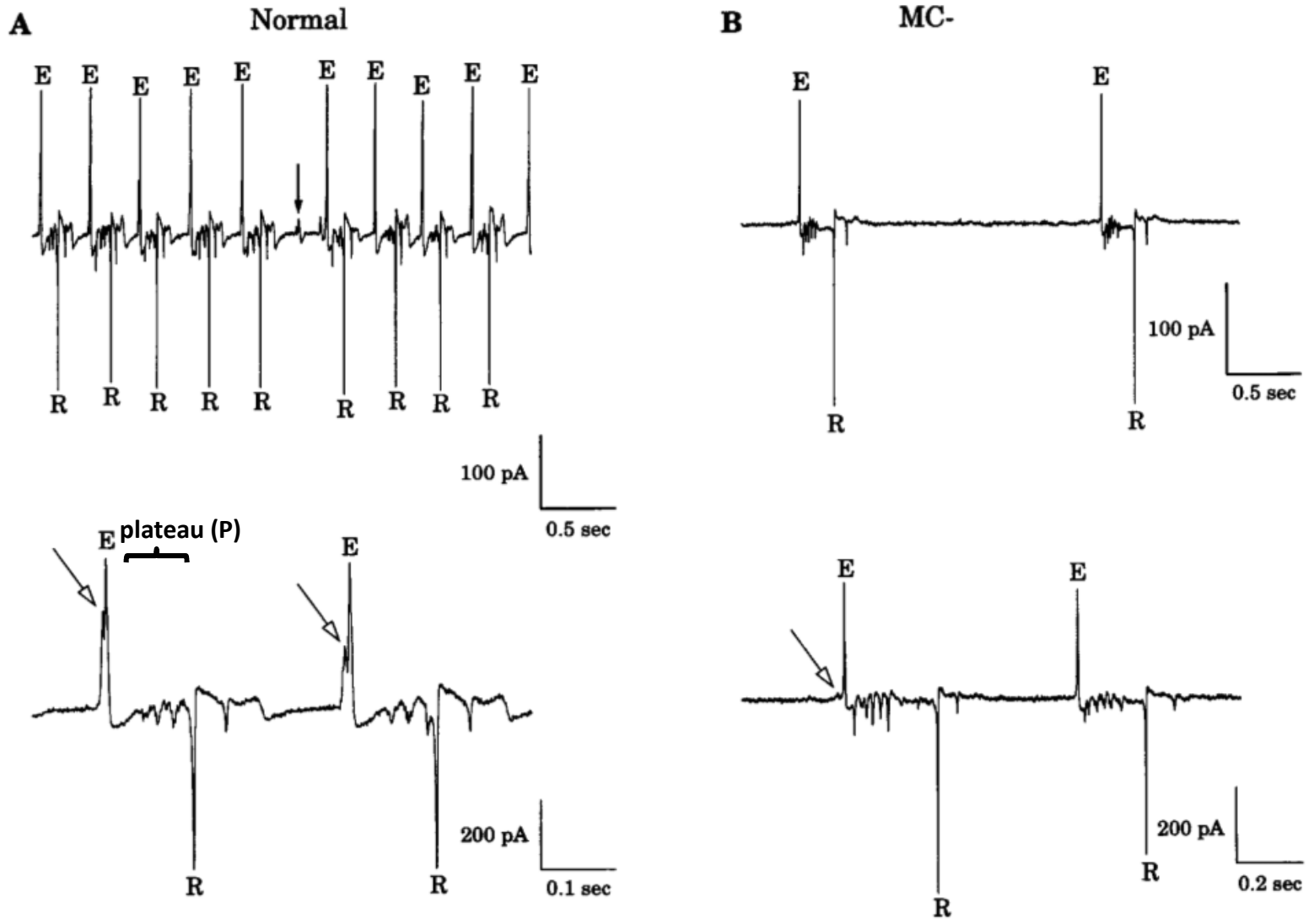



Avery..Lockery 1995

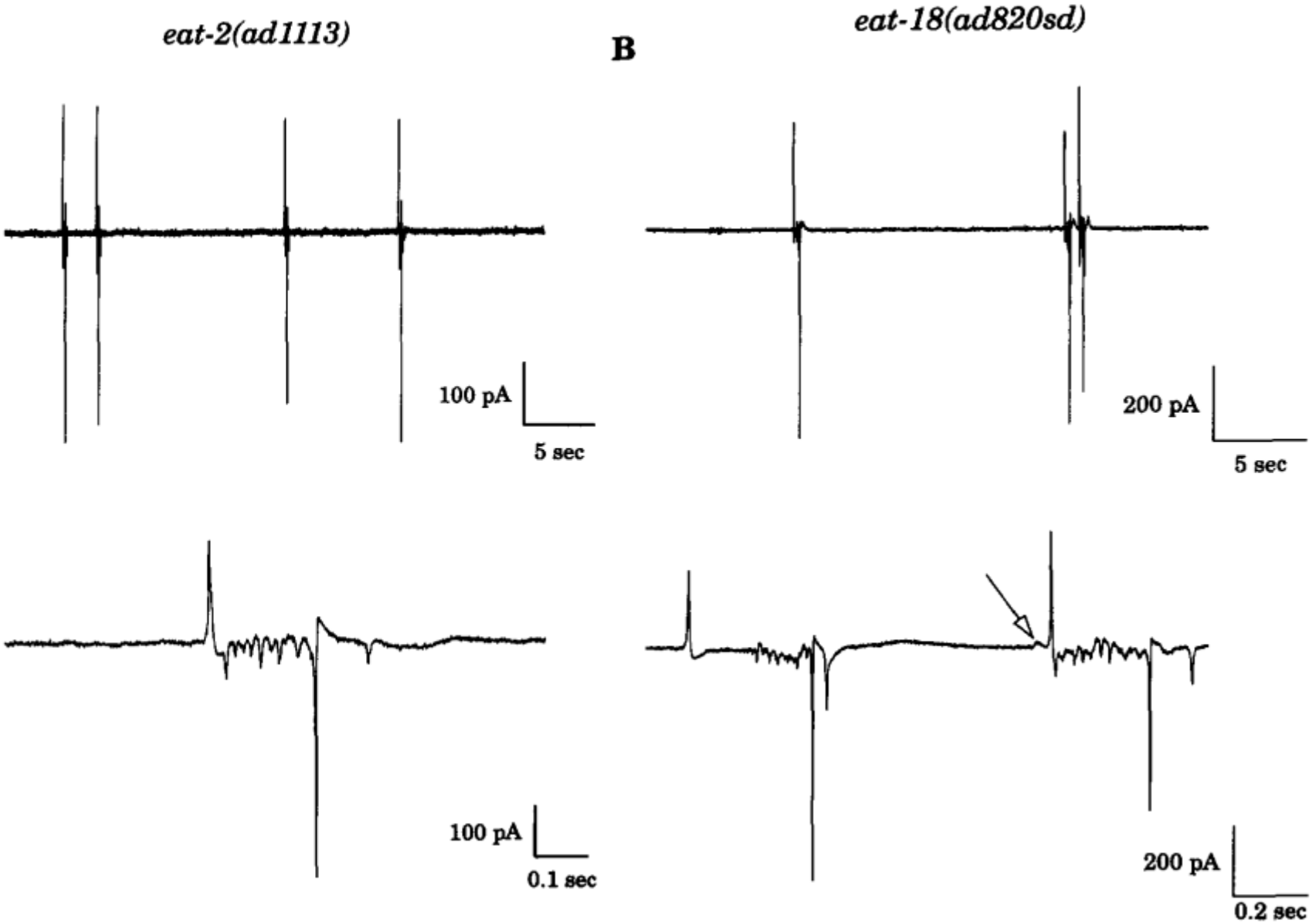
# MC causes pre-E spike and I-spike in EPG

**E = excitation**
**R = relaxation**



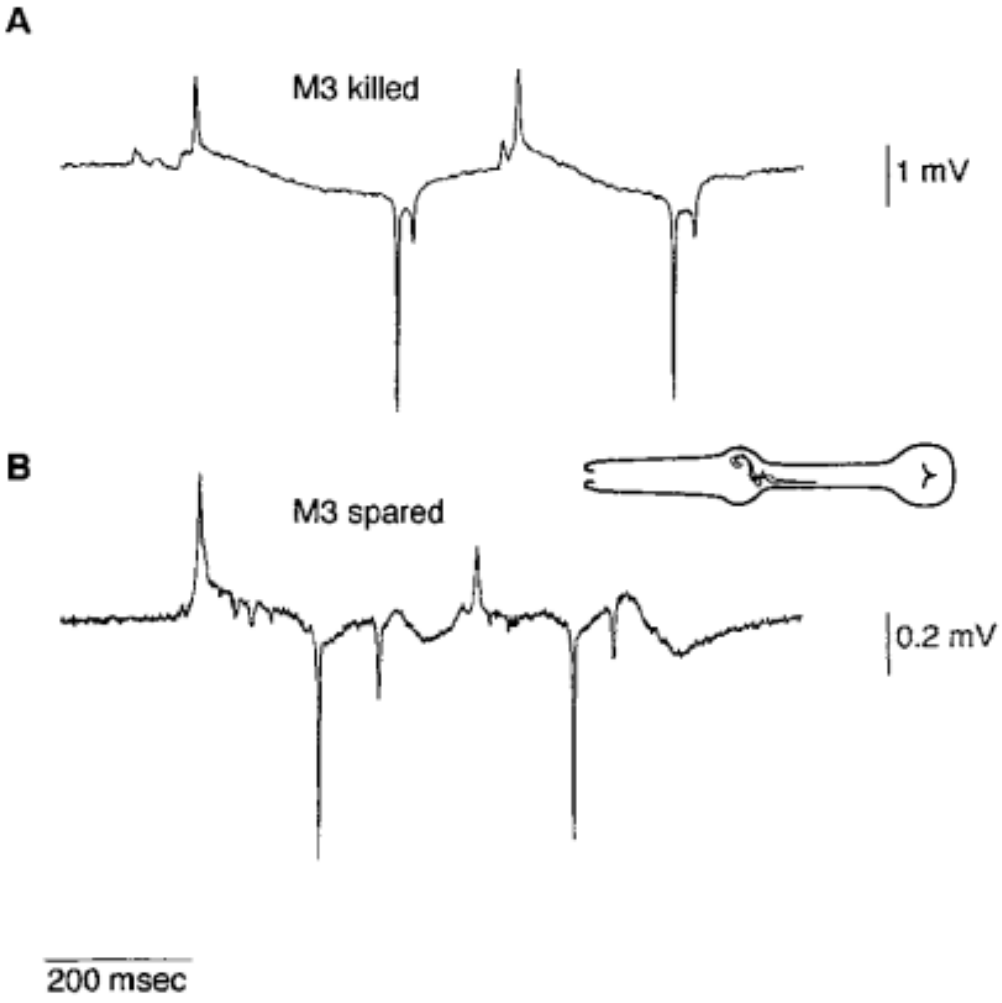

Raizen..Avery 1995

# *eat* mutants have reduced pumping rate




Raizen..Avery 1995

# M3 is required for P-spikes




Raizen & Avery 1994