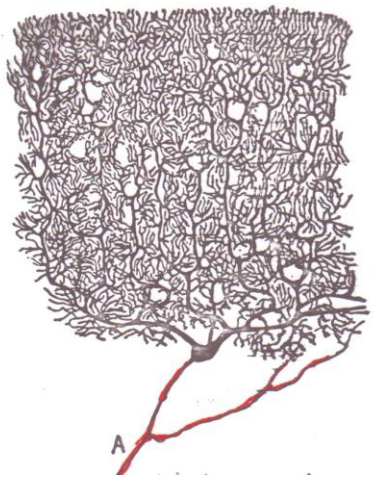
FALL 2025

APM 531 (MAT 494)

Mathematical Neuroscience



Purkinje cell in the cat cerebellum (drawn by Ramon y Cajal)

Instructor: **S. M. Baer**

Time: **3:00-4:15 Tuesday & Thursday**

Location: **EDBL1-03**

Schedule Line #: 68305 (APM 531); 69037 (MAT 494)

Credits: **3**

Content: This introductory course is designed to provide students with essential mathematical tools for studying the neural circuits that underlie brain function. It aims to systematically develop biophysical concepts to explore the relationship between the structure and function of nerve cells and their networks. This course is self-contained and structured around homework assignments rather than being a seminar course.

Topics: Cable theory and neuronal branching; dendritic spine modeling with applications; Hodgkin Huxley and Hodgkin Huxley-like excitable systems such as Morris-Lecar and FitzHugh-Nagumo models; bursting oscillations in nerve, muscle, and secretory cells; bifurcation analysis of excitable systems; synaptic modeling and activity-dependent processes; introduction to modeling neural subcircuits in the outer-plexiform layer of the retina; introduction to neuromorphic computing and modeling.

Prerequisites: Elementary Differential Equations: MAT 275.
(A course in partial differential equations is **NOT** required.)

This self contained course is open to graduate (531) and undergraduate (494) students of mathematics, life science, physics, psychology, and engineering. Please email Steven Baer (**steven.baer@asu.edu**) for further information.