Neurophysiology Laboratory

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Neurophysiology Laboratory

Lecture:	**T & Th 9:30 – 10:30**
Lab:	**T & Th 11 - 4**
Lab Manual:	**Available from Soft Reserves**
Suggested Text:	**From Neuron to Brain**
	by Nicholls, Martin & Wallace

Web Site: **www.biology.ucsd.edu/~kocorr/bipn145**
Username: **bipn145**
Password: **neuron**

Syllabus – Fall 2004

Week	Date	Lab	Topic
1	Sept 23		Introductory Lecture
2	Sept 28	Exp. 1	Lab Orientation and Instrumentation
	Sept 30	Exp. 2	Computer Simulation: Resting & Action potentials
3	Oct 5	Exp. 3	Action Potentials in Frog Sciatic Nerve
	Oct 7	Exp. 4	Action Potentials in Earthworm Giant Axons
4	Oct 12	Exp. 5	Neuromuscular Transmission in Frog / Lab Report 1 due in lecture
	Oct 14		continued
5	Oct 19	Exp. 6	Resting Potentials of Frog Muscle Cells / Quiz during Lecture
	Oct 21		continued
6	Oct 26	Exp. 7	Intracellular Recordings from Single Neurons in Leech Ganglia
	Oct 28		continued
7	Nov 2	Exp. 8	Neuron Morphology in Leech: Fluorescent Dyes
	Nov 4		Special Projects Write-up due
8	Nov 9	Exp. 9	Stretch Receptors in Crayfish / Lab Report 2 due in lecture
9	Nov 16	Exp. 10	Sensory Reception in Cockroach Cerci
	Nov 18		continued / **Special Projects Prep**
10	Nov 23		**Special Projects**
11	Nov 30		**Special Projects**
	Dec 2		**Special Projects**
Finals	Dec 8	8 – 11 AM	Final Oral Lab report

Syllabus – Fall 2004 Alternate

Week	Date	Lab	Topic
1	Sept 23		Introductory Lecture
2	Sept 28	Exp. 1	Lab Orientation and Instrumentation
	Sept 30	Exp. 2	Computer Simulation: Resting & Action potentials
3	Oct 5	Exp. 3	Action Potentials in Frog Sciatic Nerve
	Oct 7	Exp. 4	Action Potentials in Earthworm Giant Axons
4	Oct 12	Exp. 5	Neuromuscular Transmission in Frog / Lab Report 1 due in lecture
	Oct 14		continued
5	Oct 19	Exp. 6	Resting Potentials of Frog Muscle Cells / Quiz during Lecture
	Oct 21		continued
6	Oct 26	Exp. 7	Intracellular Recordings from Single Neurons in Leech Ganglia
	Oct 28		continued
7	Nov 2	Exp. 8	Neuron Morphology in Leech: Fluorescent Dyes
	Nov 4		Special Projects Write-up due
8	Nov 9	Exp. 9	Stretch Receptors in Crayfish / Lab Report 2 due in lecture
	Nov 11		continued
9	Nov 16		**Special Projects**
	Nov 18		**Special Projects**
10	Nov 30		**Special Projects**
	Dec 2		**Special Projects**
Finals	Dec 8	8 – 11 AM	Final Oral Lab report & Breakfast!

Lab Notebooks

Your Lab Book will be graded TWICE

- **The first time mostly for feedback**
- **At the end of the semester**

Summary or overview:

In a *few* sentences, summarize the overall aim, the general method(s) to be used and the particular phenomena to be studied. All of this information can be found in the Manual: on the first page of a given Exercise, in the Methods section, and in the Experimental Procedures section.

The ideal time to make this summary is *before* the lab session.

Experimental Procedures:

- A subheading: e.g. *Refractory Period*.
- Organized tabulation or description of results
- Notation of settings, conditions, etc.
- One or two sample or summary recordings and/or graphs, pictures, etc., as appropriate.
- Identification and labeling of recordings, graphs, pictures, etc.
- Answers to any questions in that part of the manual.

Comment/interpretation/conclusion

– so that we know what you think about your results.

Formal Lab Reports

Introduction (1 page max)

- This section should state the objectives of the experiments.

Materials & Methods (1 page max)

- This is a brief description of the experimental preparation and the experimental procedure.

- Tell how the measurements were performed (e.g., by ruler or on the Scope screen; to the peak or to the beginning of the upswing of the CAP) and how you analyzed the data.

Results (7 pages max)

- In this section are the presented the data obtained in written, diagrammatic, and/or numerical form. This section should include drawings, tables, and a written description that *briefly* describes the data that you have included in tables or drawings.

  - Figure legends should describe the data shown in the figure.

  - Conclusions and discussions should be in the text.

Discussion (5 pages max)

- This section begins with a very brief summary of your findings and a statement of your conclusions about what your data show.

- Then relate your results to what is already known. Draw on material from lectures and from your reading to substantiate your statements.

Formal Lab Reports

If the experiment goes bad……

(1) report in your results section what actually happened (e.g., "after we spent the whole afternoon trying to get the amplifier to work, the muscle was dead")
AND
(2) use results obtained by a fellow student in your write-up, **being sure to tell from whom you got the data**.

In your write-up, BRIEFLY consider possible causes for the problems that you experienced, as well as reporting the results that you borrowed.

Grading

- **Lab notebooks** will be graded twice
  (10% each for a total of 20% of the final grade)
- **Three formal Laboratory Reports**
  - one on exercises 3&4
  - *a joint report on exercises 7 & 8*
  - a joint ORAL report on the **Special Project (2 groups / report)**
  (15% each for a total of 45% of the final grade)
- **Two Quizzes** on lecture and lab material.
  (**30% of the final grade**)
- **Lab performance (5% of the final grade)**

This is based on attendance, active participation, persistence, carefulness, etc.

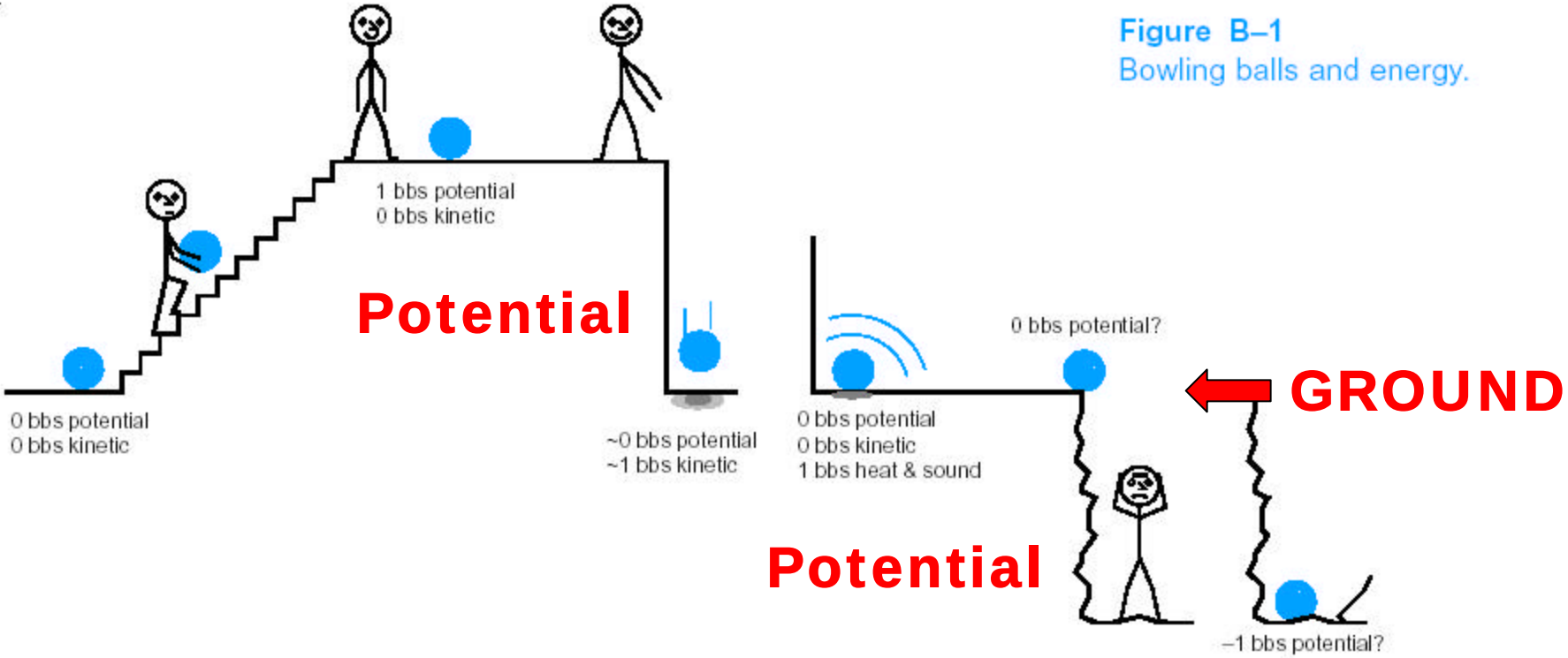
From this allowance, *you will lose 2.5 % each time (up to 2x) you miss attendance at lab. Additional absences will be reflected in the grade for the lab notebook.*

- There is **NO FINAL EXAM**

Electrical Circuit Basics

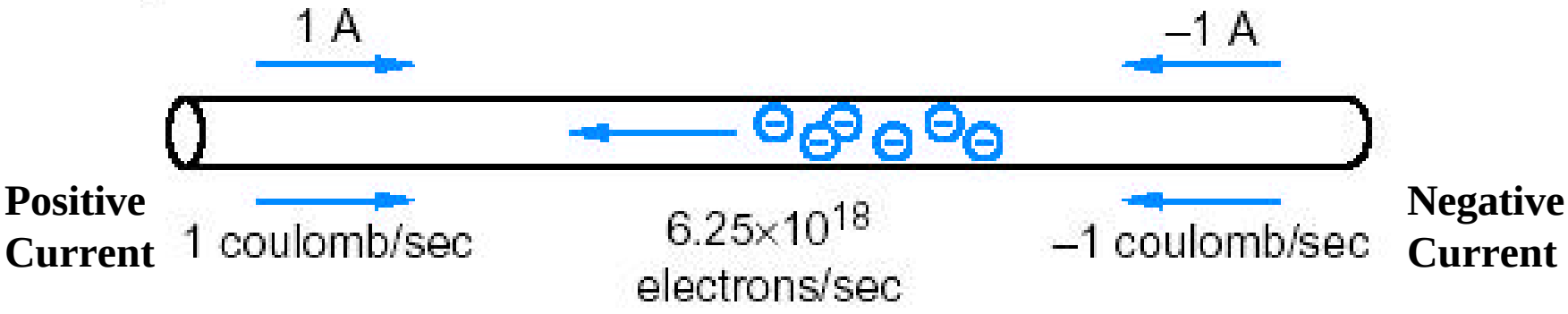
CHARGE - electrons (-), protons (+)
VOLTAGE – Potential energy due to separation of charge (V – volts)
GROUND – a Common Reference point

Electrical Circuit Basics



Electrical Circuit Basics

CHARGE - electrons (-), protons (+)
VOLTAGE – Potential Energy (V)
GROUND – a Common Reference point
CURRENT – Movement of electrons
(I – current in Amperes or Amps)



Electrical Circuit Basics

CHARGE - electrons (-), protons (+)
VOLTAGE – Potential (V)
GROUND – a Common Reference point
CURRENT – Movement of electrons (I)
RESISTOR – impedes the movement of a current
(R – resistance in ohms, Ω)

A resistance of 1 Ω means 1 volt is needed to move 1 amp of current across the resistor

Electrical Circuit Basics

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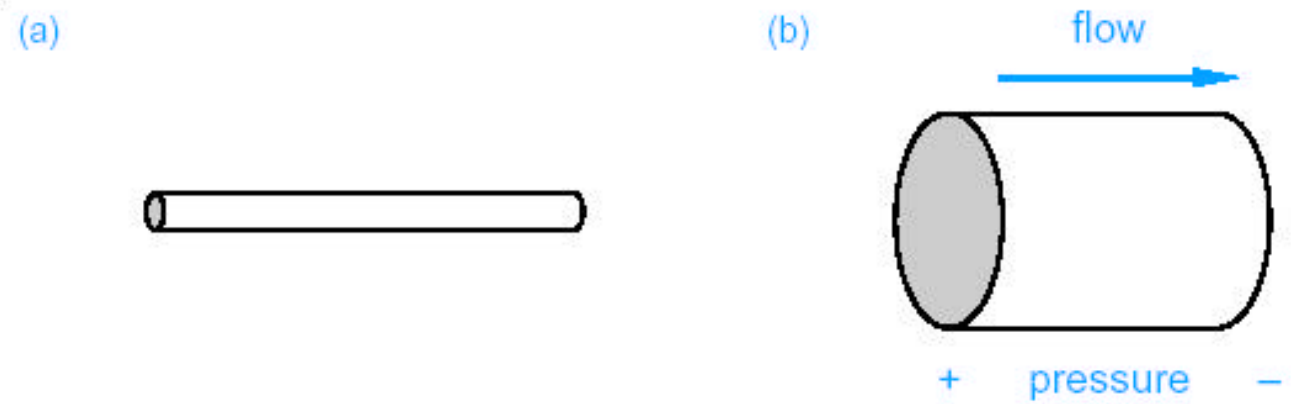
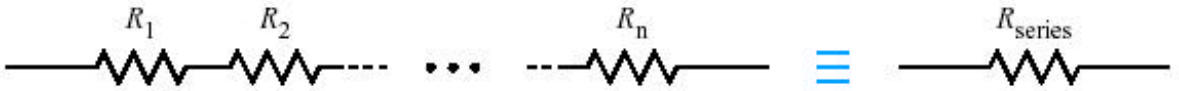


Electrical Circuit Basics

CHARGE - electrons (-), protons (+)
VOLTAGE – Potential (V)
GROUND – a Common Reference point
CURRENT – Movement of electrons (I)
RESISTOR – impedes the movement of a current (R)

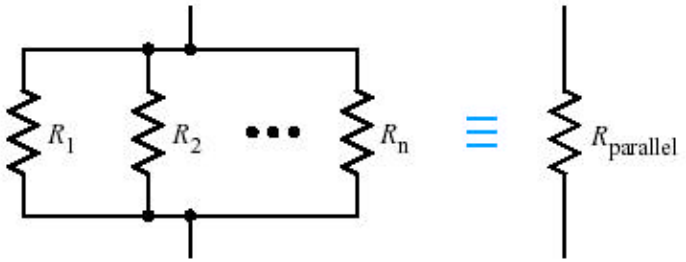
<u>Series</u>

$R_{series} = R_1 + R_2 \ldots$



<u>Parallel</u>

$1/R_{parallel} = 1/R_1 + 1/R_2 \ldots$



Electrical Circuit Basics

CHARGE - electrons (-), protons (+)
VOLTAGE – Potential **(V)**
GROUND – a Common Reference point
CURRENT – Movement of electrons **(I)**
RESISTOR – impedes the movement of a current **(R)**

These are all related by Ohms Law

V = I R

Electrical Circuit Basics

CHARGE - electrons (-), protons (+)
VOLTAGE – Potential **(V)**
GROUND – a Common Reference point
CURRENT – Movement of electrons **(I)**
RESISTOR – impedes the movement of a current **(R)**
CAPACITOR – stores charge
(C – capacitance in farads, F)

Electrical Circuit Basics

CHARGE - electrons (-), protons (+)
VOLTAGE – Potential **(V)**
GROUND – a Common Reference point
CURRENT – Movement of electrons **(I)**
RESISTOR – impedes the movement of a current **(R)**
CAPACITOR – stores charge
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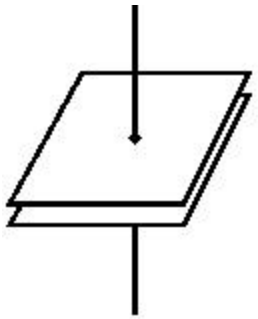
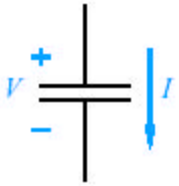
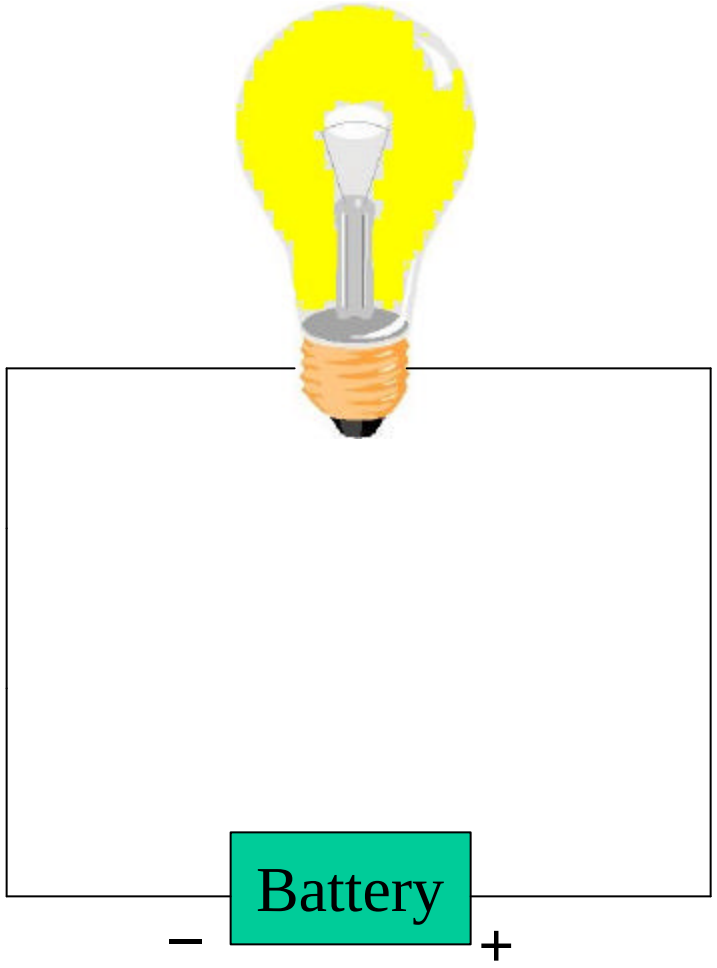


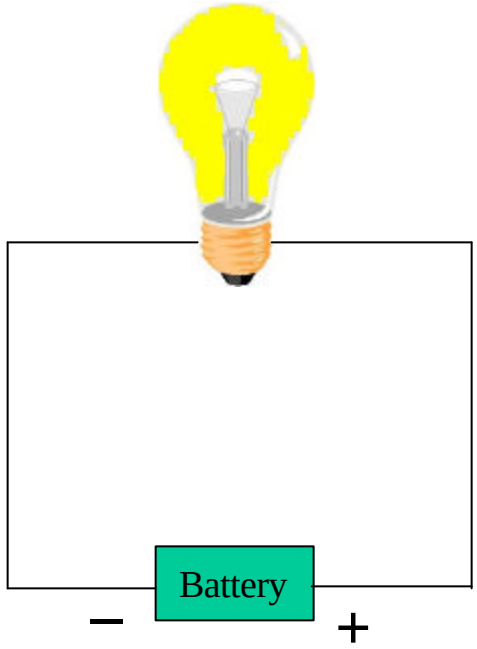


Simple Circuit



Which way do electrons flow?
Which way does the current flow?
Is there a resistor in this circuit?

Equivalent Circuit – Neural Membrane Model



- What is the cellular Battery?
- What is the source of resistance?
- What is the capacitor?

Equivalent Circuit – Neural Membrane Model