Announcements (2/9/04)

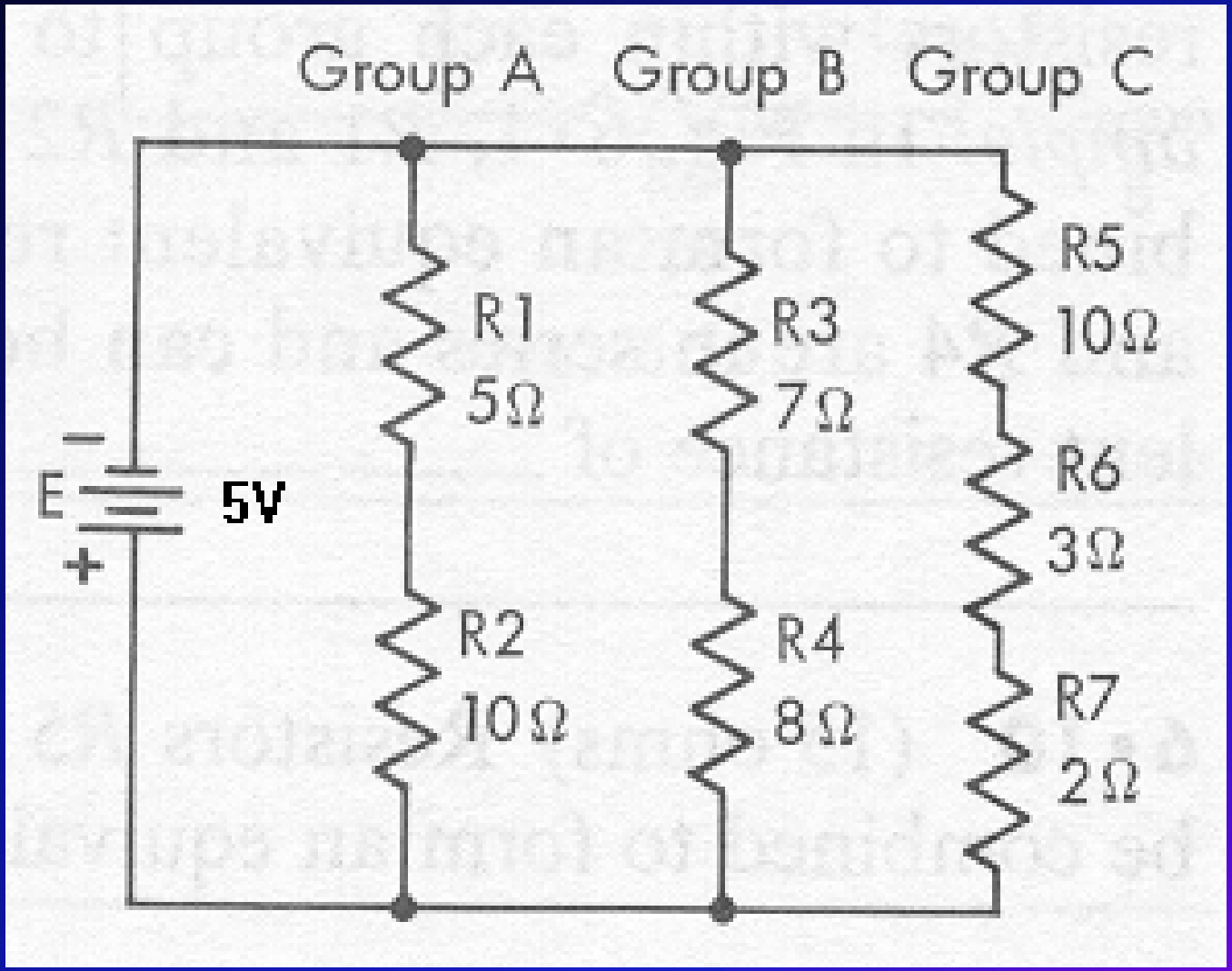
- 401B and 501B: Laboratory Meetings and Reports Due

Lab Mtg	Report Due
March 3 5-7 pm	Skin Conductance (3/3)
March 24 8-10 pm	Cardiovascular (3/24)
April 14 5-7 pm	EEG (4/14)
	ERP (5/3)

- Electricity Test next week (Feb 16)
- Video Library -- http://svl.arizona.edu.
- Information on Papers
- Review of 3x5 cards

Electricity Test Objectives

- Describe positive and negative charges
- State the law of attraction and repulsion
- Describe free electrons
- Describe the relationship between electromotive force, resistance, and flow (i.e. understand Ohm's Law)
- Draw a simple DC electric circuit comprised of a battery and:
  - Single resistor
  - Resistors in series
  - Resistors in parallel
- Solve for voltage, current, or resistance in simple DC circuits:
  - In Series
  - In Parallel
- Reduce a compound circuit to a simple equivalent
- Describe the difference between alternating and direct current (AC/DC!)
- Describe the role of a capacitor in an AC and DC circuit


Group A
Group B
Group C
R1
5Ω
R2
10Ω
R3
7Ω
R4
8Ω
R5
10Ω
R6
3Ω
R7
2Ω
E
5V
−
+

Back to the regularly scheduled lecture on Neurophysiology and Neuroanatomy

Skin Conductance:

Pontificating about sweat

Two types of Sweat Glands

- Eccrine
  - forms basis of skin conductance recording
  - located all over body, but dense concentrations on surface of hands and feet
  - has many functions
- Apocrine
  - found under armpits and genital areas
  - function a matter of debate
  - not of great interest to psychophysiologists

Functions of Sweat Glands

- Thermoregulation
- Thermal Preparation
- Facilitate manipulative contact
- Minimize abrasion
- Accentuate Tactile Acuity
- Odiferous communication? (Apocrine)

After Edelberg, 1972

Anatomy of a Gland and the Skin

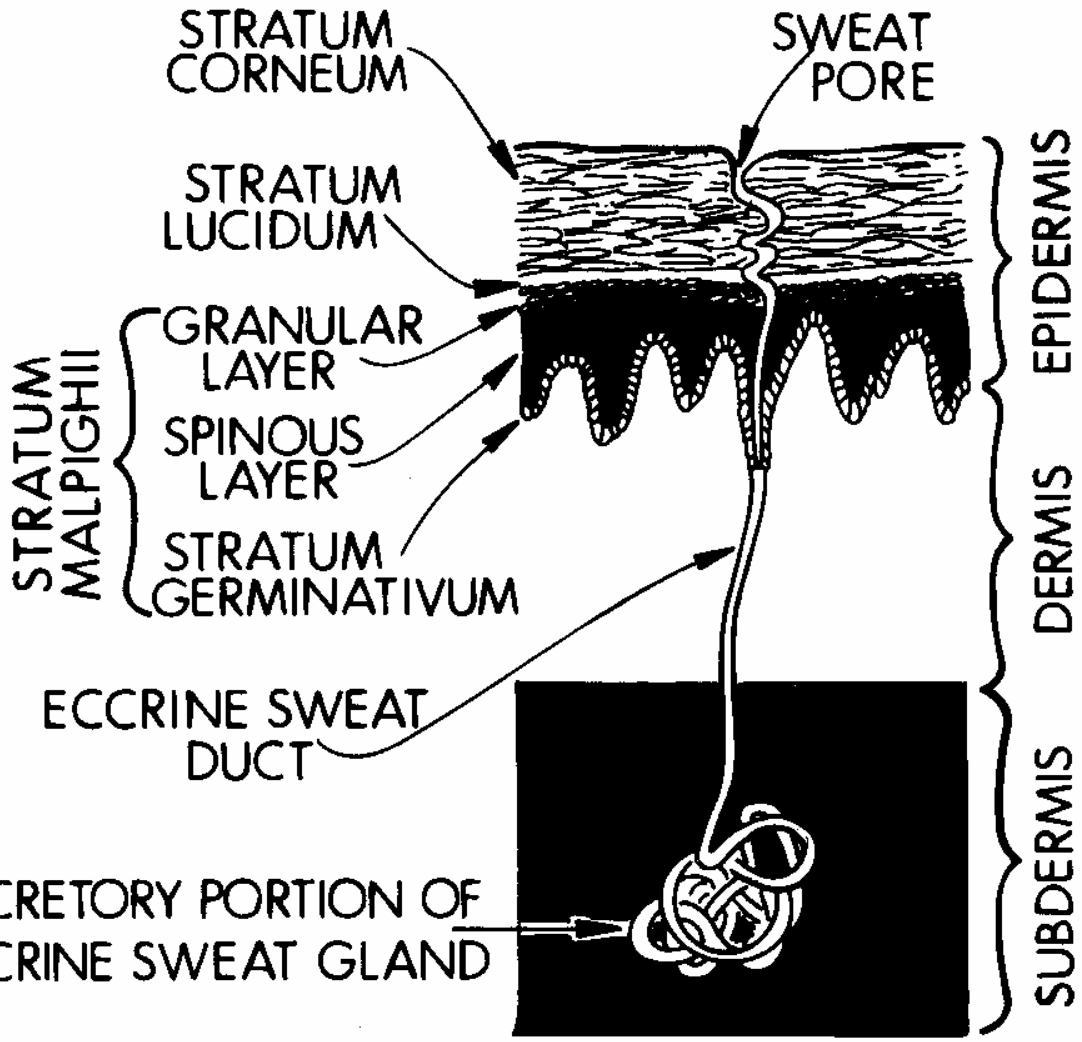
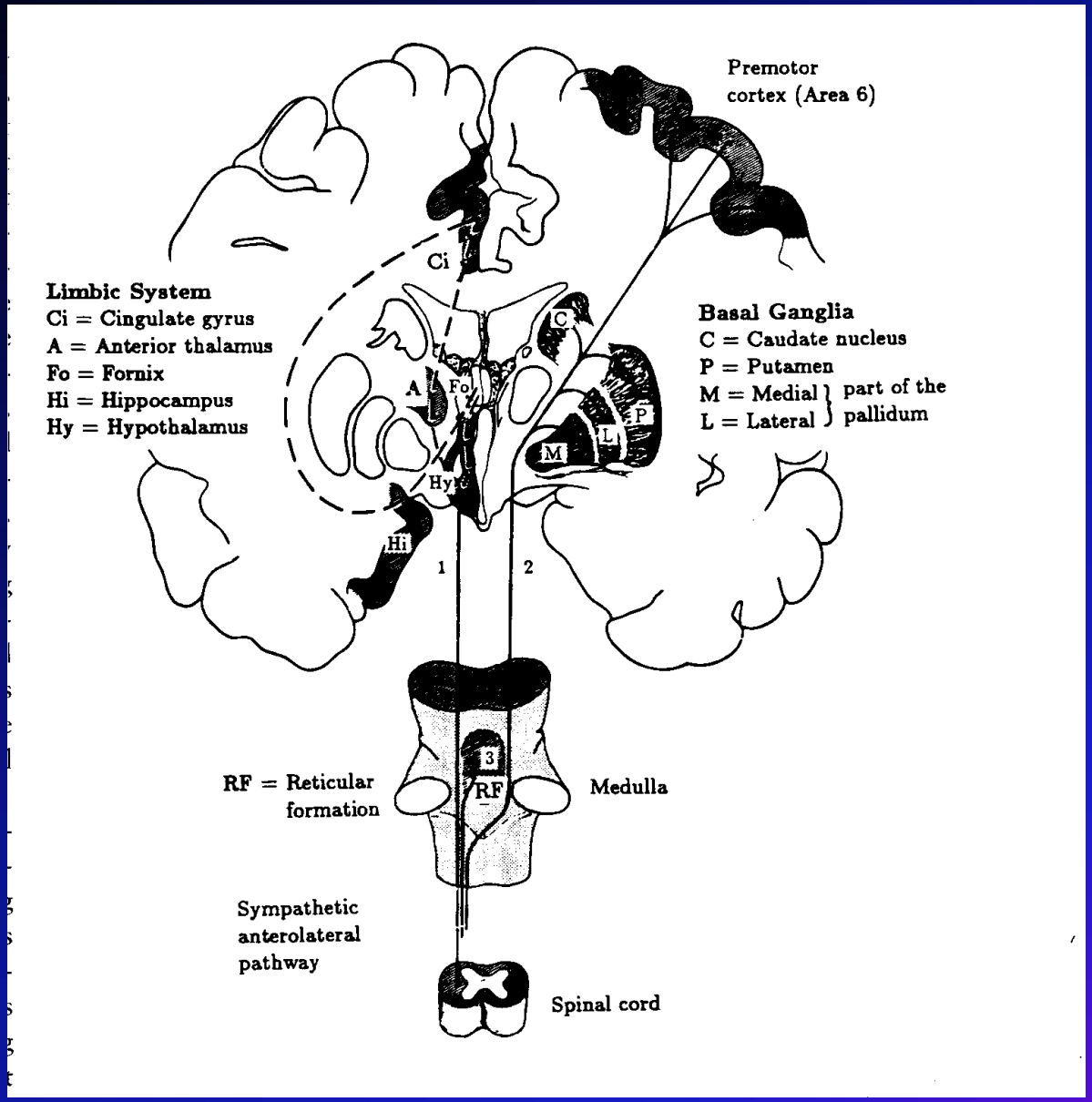


Figure 1. Anatomy of the eccrine sweat gland in various layers of skin. Adapted with permission from Hassett, *A Primer of Psychophysiology*. Copyright 1978 W. H. Freeman and Company.

- Sweat glands primarily driven by sympathetic innervation that is cholinergic
- Sudomotor fibers originate in the sympathetic chain, terminate on sudomotor cell of sweat gland
- Stratum Corneum acts as a variable resistor, with decreased resistance due to sweat

From Dawson et al 2000

Central Control



From Dawson et al 2000

Acronym Glossary

- Generic terms
  - EDA = electrodermal activity
  - GSR = galvanic skin response
- Skin Resistance
  - SRL = skin resistance level (tonic); 10,000-500,000Ω
  - SRR = skin resistance response (phasic); 100-10,000 Ω
- Skin Conductance
  - SCL = skin conductance level (tonic); 2-50 μsiemens
  - SCR = skin conductance response (phasic); .05-5 μsiemens
  - SSCR or NSSCR = spontaneous or non-specific skin conductance response
- Skin Potential
  - SPL = skin potential level (tonic); 0-60 mV
  - SPR = skin potential response (phasic); .1-10 mV

Glands Act as Resistors in Parallel

- Resistance will therefore decrease with increased recording surface area – keep surface area constant across subjects
- Resistance is not linearly related to the # of resistors

$$\frac{1}{R_t} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots$$

- Conductance, however, is linearly related to the number of resistors in the circuit
  - Therefore, there exists a linear relation between measures of conductance and sweat secretion
  - Not so for Resistance
  - The metric of conductance more accurately reflects the activity of the system

	SRL	SCL	SRR	SCR
R1 Pre	100,000	10		
R1 Post	99,000	10.1	1000	0.1
R2 Pre	20,000	50		
R2 Post	19,000	52.6	1000	2.6

- Conductance is the Reciprocal of Resistance
- This shows how two vastly different responses will appear the same using skin resistance response metrics

Recording -- Placement

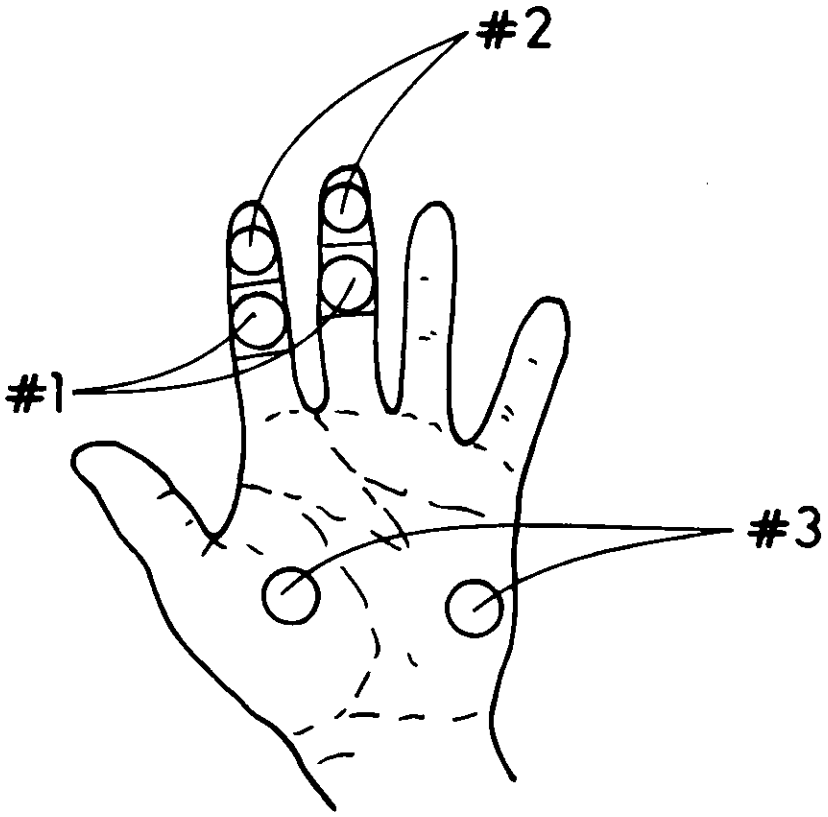


Figure 3. Three electrode placements for recording electrodermal activity. Placement #1 involves volar surfaces on medial phalanges, placement #2 involves volar surfaces of distal phalanges, and placement #3 involves thenar and hypothenar eminences of palms.

From Dawson et al 2000

Recording Considerations

- Prep the Skin?
  - Never abrade
  - Don't use other agents (ETOH)
  - Washing with soap and H2O recommended to standardize across subjects
- Electrodes – Ag-AgCl
  - Expensive and Fragile
  - But well worth it – resist polarization
- Conductive Paste
  - Because current passed continuously, can interact with with the tissue
  - Unibase + physiological saline (Fowles et al, 1981) will keep properties of tissue and paste constant over duration of recording session
  - Other gels are bad news;
    - highly conductive, but saturated with NaCl,
    - over time will migrate to skin tissue, inflating SCL
- Surface Area Exposed
  - Keep constant across subjects and session
- Constant Voltage Amplification
  - Preferred over Constant current (Lykken and Venables, 1971)
- Temporal responsivity – SC system is S…L…O…W

The Generic SCR

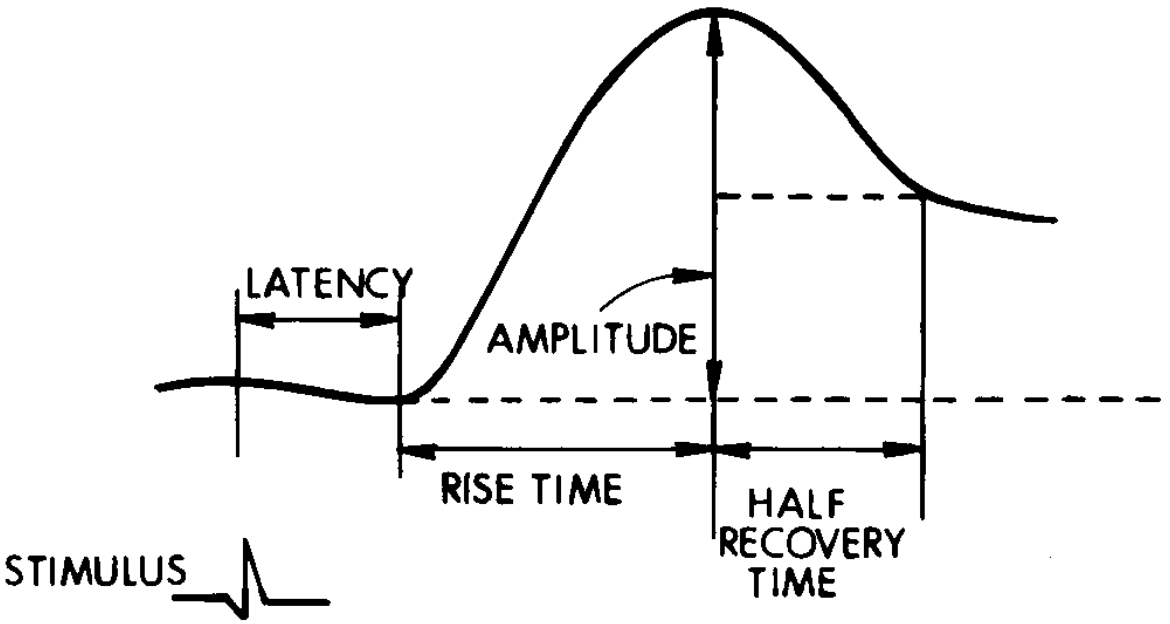


Figure 5. Graphical representation of principal EDA components.

- Latency typically 1-3 secs
- Rise time typically 1-4 secs

From Dawson et al 2000

Scoring Issues

- Responses that ride on responses
- Range Correction (Lykken et al., 1966)
  - Level

$$\frac{(SCL_{observed} - SCL_{\min})}{(SCL_{\max} - SCL_{\min})}$$

  - Response

$$\frac{(SCR_{observed})}{(SCR_{\max})}$$

- Note also slope and intercept regression approaches

Applications

- Orienting (Bauer, 1984; Tranel and Damasio, 1985)
- Fear conditioning (Őhman)
- Habituation and depression/Sz (Iacono)
- Deficient anticipatory anxiety in psychopathy (Hare)
- Deception Detection (Myriad authors)

Anticipatory Arousal

- Hare Countdown Task (1965)
- #'s appear from 1..8
- At "8" punishment is given (shock):