COGS 1

Week 7
Epigenetics & Mirror Neuron Systems
Announcements

• Midterm 2: Thursday, February 25th (weeks 4-6)

• Review Session: Monday, February 22nd
  Pepper Canyon 109 7-8pm
This Week’s Questions: Epigenetics

- What role does epigenetics play in our development
- what is the method by which epigenetics occurs (methylation)
- How did we figure that out?
- How does methylation change genetic outcomes
  - cell types?
  - cell activity?
  - gene interaction?
Brain Development

- Conception
- Neurulation
  - Neuronal proliferation
- Neural migration
- Myelination
- Synaptogenesis
- Apoptosis

Gestation (weeks)
- 4
- 8
- 12
- 16
- 20
- 24
- 28
- 32

Birth
4 months
Adolescence
Adulthood

10 cm
Brain Development

- Early development
- Adolescence
- Adult
- Aged

Graph showing synapses per 100 μm³ over time from early development to aged.
DNA Methylation in the Brain

[Diagram of neuronal and glial cells with DNA strands and methylation marks]

[Diagram showing genomic DNA, random fragmentation, and bisulfite conversion of unmethylated C to converted and protected C]
Cytosine DNA Methylation

- Covalent modification of genomic cytosine (mC)
- Key roles in imprinting, X-inactivation, transcription repression, cancer
- Stable and heritable
- Yet, reversible and potentially activity-dependent
- Rett syndrome: An autism-spectrum disorder caused by Methyl-C Binding Protein (MECP2) loss of function
Neuron Methylation

- Mature neurons have increased non-CG methylation compared to other cell types (weird!)
- Methyl donors increase health of epigenetic system
  - like folic acid during human pregnancy
  - or royal jelly for queen bees
- How is gender linked to important epigenetics questions?
<table>
<thead>
<tr>
<th>This Week’s Questions: Mirror Neurons</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Links between sociability and brain size</td>
</tr>
<tr>
<td>• Links between sociability and physical health</td>
</tr>
<tr>
<td>• <em>Mirror neurons’ role in sociability, and issues arising from faulty systems</em></td>
</tr>
<tr>
<td>• Methods of repairing faulty systems</td>
</tr>
</tbody>
</table>
Brain Size and Sociability

- Why might our brains be so big?

- What did Robin Dunbar propose?
  - how?
Sociability and Health

- What crucial aspect of our health might be socially transferred?
  - How does this happen?
  - Why might this be important?
  - Why might this occur in general?
The Role of Mirror Neurons

● Why might they exist?
  ○ What brain activity might demonstrate activity in this network?

● What might failures of this system lead to?
  ○ why?
  ○ can it be fixed?
Mirror Neurons!

- What do they respond to?
- Can you think of reasons?
Questions?

hmmmm?