

# Modular Digital Course in Undergraduate Biological Education

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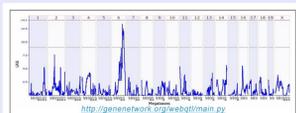
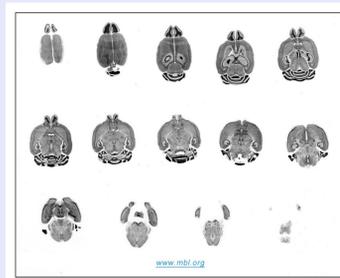
## (1) BIOINFORMATICS



Students quantify mouse brain phenotype and perform a Quantitative Trait Locus (QTL) analysis to link variation in the phenotype with chromosomal loci.

<http://mdcunc psych.ucla.edu/modules/bioinformatics/>

- Students measure olfactory bulbs areas from digital images of BxD mice brains.
- Students analyze data with multiple regression and ANOVA.



- Students determine the complete and coding sequences of the genes.

- Students run a QTL analysis on residual scores to identify chromosomal sections associated with the phenotypic variance.

- Students find genes that are highly expressed in olfactory bulbs.

Mus musculus strain C57BL/6J chromosome 6, MGScv37 C57BL/6J  
 NCBI Reference Sequence NC\_000707.5  
 CDS: 100000000..100000000  
 ORF1: 100000000..100000000  
 ORF2: 100000000..100000000  
 ORF3: 100000000..100000000  
 ORF4: 100000000..100000000  
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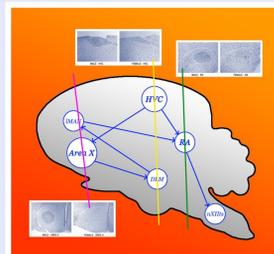
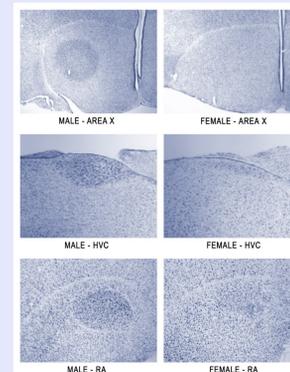
## (2) BIRD SONG SYSTEM



Students quantify zebra finch song nuclei to determine sex differences and the effects of various doses of estradiol ( $E_2$ ) given to post-hatch females.

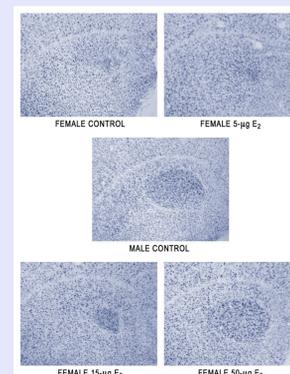
<http://mdcunc psych.ucla.edu/modules/birdsong/>

- Students measure Area X, HVC and RA regions from digital images of zebra finch brains.
- Students analyze data with ANOVA and post-hoc tests.

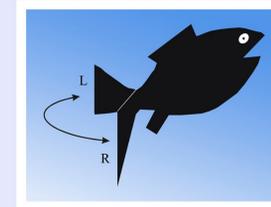


- Students determine the sensitivity of the female song system to  $E_2$ .

- Students determine if the extent of masculinization is proportional to the amount of  $E_2$  treatment.



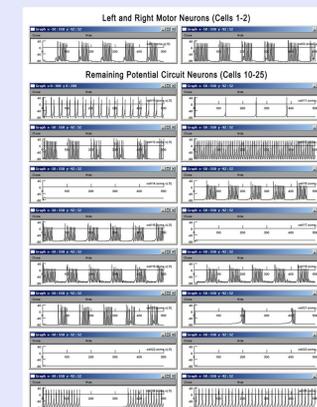
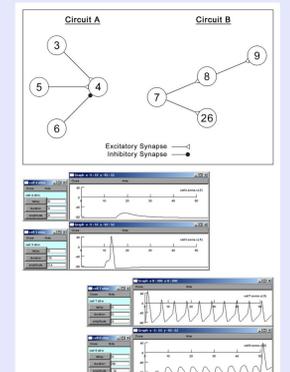
## (3) SWIMMY



Students observe and learn about neurophysiological phenomena and mechanisms of motor pattern generation using the virtual neural circuits of a fish.

<http://mdcunc psych.ucla.edu/modules/swimmy/>

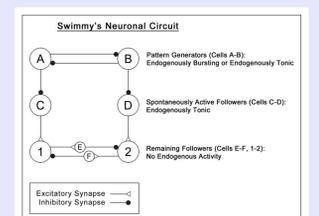
- Students are introduced to SwimmyGUI, a program that simulates the neural circuitry of a swimming fish.
- Students explore and manipulate simplified and pre-defined neuronal circuits.



- Students determine which cells are involved in the swimming circuit of a virtual fish.

- Students determine the circuitry of all swimming cells.

- Students determine pattern generators and pattern mechanisms.



## (4) RESOURCES

All materials for these modules are available for free at:

<http://mdcunc psych.ucla.edu/>

## (5) ACKNOWLEDGEMENTS

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