



Exploring epigenetics as a tool for population assessment and conservation in large marine predators

environmentalepigenetics.com

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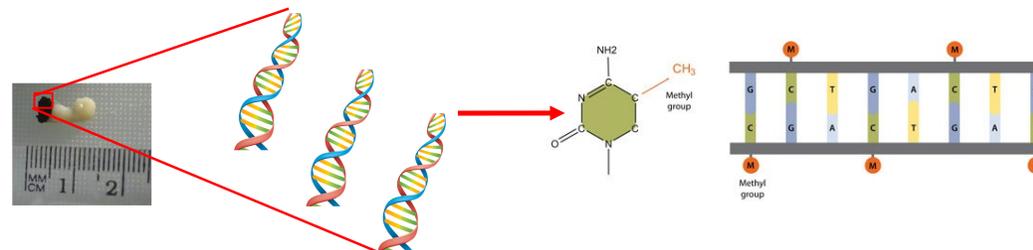


Goals

- Identify exposures to pollutants in marine predators (focus on sharks and dolphins)
- Identify and understand age-related exposures
- Identify genes whose DNA methylation changes when exposed to pollutants
- Investigate inherited environmental changes to DNA methylation due to pollutant exposures

Research Methodology

- Create molecular aging tools needed for age-related evaluations of how pollutants affect species
- Find biomarkers of exposure to different pollutants using DNA methylation
- Identify genes where changes in DNA methylation occur with environmental changes



Skin sample from a biopsy dart is subsampled

DNA is extracted and contains several copies of DNA sequence from the several cells in the sample

A percentage is calculated of the number of copies of DNA that has methylation at specific CpG sites

Figure 2. Calculating percent DNA methylation at CpG sites for age estimation

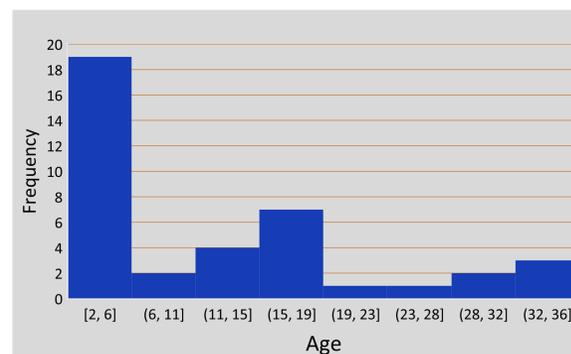


Figure 3. Histogram of ages used to calibrate the BEAT

| Gene | # of CpG sites | # sign. Corr. To age |
|--------|----------------|----------------------|
| Gene 1 | 5 | 5 |
| Gene 2 | 4 | 3 |
| Gene 3 | 6 | 3 |

Table 1. Three genes were investigated for the creation of the BEAT. Showing # of CpG sites investigated per gene and how many were significantly correlated with age.

Results

- The BEAT- A model for estimating age in small cetaceans was created
- Used two of three genes investigated
- $R^2=0.778$ Residual error=4.82
 $p=6.05 \times 10^{-13}$

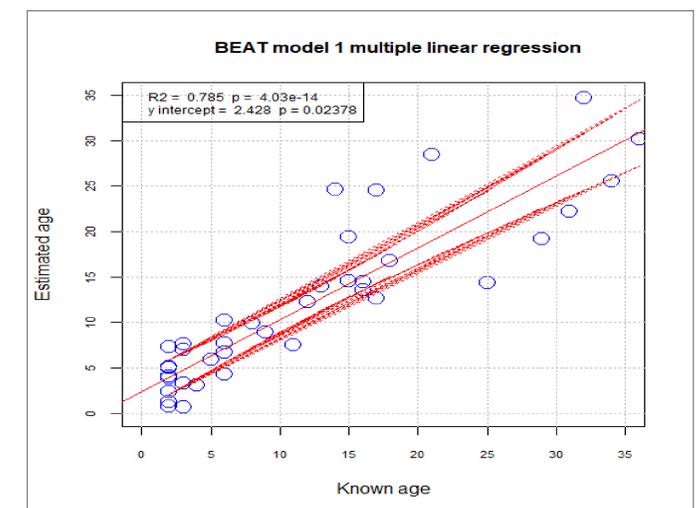


Figure 4. The BEAT Graph: showing the fit of the model created

Future Research

- Age specific exposures are expected for dolphins and sharks
- An aging tool for sharks will be feasible once a reference genome is available
- Exposures to pollutants will produce unique DNA methylation markers that can be used to identify exposures
- Some of these marks will be heritable and affect subsequent generations



Figure 1. Bottlenose dolphins pictured at top, young of year lemon shark in tonic immobility bottom left, and myself collecting water samples in Bimini bottom right.



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This material is based upon work supported by the National Science Foundation under Grant No. HRD-1547798. This NSF Grant was awarded to Florida International University as part of the Centers of Research Excellence in Science and Technology (CREST) Program. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.