Molecular Phylogenetics 2018
Topics by Week

1) Fundamentals and Parsimony #1
    a) Characters, homology, alignment
    b) Trees, rooting
    c) Maximum parsimony methods #1
        i) Justification and objections
        ii) Algorithms: tree length, tree search

    - Assigned: Nikaido et al 1999, Wheeler et al. 1995, Farris 1983.
    - Supplemental: Thompson et al. 1994; Edgar. 2006; Lloytnoja and Goldman 2008
    - Textbook: Tree Thinking, chs 3-4;

2) Parsimony #2
    a) Consensus and Weighting
    b) Support for phylogenetic inference: Decay index, Bootstrap, KH test
    c) Accuracy of MP and long-branch attraction

    - Hillis and Bull 1993; Wenzel and Siddall 1999; Hillis 1998
    - Discussion: Huelsenbeck 1997 / Whiting 1998 (Supplementary recent analysis of this classic problem: Boussau et al. 2014; Niehuis et al 2012)
    - Strongly recommended: Felsenstein 1978; Mindell and Thacker 1996; These are important, but there's a lot of reading already for this week.
    - Textbook: Felsenstein chs. 3-5, 20-21, pp 81-87
    - Due: Problem set 1: Trees homology and alignment

3) Distance Methods
    a) Defining and correcting pairwise distances
    b) UPGMA
    c) "Regression" methods
    d) NJ and minimum evolution
    e) Objections and rejoinders

    - Assigned: Hillis, Huelsenbeck and Cunningham 1994; (Also: read leftovers Felsenstein 1978 and Mindell and Thacker 1996 from week 2)
    - Discussion: Aguinaldo et al. 1997 / Blair 2002
    - Textbook: Felsenstein ch 11
    - Due: Problem set 2: Maximum Parsimony

4) Maximum likelihood #1
   a) Why ML?
   b) Likelihoods on trees
   c) Markov models of sequence evolution

   - Assigned: Foster 1991; Le and Gascuel 2008
   - Discussion: Zanis 2003
   - Textbook: Felsenstein ch. 16;
   - Due: Problem set 3: Long branch attraction

5) Maximum likelihood #2
   a) Choosing models: LRT, AIC
   b) Basic models
   c) Heterogeneous models
   d) Support: LRS, parametric bootstrap, SH/SOWH

   - Assigned: Cunningham et al. 1998; Lartillot and Phillipe 2007; Le and Gascuel 2010;
   - Discussion: Nardi et al 2003 / Delsuc et al. 2003
   - Supplementary: Anisomova and Gascuel 2011; Le and Gasccuel 2012
   - Textbook support: Felsenstein 13-14
   - Due: Problem set 4: ML #1
   - Due: 1 paragraph prospectus

6) ML #3/Bayesian Phylogenetics #1
   a) Performance of ML, model violation, consistency, objections
   b) Relationship between ML and MP
   c) Bayesian phylogenetics: principles
   c) Posterior probabilities on trees and parts thereof

   - Assigned: ML: Siddall and Kluge 1999; Kolaczkowski and Thornton 2004; Huelsenbeck et al. 2002
   - Discussion: Phillippe et al 2005
   - Supplementary: Zhou, Shin, Hittinger and Rokas et al 2017
   - Due: Problem set 5: ML #2
   - Due: Specific aims

7) Bayesian analysis #2
   a) Bayesian phylogenetic algorithms
   b) Choice of priors, impacts on inference
   c) Model violation

   - Assigned: Kolaczkowski and Thornton 2007; Nascimento et al. 2017
   - Discussion: Murphy et al. 2001; Delsuc et al 2006 / Bourlat et al. 2006
   - Supplementary: Kolaczkowski and Thornton 2009
   - Due: Midterm

8) Phylogenomics/incongruence
   a) Separate or combined analysis of genes?
   b) Incongruence, measures, tests
   c) Supertrees and supermatrices
   d) Choosing good data in a phylogenomic context

   - Assigned: Dequeiroz et al. 1995; Farris et al. 1995; Shen, Hittinger and Rokas 2017
   - Discussion: Rokas 2003 / Jeffroy 2006;
   - Due: Problem set 6 Bayesian phylogenetics

9) Ancestral sequence reconstruction
   a) Algorithms
   b) Bias
   c) Robustness and error

   - Assigned: Hanson-Smith et al. 2010; Williams et al. 2012; Eick et al. 2016;
   - Discussion: Whelan et al. 2015; Pisani et al. 2015 ; Simon et al. Curr Biol 2017
   - Supplementary: Yang et al 1995, Thornton NRG 2004
   - Due: Nothing. Work on your project.

10) Molecular evolutionary analysis using phylogenetic methods
   a) Adaptive evolution and codon models
   b) Gene family evolution: duplication, changes in rates, etc
   c) Rates, clocks, dating

   - Assigned: Yang and Nielsen 2002; Venkat et al. 2017;
   - Discussion: Dehal and Boore 2005
   - Supplementary: Zhang et al. 2005
   - Due Monday: Proposal draft for peer workshop

- Read Guoy: rooting the tree of life: the phylogenetic jury is still out. Systematic error. Heterogeneity.
- Suppl: Philippe's essay on data quality