BIO 120

2016 09 14

INTRODUCTION TO EVOLUTIONARY BIOLOGY

COURSE WEBSITE:

- PORTAL.UTORONTO.CA
- COURSE SYLLABUS (!)
  - ON PORTAL
  - IN THE LAB MANUAL

WEEK 1 LABS (01) OCT. 4-7
WEEK 2 LABS (02) OCT 11-14

LOOK AT "MY GRADES" AFTER 5 pm ON SEP 19

REQUIRED COURSE MATERIALS:

1. LAB MANUAL
2. THE STRUGGLE FOR EXISTENCE
   JAMES D. THOMSON
   PDF
3. LAB COAT

ACADEMIC HELP:

1. OPTIONAL WEEKLY TUTORIAL
2. LECTURE DISCUSSION FORUM

MON 5 PM	BRECHANN
WED 8 PM	MC GOEY

LAB CONTENT:

1. OFFICE HOURS
2. LAB DISCUSSION FORUM

ES 3D FLOOR
BARRET LAB

1. INTRODUCTION TO EVOLUTION LECTION
2. HOW EVOLUTION IS STUDIED.
3. BIODIVERSITY & ADAPTATION
4. PROJECTS IN THE BARRET LAB

FOCUS ON RESEARCH

ASSUMED BACKGROUND KNOWLEDGE:

- MENDELIAN GENETICS
- INHERITANCE
- STRUCTURE OF DNA
- MITOSIS AND MEIOSIS
- CHROMOSOMES

→ SEE ADVICE ON BLACKBOARD

→ BOOK "SPECIATION"

LECTURES ON EVOLUTION

- BIOGEOGRAPHY OF BIODIVERSITY & ADAPTION
- WHY GENETIC VARIATION MATTERS
  ↳ measurement and maintenance of genetic variation
- EVOLUTION OF SEX AND REPRODUCTIVE SYSTEMS
- STRUCTURE OF POPULATIONS, GENE FLOW AND GENETIC DRIFT
- SPECIES, SPECIATION AND HYBRIDISATION
- PHYLOGENETICS AND MACROEVOLUTION
- CONTEMPORARY EVOLUTION AND INVASIVE SPECIES

AND MOR

LEVELS OF BIOLOGICAL STUDY:

- MOLECULES
- CELLS
- ORGANISMS
- POPULATIONS
- COMMUNITIES
- GROUPS

QUESTIONS IN EVOLUTIONARY BIOLOGY:

SCOPE OF A QUESTION

SMALL

EASILY SOLVABLE CHUNKS OF BIG PROBLEMS

eg (STUDIED IN MASTER'S OR PhD DEGREES)

LARGE

UNLIKELY TO BE ANSWERED BY ONE EXPERIMENT

eg WHY DID SEX EVOLVE?

WHY IS THERE SO MUCH BIODIVERSITY IN THE TROPICS?

TYPE OF QUESTIONS

HOW

PROXIMATE QUESTIONS WHICH INVOLVE DETERMINING THE PHYSIOLOGICAL OR GENETIC MECHANISMS RESPONSIBLE FOR THE EVOLUTION OF A TRAIT

WHY

ULTIMATE QUESTIONS

THE ECOLOGICAL FUNCTION AND ADAPTIVE SIGNIFICANCE

APPROACHES USED IN EVOLUTIONARY BIOLOGY

A VARIETY OF APPROACHES IS USED!

- OBSERVATIONAL :: DESCRIBING AND QUANTIFYING
- THEORETICAL :: DEVELOPING MODELS. VERBAL, GRAPHICAL, MATHEMATICAL
- COMPARATIVE :: OBTAINING THE SAME DATA FOR MANY SPECIES
- EXPERIMENTAL :: MANIPULATING A SYSTEM TO ADDRESS A SPECIFIC HYPOTHESIS; REQUIRES AN EXPERIMENTAL DESIGN AND STATISTICAL ANALYSIS

IMPORTANT ASSUMPTIONS ABOUT EVOLUTION VERIFIED BY SCIENTIFIC STUDIES:

- ORGANISMS CHANGE OVER TIME
- CHANGES ARE GRADUAL
- BIODIVERSITY ORIGINATES FROM SPECIATION AND BRANCHING
- ALL SPECIES HAVE COMMON ANCESTORS
- THE ONLY PREDOMINANT FACTOR OF ADAPTATION AND EVOLUTION IS NATURAL SELECTION

BIODIVERSITY :: THE NUMBER AND KINDS OF LIVING ORGANISMS IN A GIVEN AREA

ADAPTATION ::

1. STATE :

ADVANTAGES MAKING THE ORGANISM FITTER

2. PROCESS :

LEADS TO THE ORIGIN AND DIVERSIFICATION OF SPECIES

THEORY OF EVOLUTION

THE CENTRAL UNIFYING CONCEPT OF BIOLOGY AFFECTING MANY OTHER AREAS OF KNOWLEDGE

T. Dobzhansky:

"NOTHING IN BIOLOGY MAKES SENSE EXCEPT IN THE LIGHT OF EVOLUTION"

EVOLUTIONARY BIOLOGY TODAY

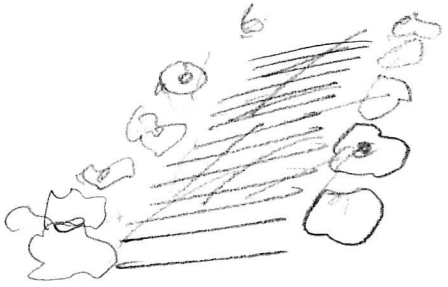
EVOLUTIONARY MECHANISM — MICROEVOLUTION

EVOLUTIONARY HISTORY — MACROEVOLUTION

↳ LARGELY PATTERN-BASED AND NON-EXPERIMENTAL

WORK OF BARRETT LAB:

- DISCOVERY OF THE MISSING FORM OF WATER HYACINTH, AFFECTING NEGATIVELY THE TROPICS DUE TO THE ABILITY OF CLONING AND REPRODUCTION
- NOVEL ADAPTATION PROMOTING OUTCROSSING IN PLANTS



MISSING SHORT-STYLED (S) MORPH OF WATER HYACINTH
!? J.B.S. HALDANE

→ FOUND IN THE AMAZON IN 1974
SCI. AMERICAN 1989

- WORLD'S MOST SERIOUS INVASIVE AQUATIC PLANT
- REPRODUCES BOTH BY CLONAL AND SEXUAL REPRODUCTION
- 3 MORPHS RESTRICTED TO THE NATIVE RANGE
- MOST REPRODUCTION BY CLONING
- MASSIVE FOUNDER EVENT

BABIANA RINGENS | RAT'S TAIL

SABBATICAL 2003 IN SOUTH AFRICA

- ENIGMATIC SPECIES ENDEMIC TO THE WESTERN CAPE
- UNUSUAL TRAITS INCLUDE GROUND FLOWERING & NAKED INFLORESCENCE !!!
- WHAT POLLINATES THIS PLANT?

BIRDS

NEW WORLD

HOVERING

OLD WORLD

PERCHING

AN AXIS
FOR PERCHING

EVIDENCE FROM GENETIC MARKERS

→ PERCH REMOVAL RESULTS IN SIGNIFICANT REDUCTION OF FERTILITY AND THE QUALITY OF OFFSPRING

KEY POINTS:

DOBZHANSKY AND DARWIN