Ecology and Science

So……What is science?

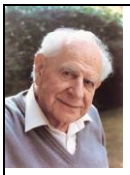
Deduction?

Induction?

GOAL OF SCIENCE:

"…the aim of science [is] to find satisfactory explanations of whatever strikes us as being in need of explanation" (Popper 1972:191)

"Prediction and explanation are the twin pillars upon which the scientific enterprise rests." (Casti and Karlqvist 1991:vii)



Karl Popper

PHILOSOPHIES OF SCIENCE

"because all theories remain] guesses, conjectures, hypotheses… we are therefore at best always faced with the question of preferring, tentatively, some guesses to others…" (Popper 1972:13)

1) Begin with a problem based on observations that generate new questions or contradict established theory
2) Develop conceptual hypothesis/model
3) Formulate specific hypotheses/models (several of them) that make testable predictions
4) Devise critical test and *repeatedly* test hypotheses looking for falsification (evidence contrary to model predictions)
5) Retain unfalsified hypothesis. If >1 unfalsified hypothesis, retain the one with greatest **degree of corroboration**

Imre Lakatos

PHILOSOPHIES OF SCIENCE

"All theories…are born refuted and die refuted. But are they equally good?" (Lakatos 1978)

Same as Popper to start:

1) Begin with a problem based on observations that generate new questions or contradict established theory
2) Develop conceptual hypothesis/model
3) Formulate specific hypotheses/models (several of them) that make testable predictions

THEN: Keep best available hypotheses

Do not have to retain only unfalsified hypotheses because of the philosophy that hypotheses may never be truly falsified

Science may keep a hypothesis that is wrong if there is not a better one available.

Basis for Information Theoretic Model Selection Approach

Statistical Approaches to Science

Hypothetico-deductive:

Test a single hypothesis using frequentist methods

Follows Popper in that a statistical null hypothesis of 'no effect' is crafted and tested.

Biological significance vs statistical significance

Platt's Strong Inference:

As above but testing a series of multiple alternative hypotheses to eliminate as many as possible

Statistical Approaches to Science

Information Theoretic Approach:

Competition between multiple hypotheses (models) and the data.

Meaningful hypotheses (models) determined a priori.

Data collected and models run

Uses an objective criterion to rank best model(s) -AIC

Idea of parsimony

Model averaging