

ORDERING DIVERSITY

Diversity of organismal form
is **gigantic** and **bewildering**

to make sense of earth's life, we need

A naming system
- *a taxonomy*

An organising system
- *a classification*

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IMPORTANT GENERAL TERMS:

Biota: the entirety of life of some given region

Lineage: an evolutionary series of forms,
possibly branching

Descent: blood relationship through time

Hierarchy: multi-level system of subordinate
categories, as in a classification

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TAXONOMY - naming life

Our basic unit of life is *the species*

Species have two names **Genus + species**

Genus = "surname" - includes closest relatives;
can change with new evidence

Species = "given name" - unique in combination
w/generic name; never changes

There is no universal definition of "species"
but accepted as objectively real
(unlike higher categories... we decide..)

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There are many species definitions

Their usefulness depends on the organism

Morphological concept: **universally applicable**
a distinctive cluster of forms....
statistical separation; observable attributes

Biological concept: **preferred; tricky**
interbreeding & genetic isolation;
common gene pool (also statistical.....)
not applicable to asexual forms.....

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CLASSIFICATION

- ordering life into *higher groups*

- many grouping principles *could* be used

- but in biology we agree that **some measure** of
STRUCTURAL SIMILARITY
is the relevant criterion for grouping

- measure characters, **assess levels** or
degrees of similarity

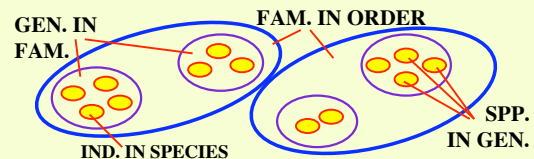
- characters used depend on organisms **and**
available technologies (see later....)

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When we compare similarity among some
group of organisms, we find this results in

A NESTED HIERARCHICAL SYSTEM



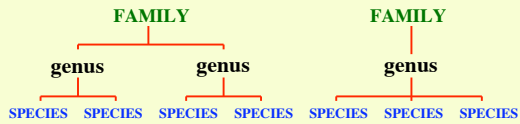
- **this natural structure long known**

- **Darwin explained it as reflecting *genealogy*:**
true "blood" relationships in deep time

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- thus our biological classification, based in closeness of similarity, is naturally structured and, by our theory, seen as reflective of varying levels of closeness of evolutionary descent



-but boundaries of groups not always obvious

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Darwin thus explained the natural pattern of resemblance with the corresponding pattern of evolutionary ("blood") descent

This is what we may call Darwin's Great Idea #1:

Evolutionary change by "Descent with modification"

- more separated by descent, more time for mutations = change = more distinct

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BUT apparent similarity depends on

- Characters scrutinised
- Closeness of scrutiny & technology used:
 - whales as "fishes" - gross external
 - animals vs. plants - anatomy + physiology

E.M. shows ultrastructure
- an entirely new set of characters

2-K superseded by 5-K

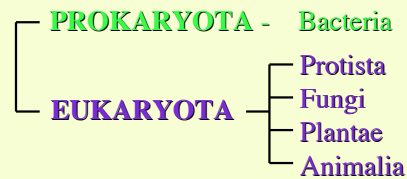
thus classifications are provisional hypotheses

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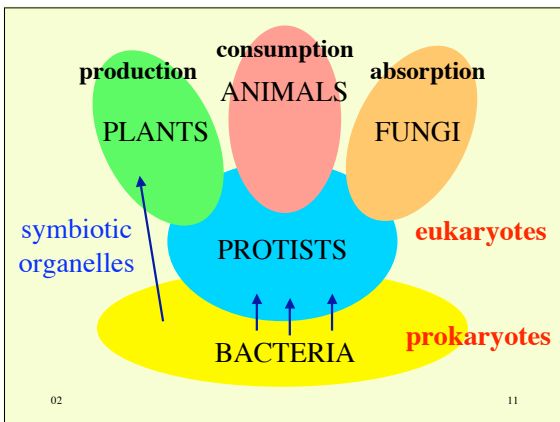
Actually, 5-K is (1 + 4)-K

ANIMALS, PLANTS, FUNGI & PROTISTS are ALL rather similar at cell-level, BUT VERY DIFFERENT FROM ALL BACTERIA



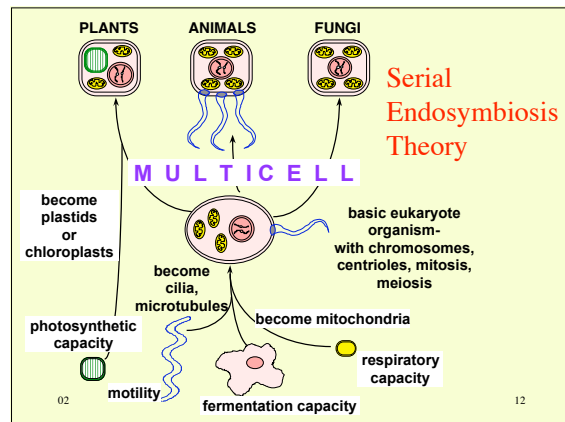
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The 5-K classification does a good job of representing *basic physical structure*

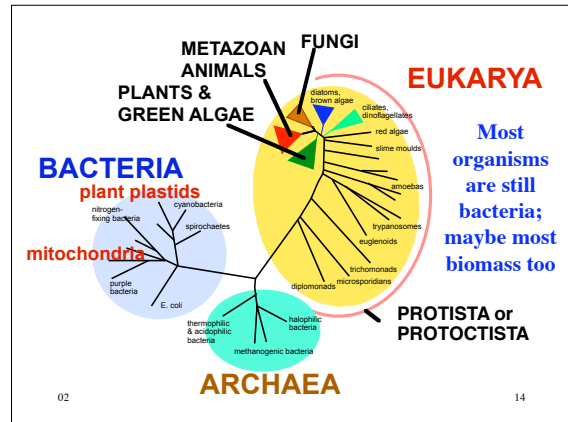
-but recently we have begun looking at *sequences of hereditary molecules*

this tool provides a *new window* on *relatedness*, which is *independent* of *morphological structure*

also allows us to look at how much *time* separates elements of the biota.....

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so we have seen that species are *real*
but how to *define* them is problematic
a species' *specific* name *never changes*
though it may be *moved* to another genus
there is a *hierarchy* of *similarity* from *descent*
but similarity depends upon *how we look*
we *classify* according to *perceived similarity*

is there a better way?

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Next class:

Does **all** character similarity
relate to closeness of
evolutionary descent?

Darwin's 2nd great idea.

Adaptation, analogy & homology

Lecture Notes 1&2.

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