

Theory of Evolution

addresses how life has changed on earth over time
does not address origin of universe, solar system, & earth
does not address origin of life

Chpt 25 addresses origin of universe & life

scientists estimate Big Bang occurred 15 billion yrs ago
Earth formed ~4.6 bill yrs ago

evidence: moon rocks & meterorites can be dated to
4.5-4.6 bill yrs ago, this is indirect evidence

how can we determine ages?

by radiometric dating we can get an absolute age
you should realize that "absolute" just means we can
estimate the age in years, it does not mean that it is
exact

radioactive isotopes are used in radiometric dating
these isotopes are unstable & will decay into stable
isotopes at a steady rate

these isotopes have a half-life

half-life is the time required for half of
radioactive atoms to decay

to calculate age of sample, you use proportion of
radioactive to stable isotopes

we can also use "relative age"

in this type of dating, we are not determining an age
instead we are determing whether fossils are older or
younger than other fossils by looking at layers in
earth

early atmosphere of earth

hot, volcanic gases present: N_2 , CO_2 , H_2O vapor, CO , ammonia NH_3 , methane gas CH_4 , hydrogen sulfide H_2S

O_2 not present

could not have supported life as we know it today

early on oxygen was bound in CO_2 & H_2O

1st photosynthetic organisms began releasing O_2 into atmos

~3.0-3.5 bill yrs ago

atmosph reached today's O_2 levels ~600-800 mya

early earth was hostile environmt, hot volcanic gases, UV rays of sun

today ozone O_3 protects us from sun

ozone formed after mill of yrs of O_2 added to atmosph

3 hypotheses of origin of life

1-life originally arose elsewhere & brought here

prob: does not explain origin, can't test

2-life arose by unknown means

prob: can't test idea

3-life evolved from inorganic substances interacting w/ environ

what are inorganic substances? elements & compds

not directly making up living organisms

organic compounds: made by and make up living organ

proteins, carbohydrates, fats, nucleic acids

must have these organized together to get life

all life can be boiled down to its most basic level as a series of chemical interactions

origin of life is a chemical process

this hypoth can be tested, has been tested in labs

one more hypoth that is not testable: deity created life

Heterotroph hypothesis

life evolved in a complex soup of inorganic materials
only need some E source to force inorganic materials to
interact w/each other

E source: lightning, UV radiation, radioactivity, heat
all organic compds contain C, H, O in differing arrangements
these elements were present in other forms in inorganic soup
Miller & Urey's experiment p.508

heterotroph hypothesis explaining origin of life says:

1-abiotic substances had to make small simple organic
molecules

2-something had to organize those molecules into larger
more complex organic molecules

3-these molecules had to be able to copy themselves &
become self-replicating

ultimately, scientists think a cell membrane structure (large,
complex organic molecule) formed around other organic
molecules----->first cell

oldest known microfossils or fossil microorganisms
are tiny, single-celled, filaments
similar to today's bacteria that can photosynthesize
found in rocks 3.5 bill yrs old

true prokaryotes have probably been on Earth for 2 bill yrs
before 1st eukaryotes showed up
first eukaryotes from microfossils are 1.4 bill yrs old
so how did we get from prokaryotic cells to eukaryotic cells?

Endosymbiont Hypothesis

symbiosis: when 2 diff species live together in relationship
there are 3 types of symbiotic relationships

1-mutualism: both species benefit from relationship
clown fish & sea anemone, lichens (algae & fungus)

2-parasitism: one species benefits, other is harmed
tapeworm, heartworm, leech, tick

3-commensalism: one benefits, other is not affected
barnacles on whales, remora on sharks

Endosymbiont Hypothesis (p.516-517)

eukaryotes evolved when larger prokaryotes engulfed small prokaryotes

brought them inside but instead of digesting them, they formed a symbiotic relationship

eventually, the internal organisms (endosymbionts) could no longer live on own

thus now there were other membrane-bound structures inside them