



# Liberal Arts : Biology

## “Global Warming”



memahami  
“Global Warming”  
dari sudut ilmu biologi





Bumi (diperkirakan) sebelum ada kehidupan

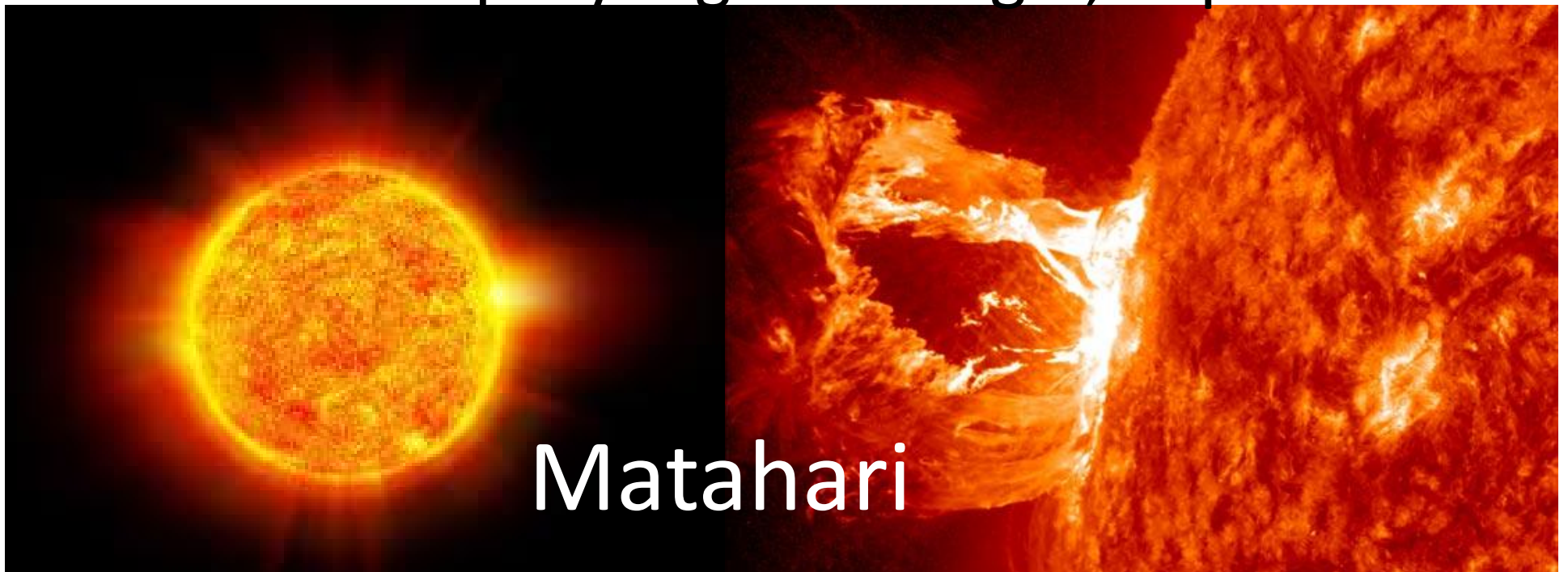


Bumi sekarang



Planet bumi

bumi: “bola api” yang mendingin, dapat dihuni



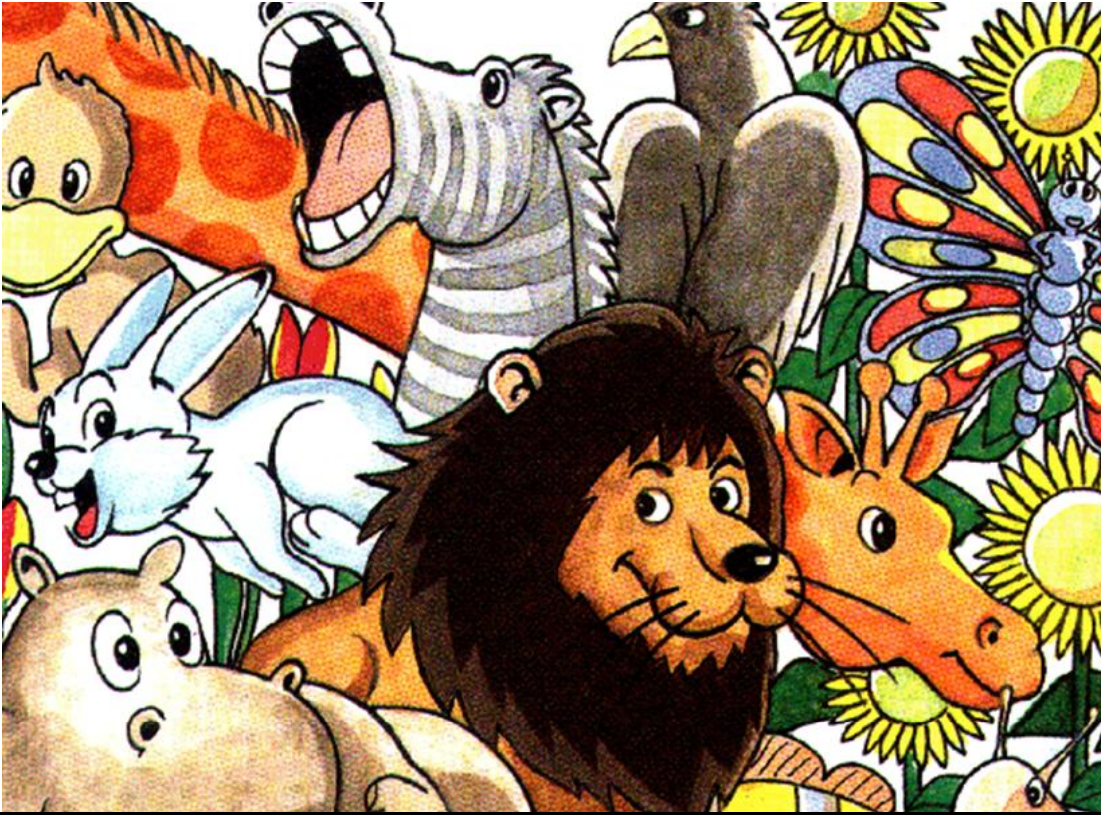
Matahari

Keanekaragaman mahluk hidup muncul dan berkoloni menjadi penghuni bumi

Bumi menjadi “1 habitat raksasa” bagi aneka ragam mahluk hidup

Dalam kemajemukan yg tak terhingga, mereka saling ketergantungan dalam regulasi yg rumit yg merawat habitat bersama





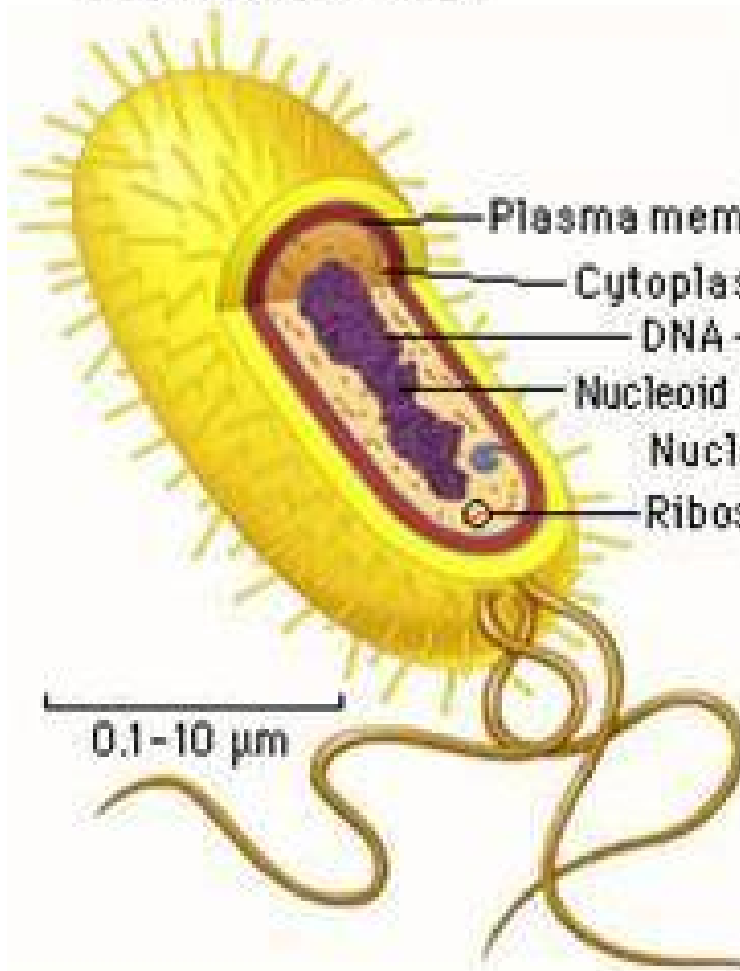
Keanekaragaman  
an mahluk  
hidup yang tak  
terhitung

Berkah yang  
melekat dan  
menentukan  
nasib manusia

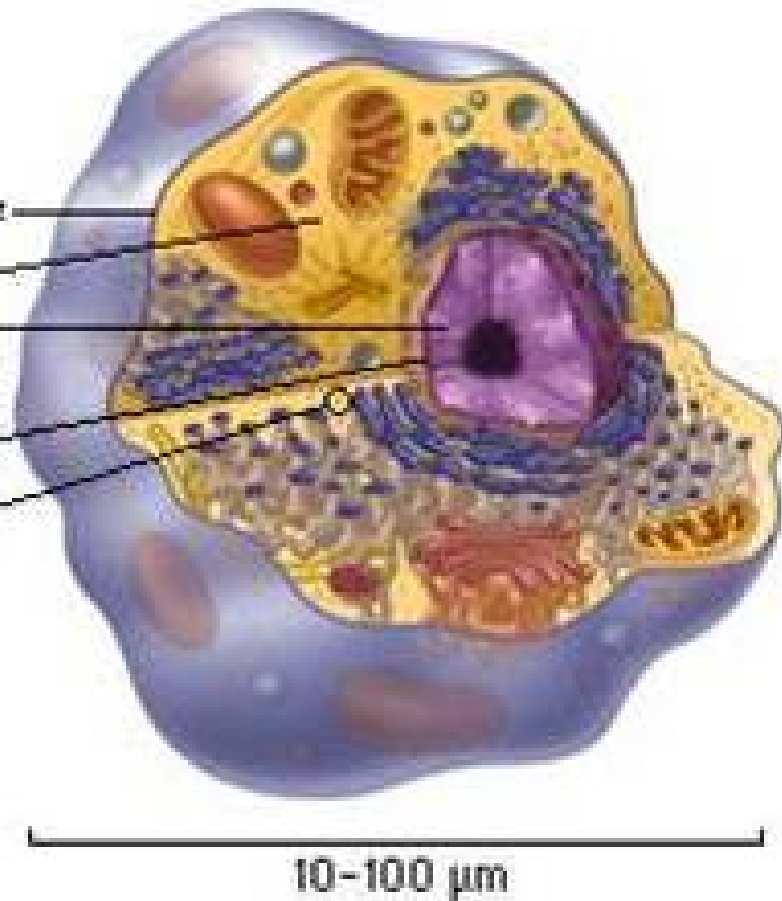
Tanpa  
mereka, manusia  
tidak ada

# SEL: blok bangunan dasar dari semua makhluk hidup

Prokaryotic cell



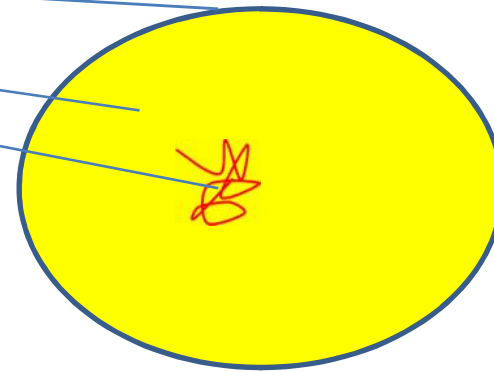
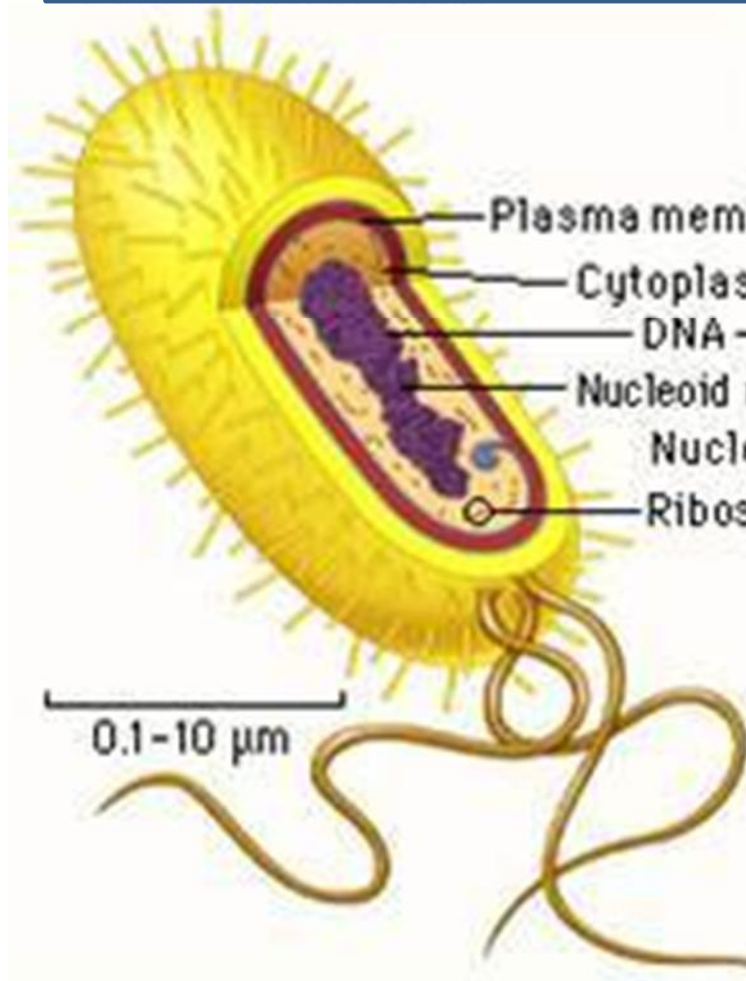
Eukaryotic cell



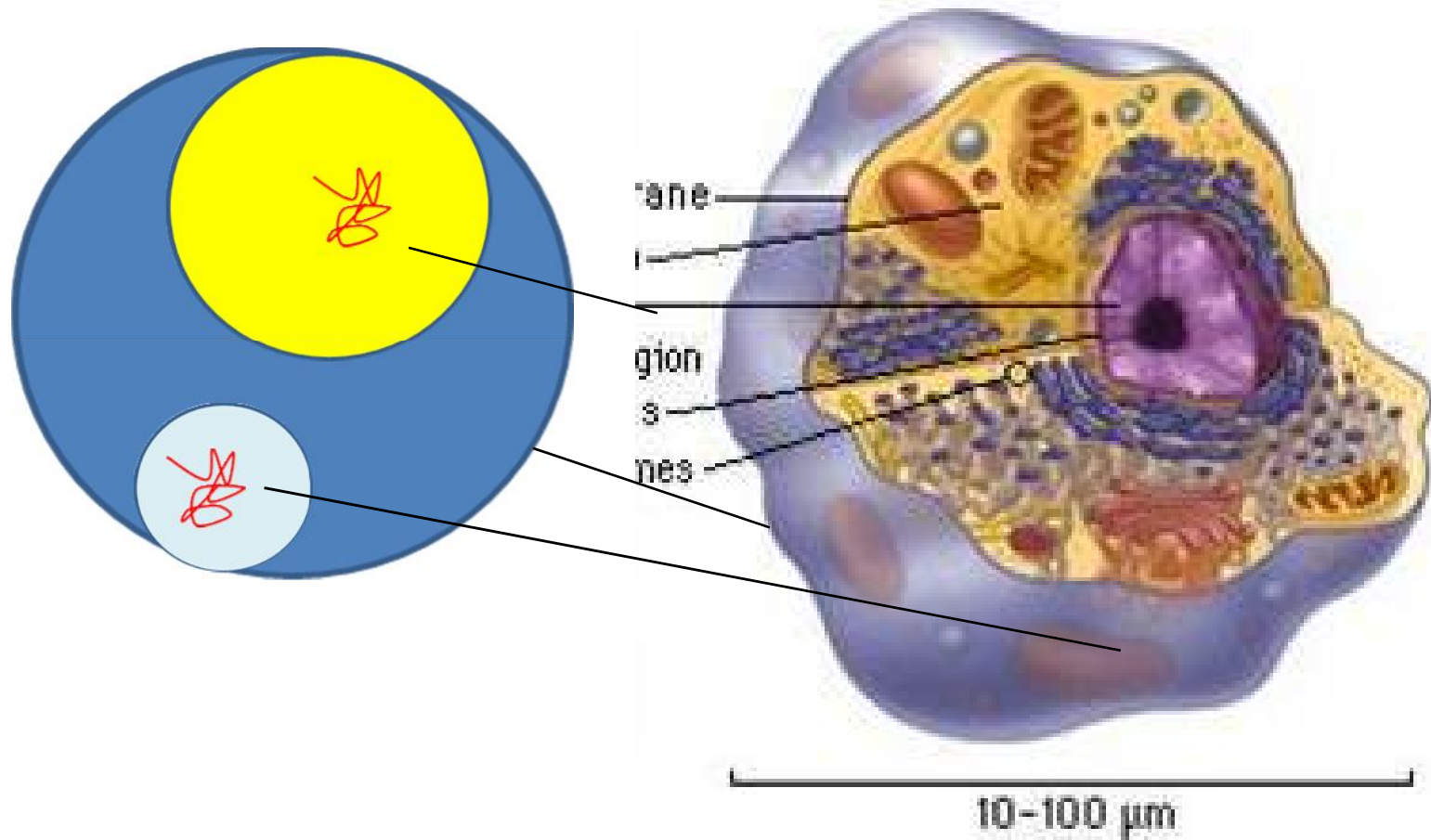
- Plasma membrane
- Cytoplasm
- DNA
- Nucleoid region
- Nucleus
- Ribosomes



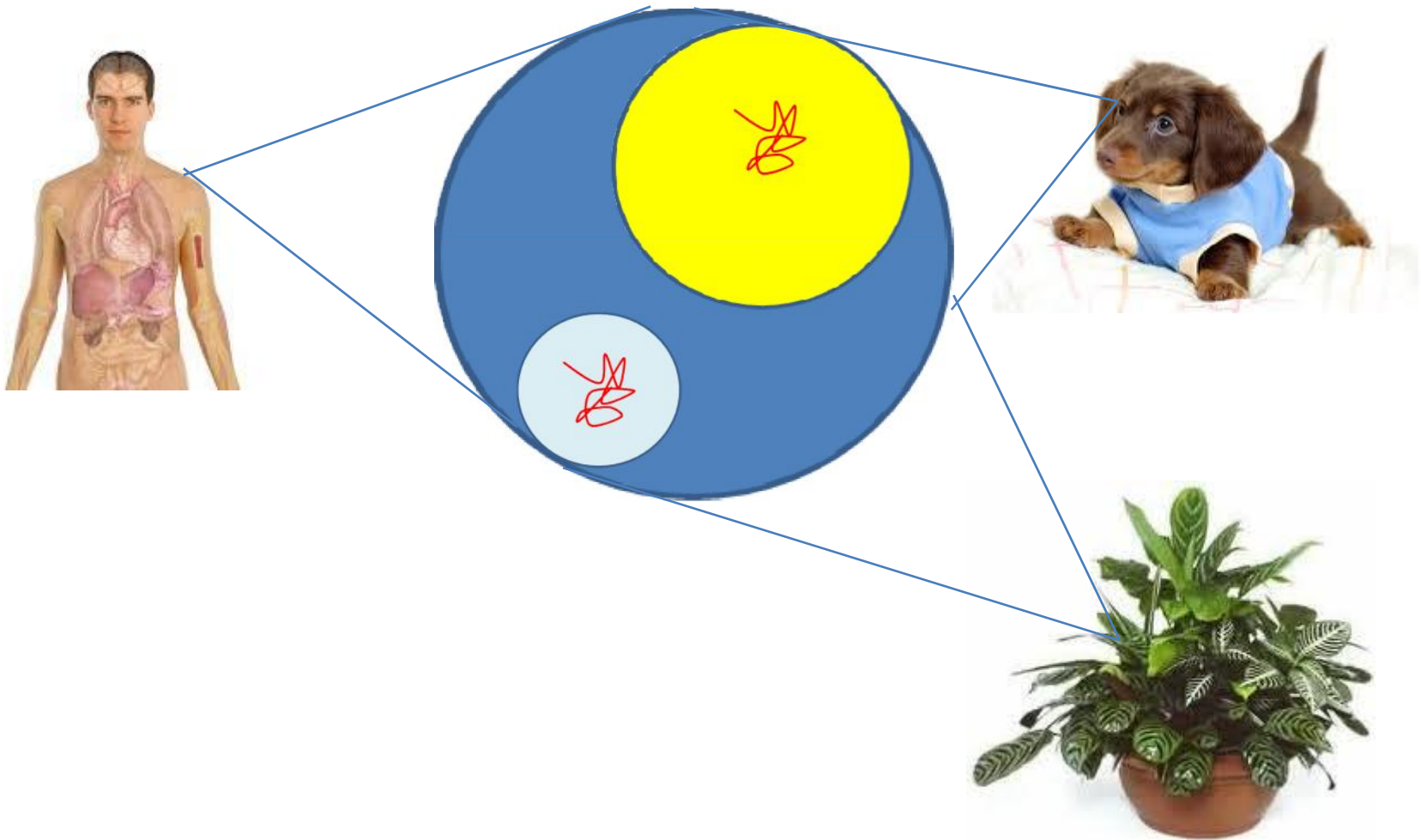
# Sel Prokariot : sederhana (bakteri, cyanobacteria)

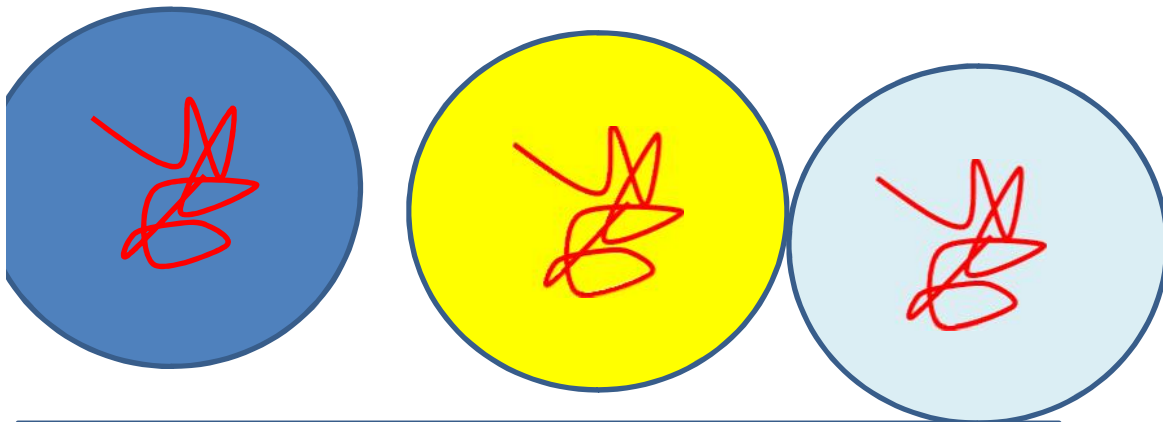


# Sel Eukariot : kompleks, gabungan dr sel prokariot (tumbuhan, hewan, manusia)

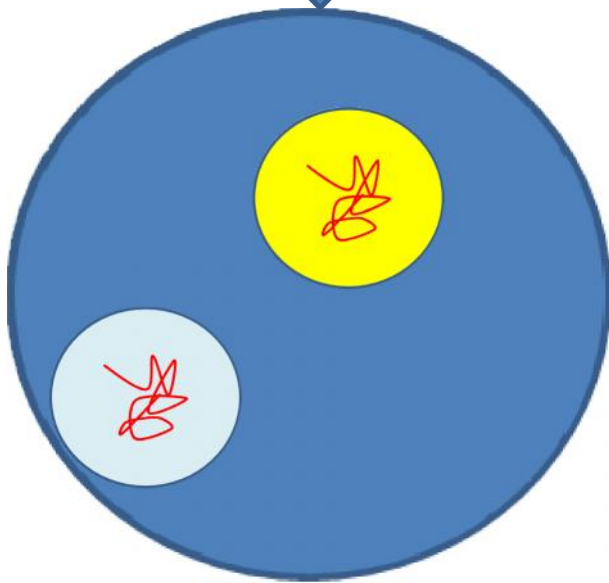


# Sel Euokariot : kompleks, gabungan dari sel prokariot (tumbuhan, hewan, manusia)





3 sel **prokariot**  
bakteri



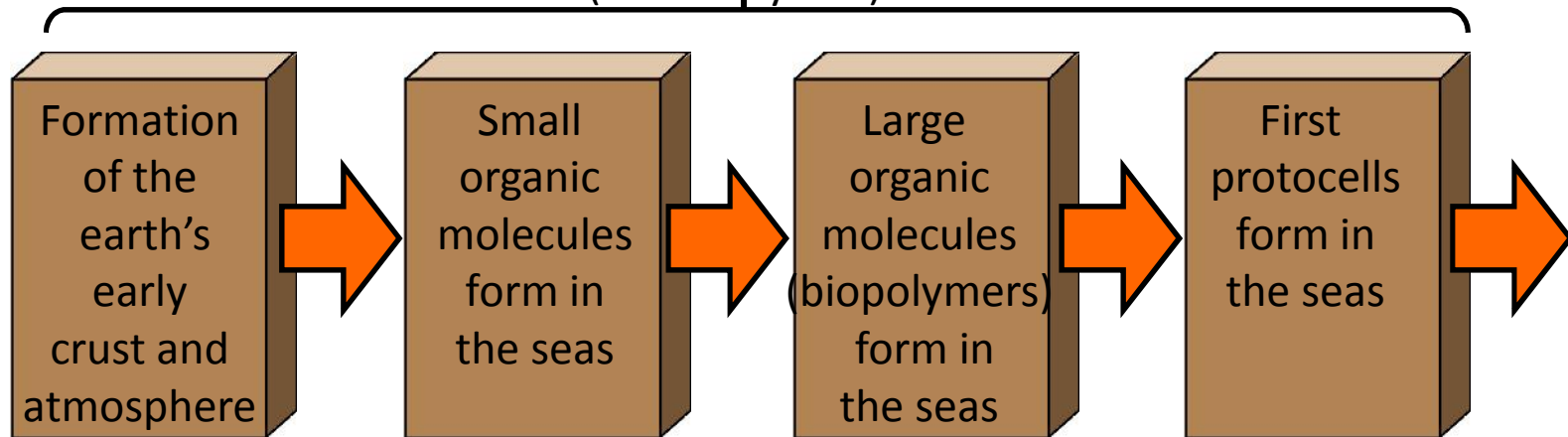
bergabung  
menjadi 1 sel  
**eukariot**

Tumbuhan hewan manusia

# Summary of Evolution of Life

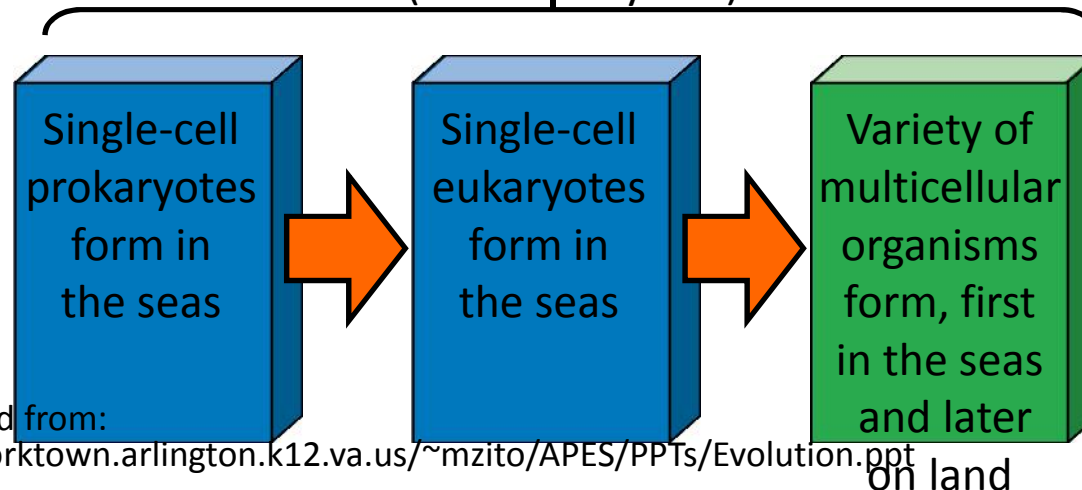
## Chemical Evolution

(1 billion years)

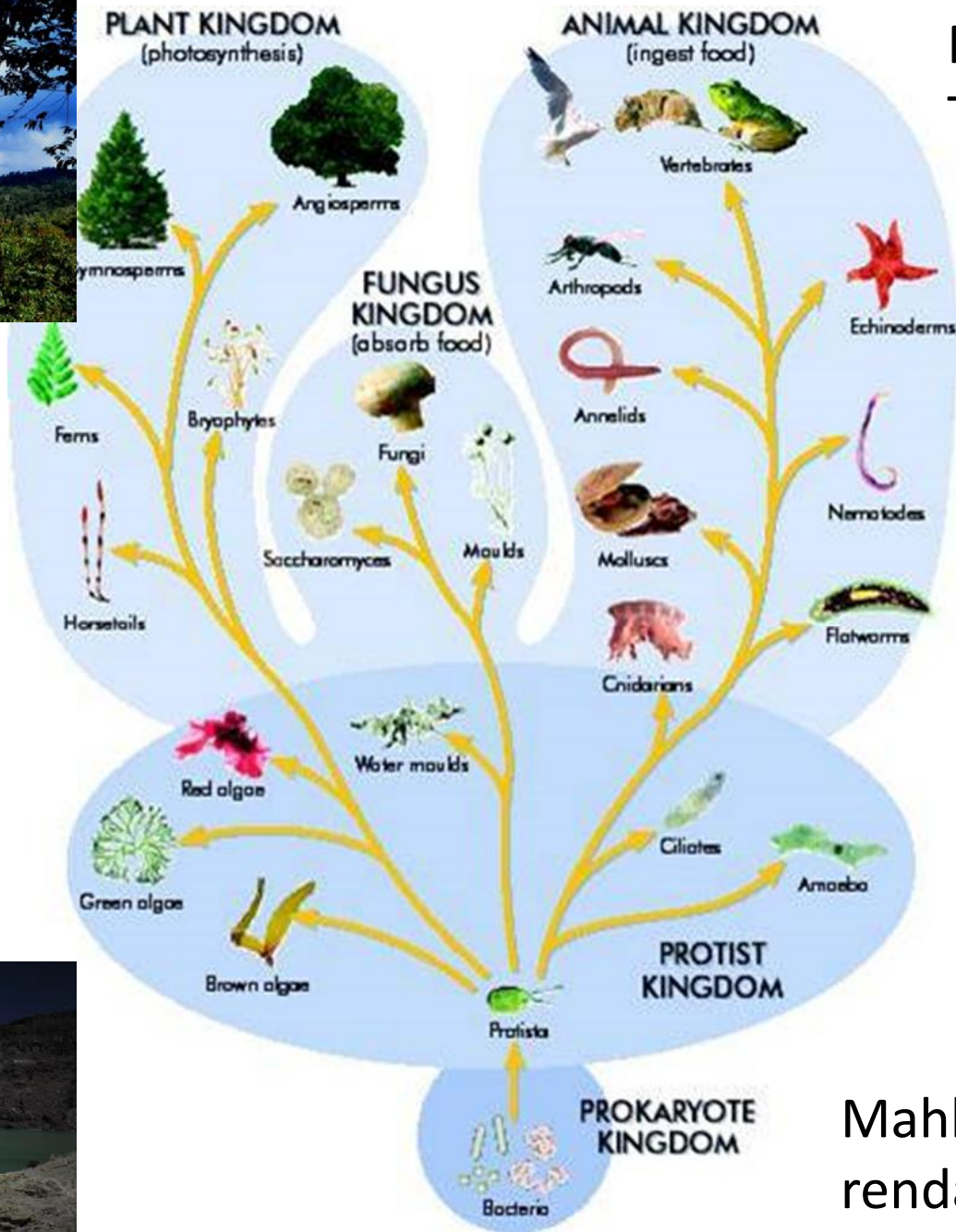


## Biological Evolution

(3.7 billion years)



- Miller Chapter 5
- Powerpoint Adapted from:  
<http://yhspatriot.yorktown.arlington.k12.va.us/~mzito/APES/PPTs/Evolution.ppt>

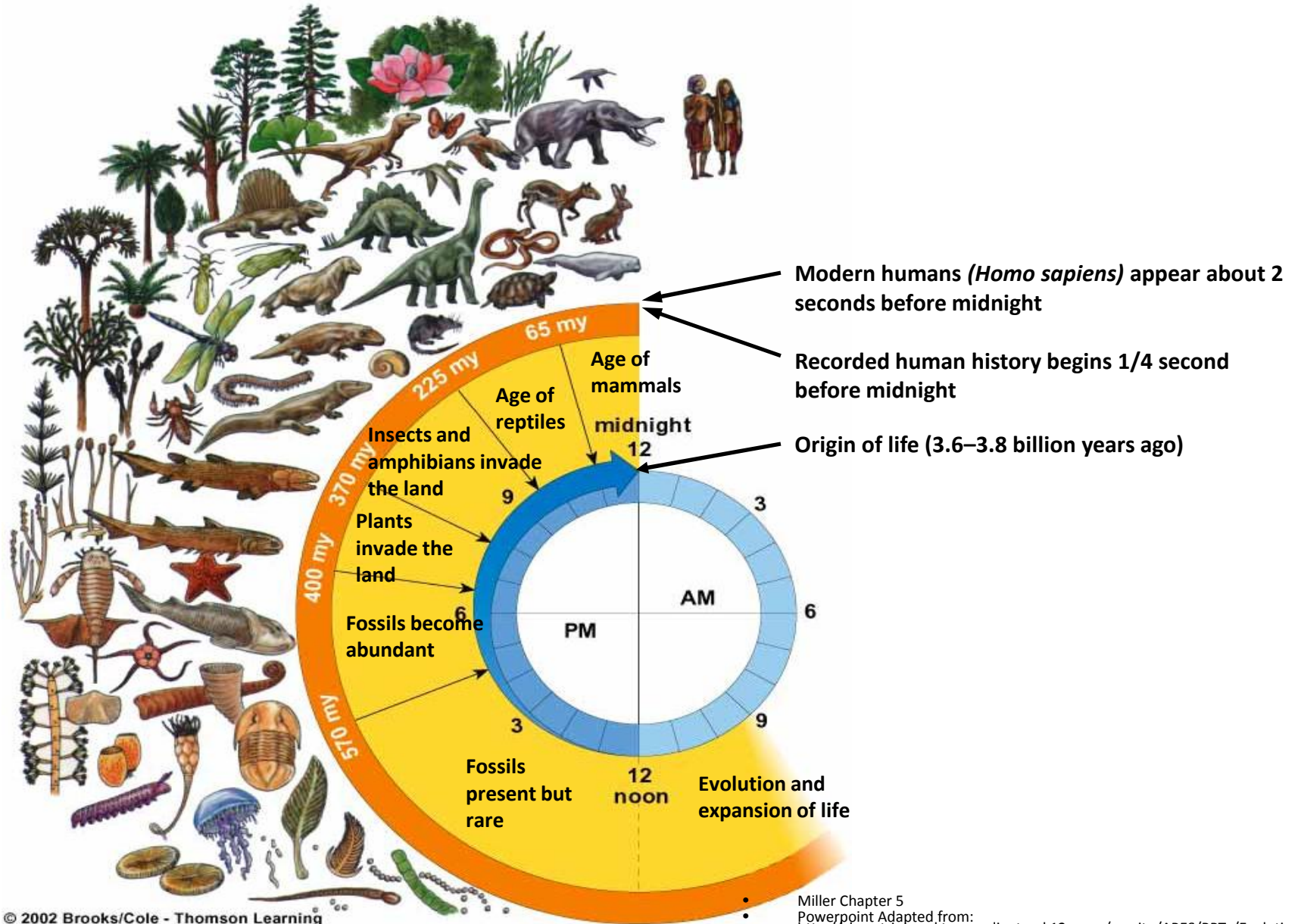


Mahluk tingkat Tinggi



Mahluk tingkat rendah

# Biological Evolution



Modern humans (*Homo sapiens*) appear about 2 seconds before midnight

Recorded human history begins 1/4 second before midnight

Origin of life (3.6–3.8 billion years ago)

Age of mammals  
midnight  
12

Insects and amphibians invade the land  
9

Plants invade the land  
6

Fossils become abundant  
3

Fossils present but rare  
12 noon

Evolution and expansion of life

PM

AM

65 my

225 my

370 my

400 my

570 my

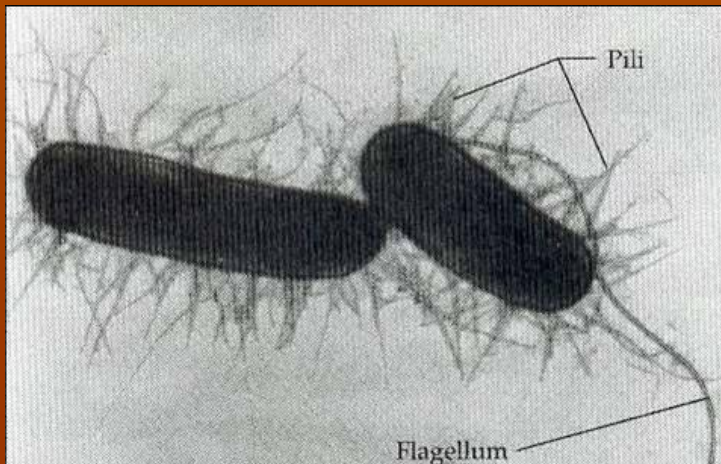
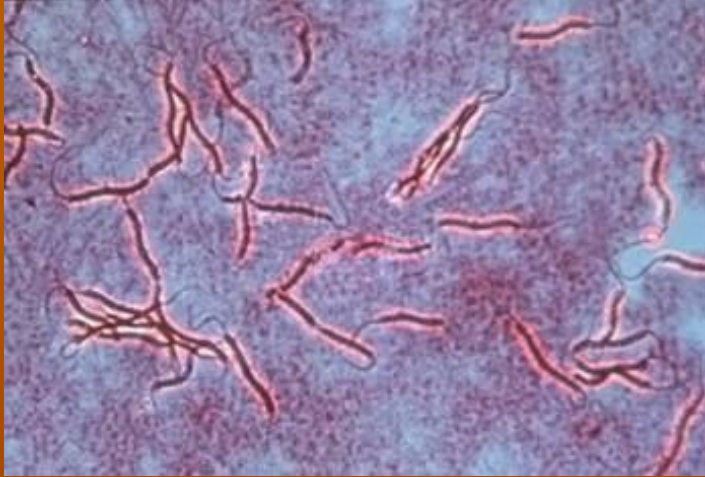
# Monera (Prokaryotae)

- Bacteria were the first organisms on earth.
- They are by far the most numerous organism on the planet.





# Monera



# Protista (Protoctista)

- Contains a wide variety of organisms from large plant-like algae seaweeds to single-celled organisms such as *Amoeba*.
- Protists are found almost anywhere water is present.



# Protista – main features

- Contains single celled (Amoeba) and simple multicellular organisms (Algae)
- They have a membrane-enclosed nucleus
- Some feed by taking in organic substances (they absorb nutrients through the cell wall)
- Others can produce their own food by photosynthesis

# Protista



# Fungi

- Examples of fungi include mushrooms, mildews, moulds and yeasts.
- Fungi play a vital role in that they break down dead organisms and allow minerals to be recycled.



# Plants

- This kingdom includes the mosses, ferns and seed-producing plants.
- Seed producing plants can be further subdivided into flowering and non-flowering.



# The Plant Kingdom

Mosses and  
liverworts



No proper roots or stems  
Thin leaves that lose water  
Reproduce by spores

Ferns



Strong stem, roots, leaves  
Reproduces by spores

Gymnosperms  
(Conifers)



Strong stems and roots  
Needle-like leaves  
Seeds made inside cones

Angiosperms  
(Flowering plants)



Strong stem, roots, leaves  
Flowers, that make seeds

# Animals

- This kingdom includes jellyfish, flatworms, snails, roundworms, segmented worms, frogs, lizards, birds and humans.
- The first animals evolved in the sea about 700 million years ago.





# Animals – main features

- All organisms in this Kingdom are multicellular
- They are eukaryotic - have a nucleus and membrane enclosed organelles
- Animal cells have no cell walls
- All animals are heterotrophic – they cannot produce their own food
- They normally reproduce sexually.

# The Animal Kingdom

**INVERTEBRATES**  
(No backbone)

**VERTEBRATES**  
(backbone)



Fish, e.g. cod  
Amphibians, e.g. frog  
Reptiles, e.g. lizard  
Birds, e.g. blackbird  
Mammals, e.g. squirrel

Body not divided into segments

Body divided into segments

Echinoderms



Hard covering with spines

Sea cucumbers  
Sea urchins  
Starfish

Coelenterates



Hollow body with stinging cells

Corals  
Sea anemones  
Hydras  
Jellyfish

Flatworms



Flat body

Flukes  
Tapeworms

Molluscs



Soft body, usually with shell

Octopus  
Oyster  
Snail

Arthropods

Jointed limbs



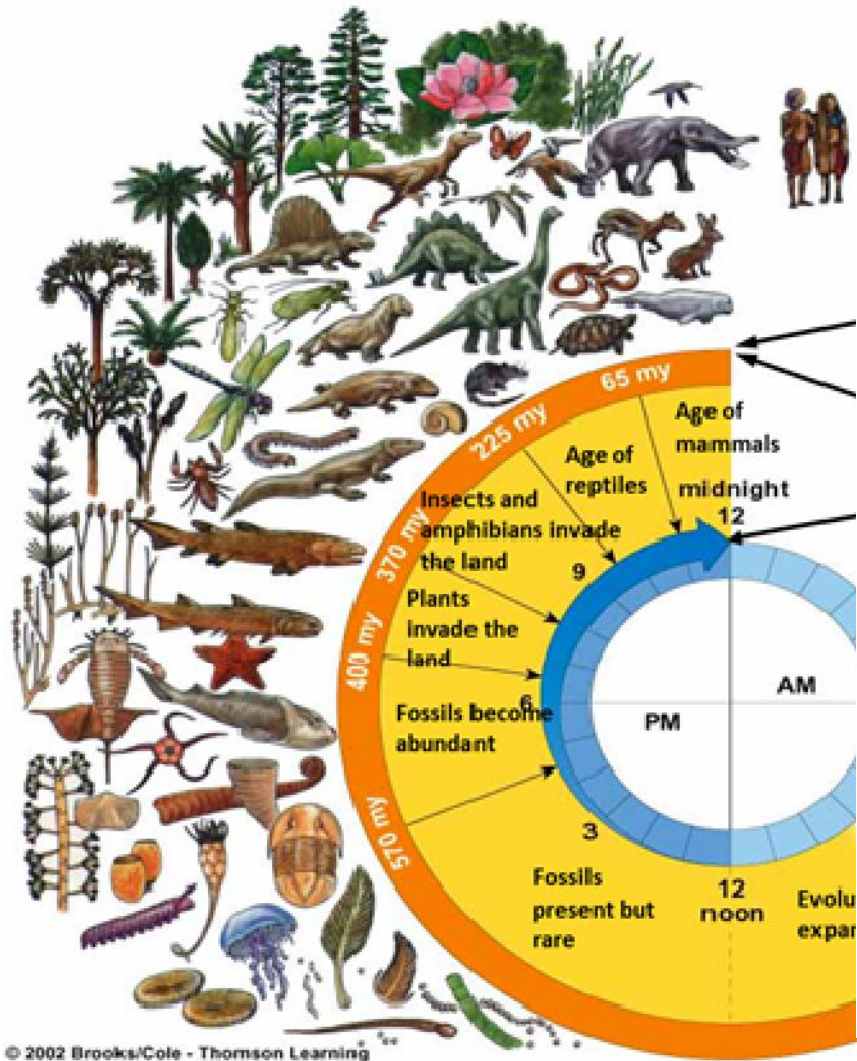
Crustaceans, e.g. crab  
Centipedes  
Millipedes  
Insects, e.g. locust  
Arachnids, e.g. spider

Segmented worms

Obvious segments



Marine worms  
Leeches  
Earthworms

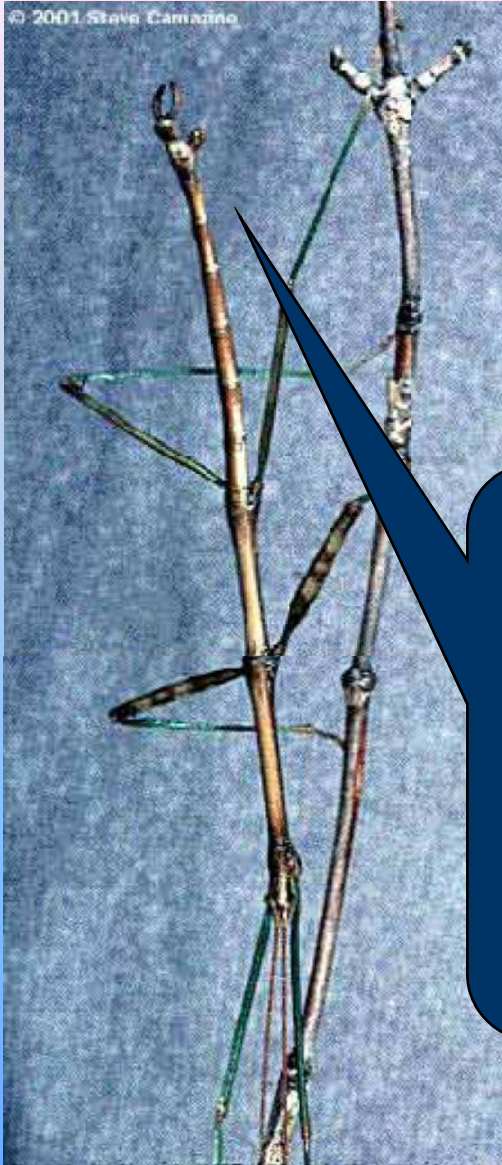


Dari Keanekaragaman mahluk hidup ini, terkandung beberapa karakter prinsip yang universal

## Karakter universal keanekaragaman hayati



1. Memiliki satu kemiripan umum (serupa tapi tak sama)
2. Interaksi (asosiasi berbagai makhluk menjadi satu, interdependensi, interkoneksi)
3. Adaptasi
4. Regulasi (proses benar dan baik untuk manusia)
5. Berpasang-pasangan di segala level



- **Physical adaptations** are body structures that allow an animal to find and consume food, defend itself, and to reproduce its species.

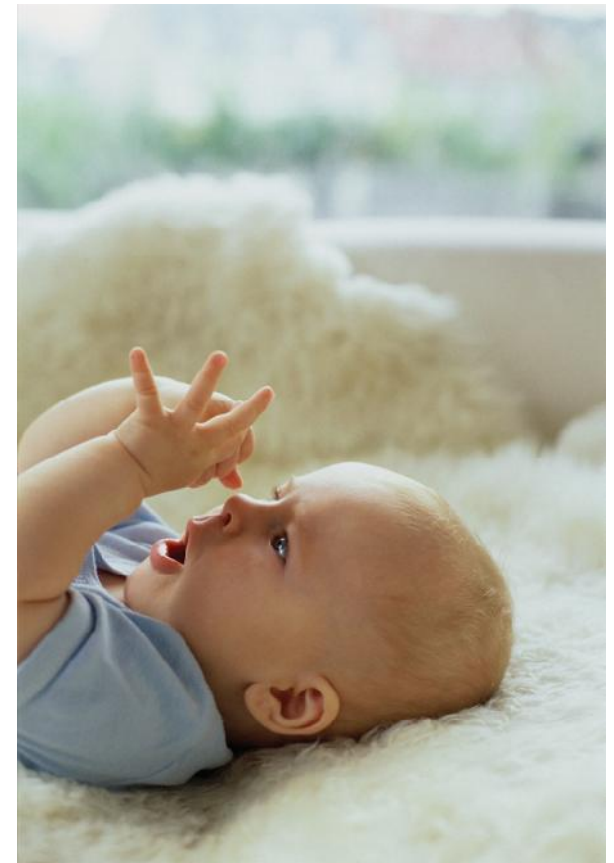
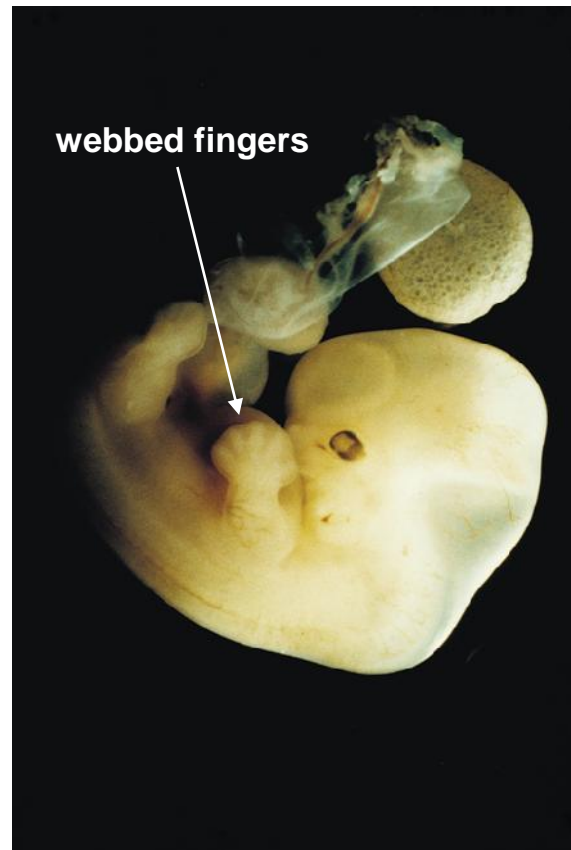
- **Physical adaptations** help an animal survive in its environment.

Behavioral Adaptations allow animals to respond to life needs.



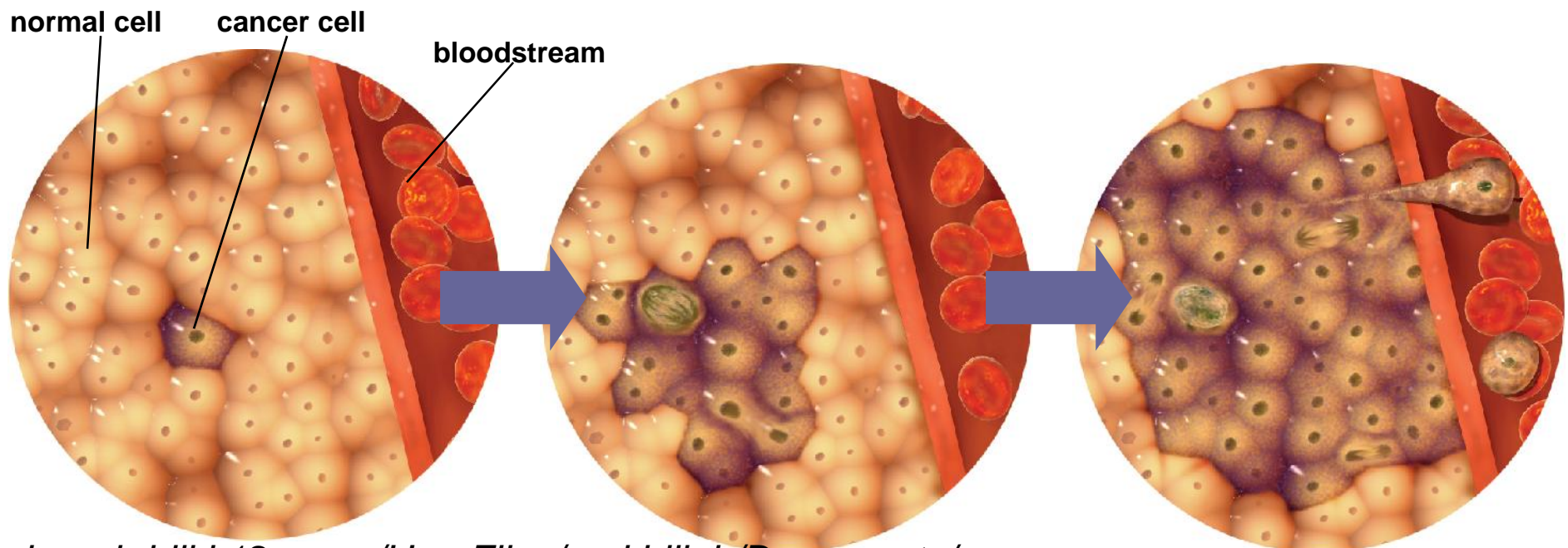
# Contoh regulasi pada proses siklus sel

- Apoptosis adalah kematian sel yang terprogram
  - Kejadian normal pada makhluk hidup
  - Disebabkan oleh enzim bunuh diri yang diproduksi sel
  - Terjadi pada proses perkembangan janin bayi



## 5.3 Regulation of the Cell Cycle

- ▶ **Pembelahan sel yg tidak terkendali pada cancer.**
  - Cancer cells form disorganized clumps called tumors.
    - Benign tumors remain clustered and can be removed.
    - Malignant tumors metastasize, or break away, and can form more tumors.





(cuplikan *Timeline*)  
Sejarah pembentukan planet

Bumi kering tanpa air dan kehidupan

Bumi “dikirimi” air melalui tabrakan dgn komet es (air)

(Earth and Planetary Science Letters 313–314 (2012) 56–66)

Terbentuk mahluk hidup sederhana dalam air tanpa O<sub>2</sub>

Terbentuk cyanobacteria  
penghasil  $O_2$

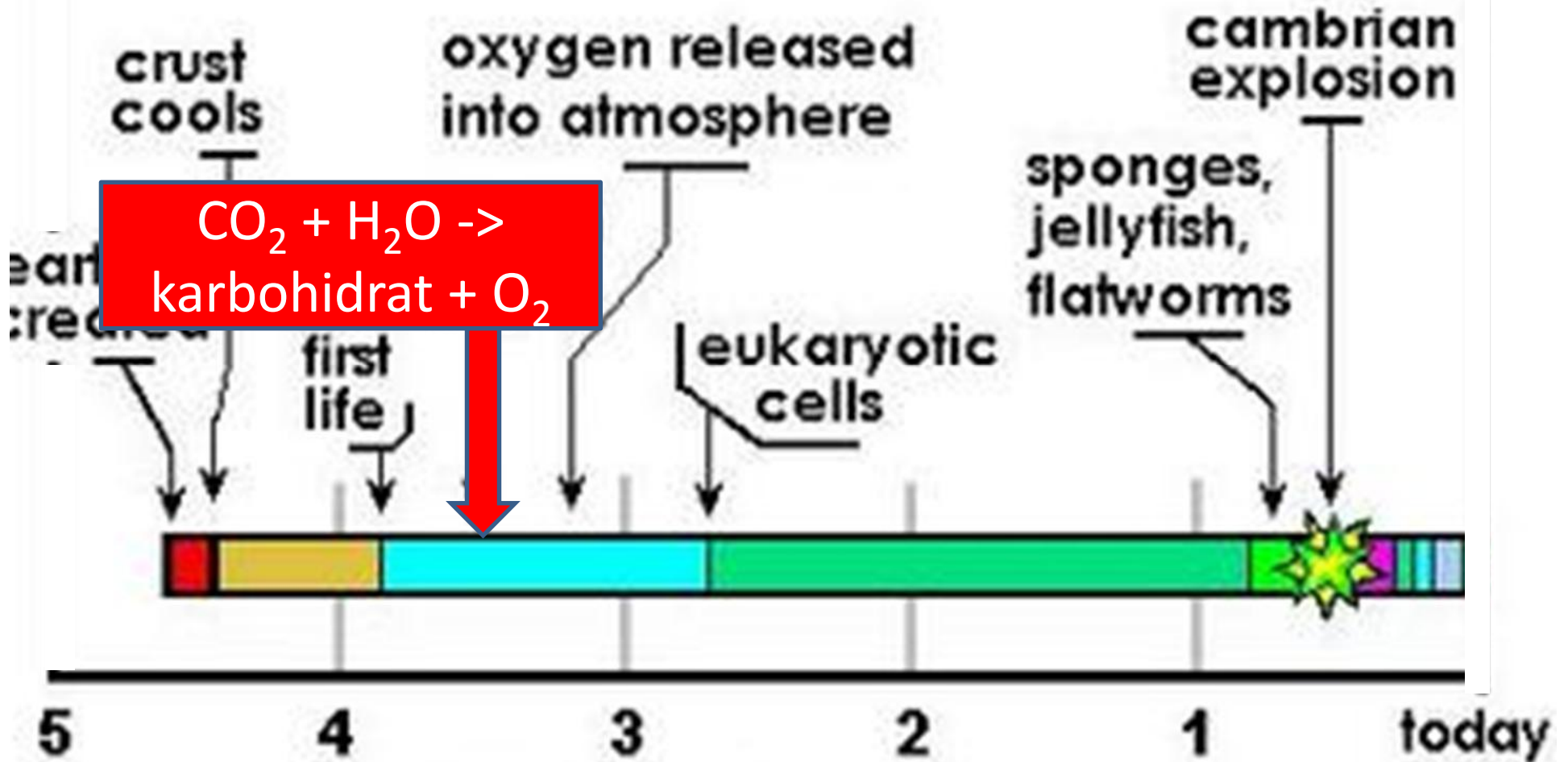
Bencana  
oksigen( $O_2$ )

Terbentuk tumbuhan  
penghasil  $O_2$  penyerap  $CO_2$

$O_2$  terakumulasi di atmosfer  
jadi ozone

Muncul makhluk hidup dari air  
ke darat

# “Timeline” pembentukan planet bumi

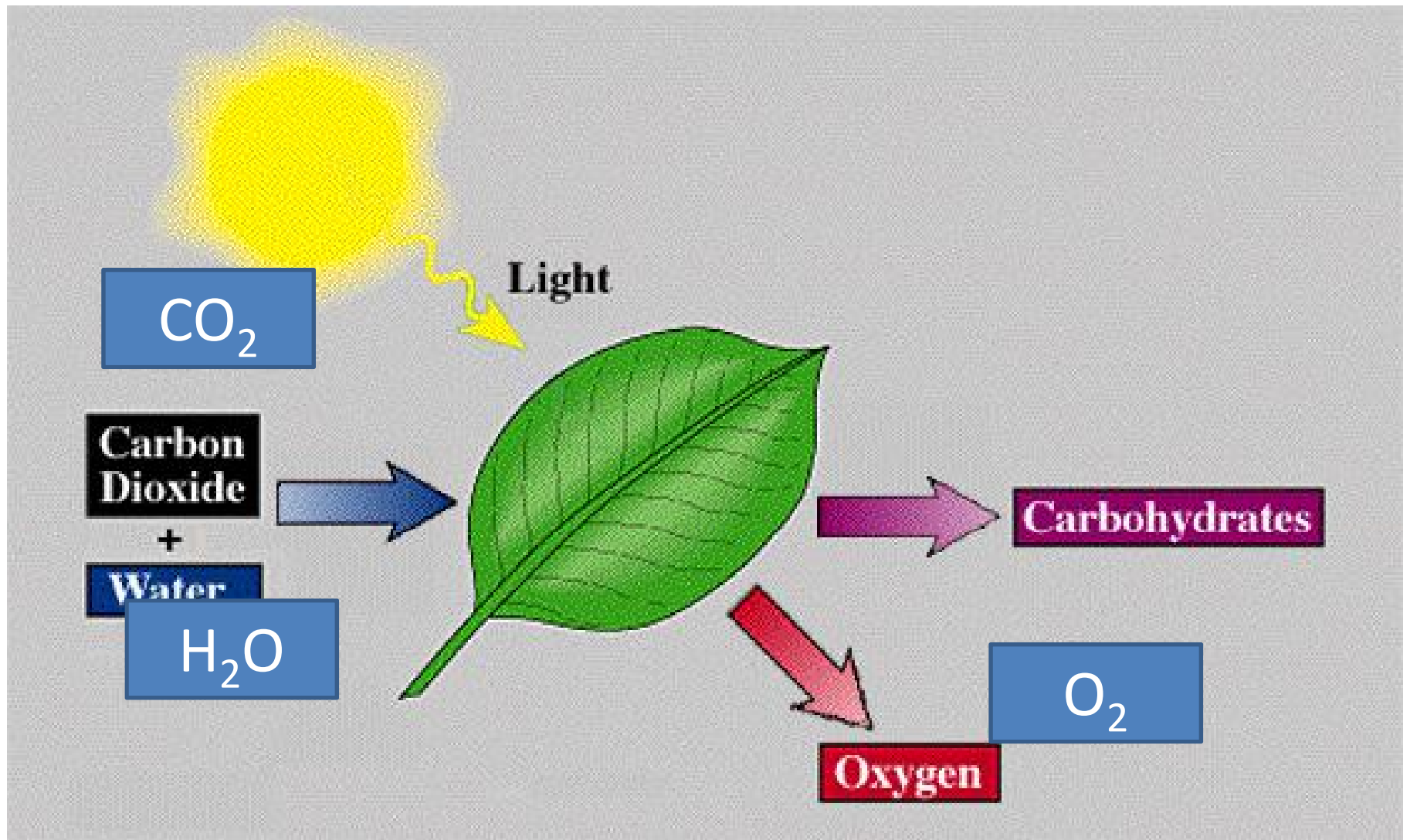


Waktu (milyar tahun yang lalu)



Mahluk tingkat tinggi (aerob>)

Mahluk tingkat rendah (anaerob>)



Fotosintesis : karbon dioksida dan air menjadi karbohidrat dan oksigen

$O_3$ (ozone)

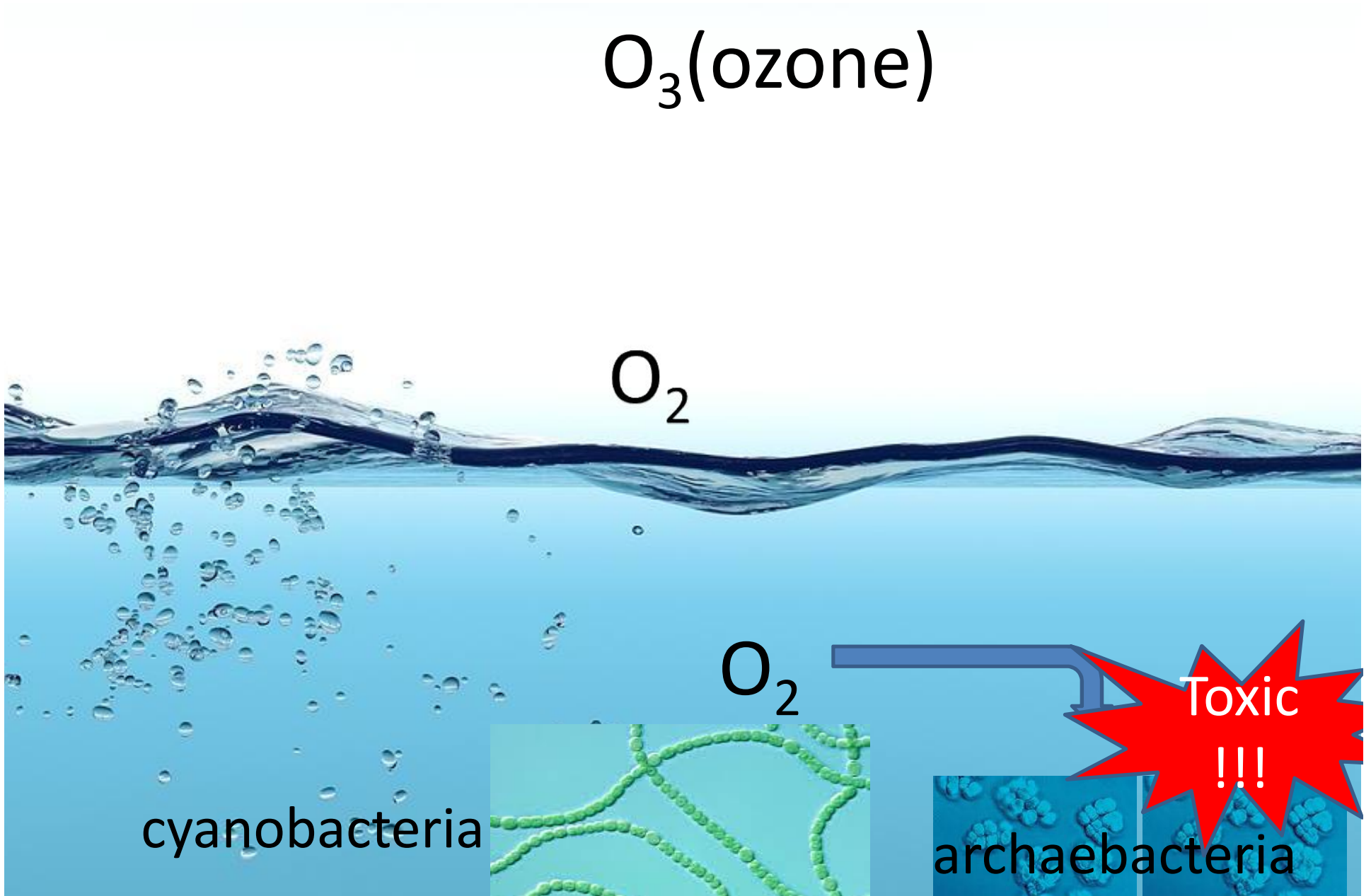
$O_2$

$O_2$

Toxic  
!!!

cyanobacteria

archaebacteria



# Apakah hubungan antara Fotosintesis – bahan bakar fosil – global warming



Manusia membongkar tumpukan  $\text{CO}_2$  yg tersimpan berkat fotosintesis (pembakaran Bahan Bakar Fosil -bensin, gas, -batubara)

sehingga mengakibatkan “rumah kaca”

Manusia melubangi lapisan ozone ( $\text{O}_3$ ), yg bahan penyusunnya ( $\text{O}_2$ ) dihasilkan dari fotosintesis sehingga bumi kurang terlindungi dari sengatan UV matahari

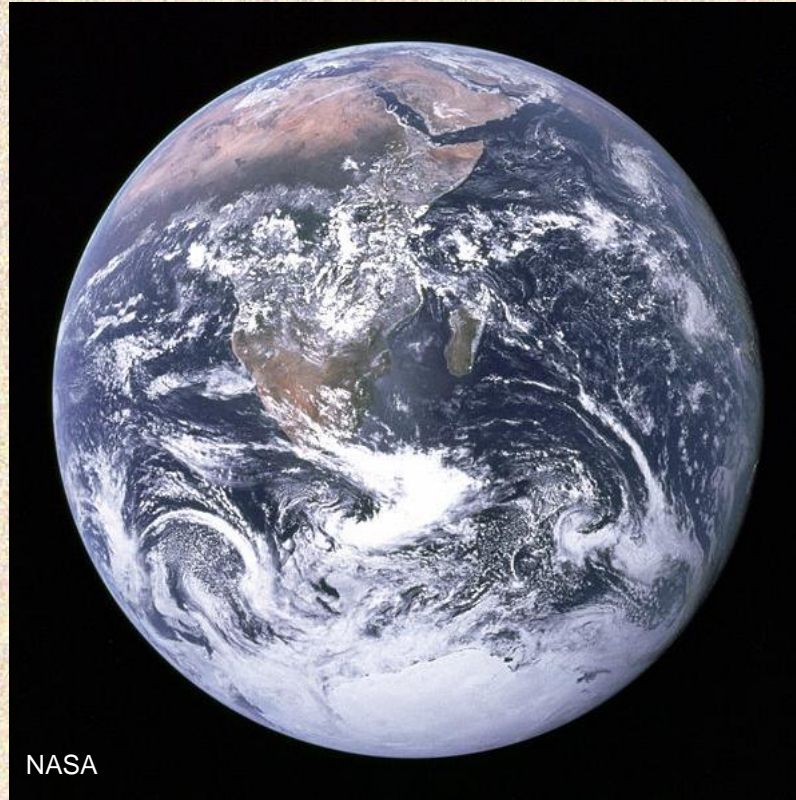
Bagaimana hal tersebut terjadi ?







# Minyak dan Gas



NASA



[http://en.wikipedia.org/wiki/Image:Moscow\\_traffic\\_congestion.JPG](http://en.wikipedia.org/wiki/Image:Moscow_traffic_congestion.JPG)  
[en.wikipedia.org/wiki/Image:Ceratium\\_hirundinella.jpg](http://en.wikipedia.org/wiki/Image:Ceratium_hirundinella.jpg)

[http://upload.wikimedia.org/wikipedia/commons/c/ce/Oil\\_well.jpg](http://upload.wikimedia.org/wikipedia/commons/c/ce/Oil_well.jpg)  
[en.wikipedia.org/wiki/Image:Oil\\_platform.jpg](http://en.wikipedia.org/wiki/Image:Oil_platform.jpg)

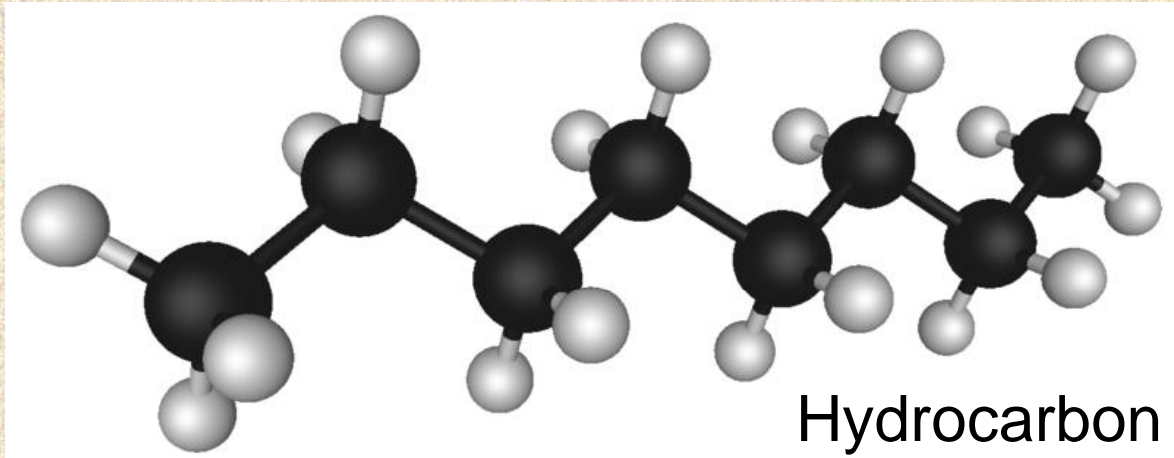
# Origin (1): Kimia

[en.wikipedia.org/wiki/Image:Petroleum.JPG](http://en.wikipedia.org/wiki/Image:Petroleum.JPG)



Crude Oil

[en.wikipedia.org/wiki/Image:Octane\\_molecule\\_3D\\_model.png](http://en.wikipedia.org/wiki/Image:Octane_molecule_3D_model.png)

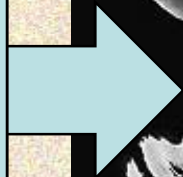


- minyak dan gas terbuat dari campuran **hydrocarbons**.
- molekul **hydrogen** terikat pada atom **carbon**.

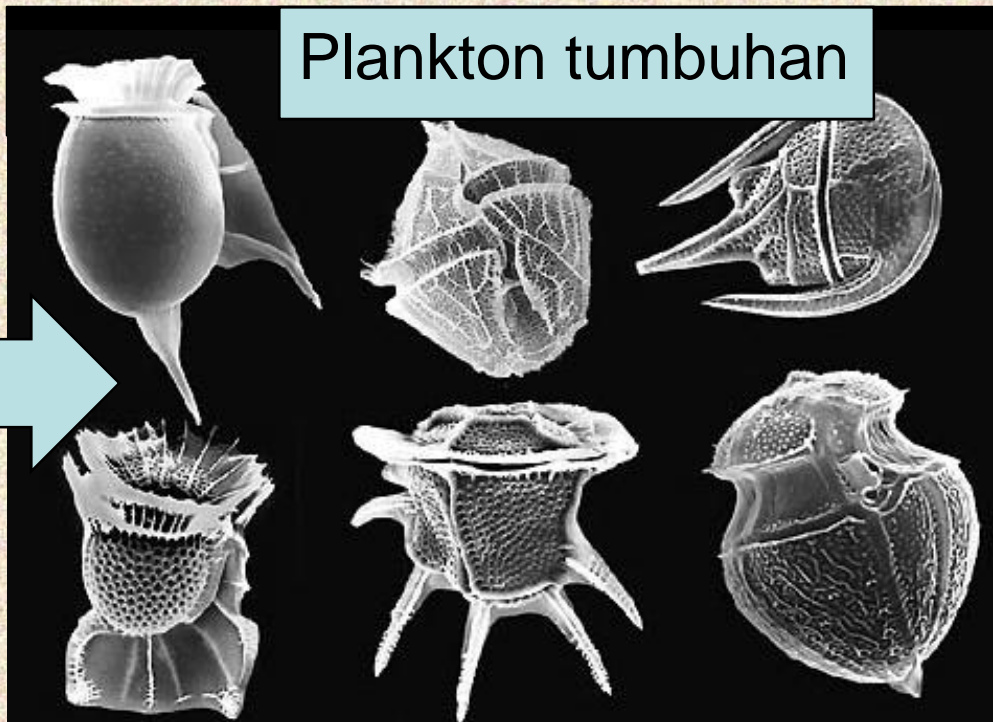
# Origin (2): Plankton

cache.eb.com/eb/image?id=93510

10,000 macam mahluk  
ini = bahan bakar!

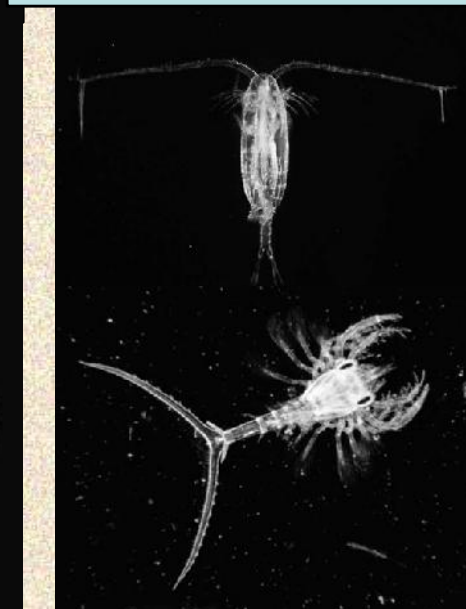


Plankton tumbuhan



en.wikipedia.org/wiki/Image:Ceratium\_hirundinella.jpg

Plankton hewan



en.wikipedia.org/wiki/Image:Copepod.

- minyak dan gas berasal dari **tumbuhan dan hewan mikroskopik** yang hidup di lautan

# Origin (3): peledakan populasi

[serc.carleton.edu/images/microbelife/topics/red\\_tide\\_genera.v3.jpg](http://serc.carleton.edu/images/microbelife/topics/red_tide_genera.v3.jpg)



© Miriam Godfrey



Dinoflagellate bloom

- sekarang, plankton masih dapat dilihat di permukaan laut
- Blooms of certain plankton called **dinoflagellates** may give the water a red tinge

# Origin (4): di dasar laut

[upload.wikimedia.org/wikipedia/en/0/04/Plankton.jpg](http://upload.wikimedia.org/wikipedia/en/0/04/Plankton.jpg)



Ketika **plankton mati**, jasadnya rontok ke dasar lautan membentuk massa organik

[en.wikipedia.org/wiki/Image:Nerr0328.jpg](http://en.wikipedia.org/wiki/Image:Nerr0328.jpg)

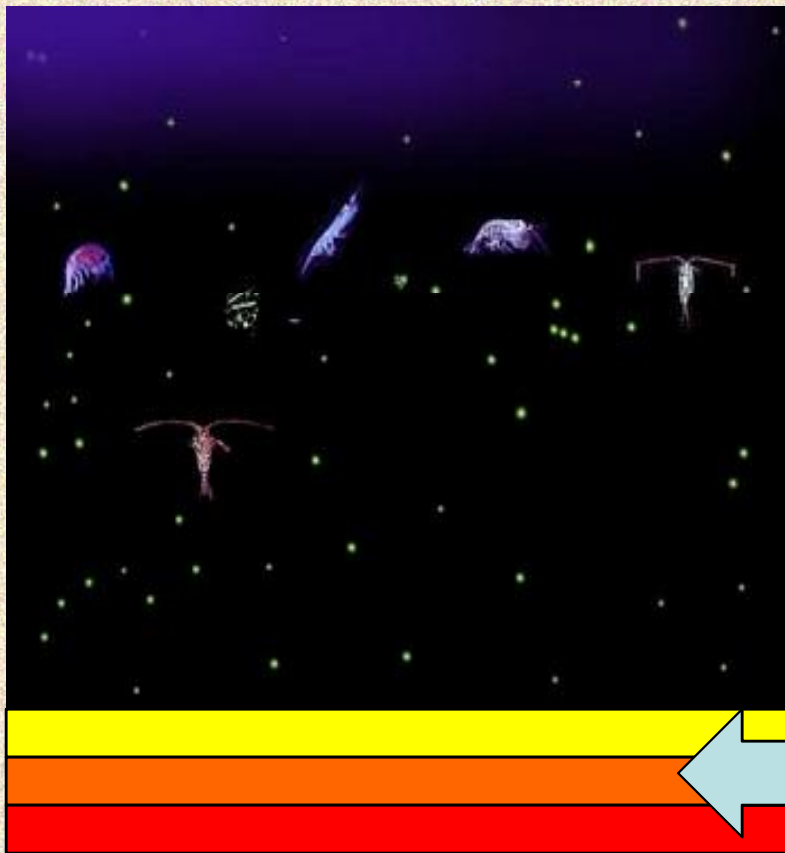


Dasar laut

Hewan memakan plankton dan mati, rontok ke dasar laut

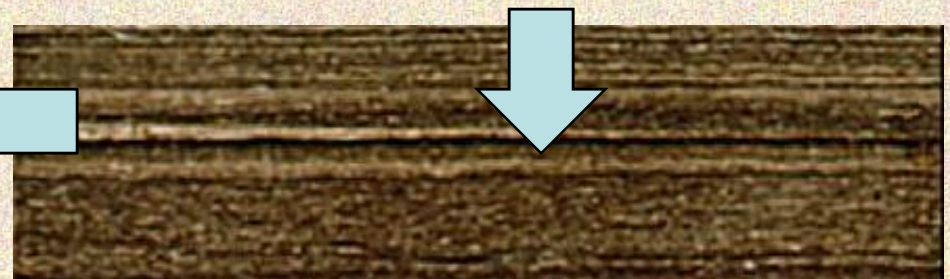
# Origin (5): lempeng

upload.wikimedia.org/wikipedia/en/0/04/Plankton.jpg



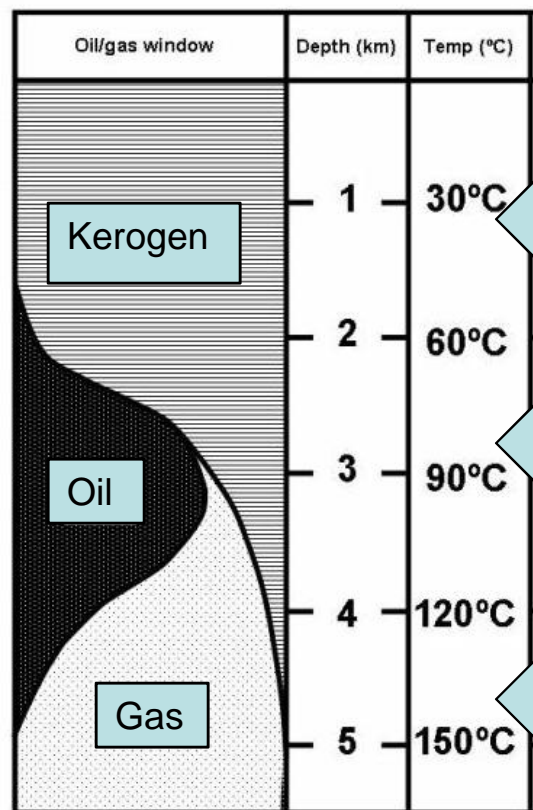
- akumulasi bahan organik mati pada dasar laut

- sedimen mengandung bahan organik **Lempeng (black shale)**



# Origin (6): pematangan

Timbunan Black Shale **menimbulkan panas**



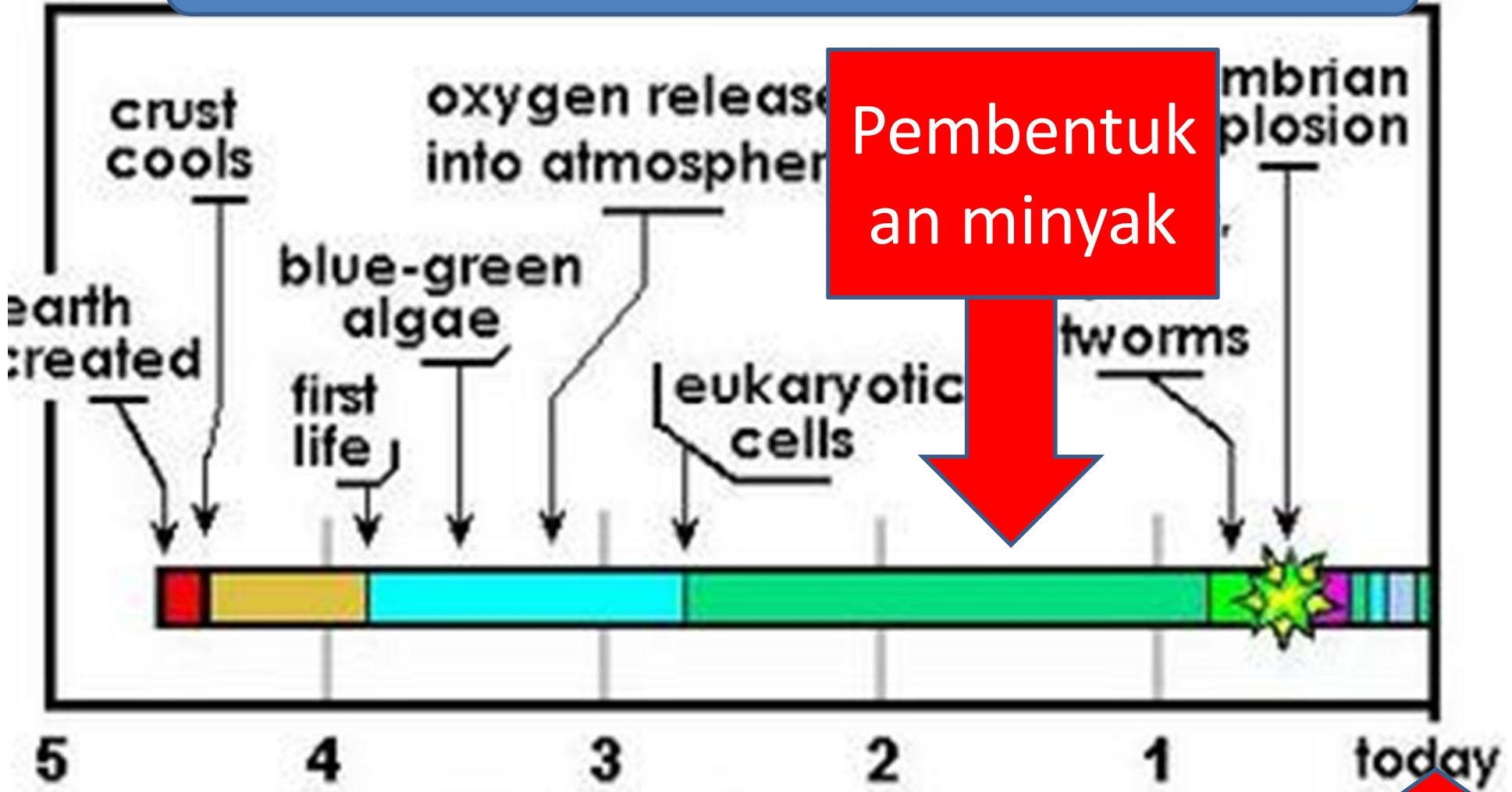
Bahan organik berubah jadi kerogen,  
**bentuk padat** dari hydrocarbon

90° C, berubah jadi **cair**  
yg kita sebut **minyak**

Sekitar 150° C, berubah jadi **gas**

[www.oilandgasgeology.com/oil\\_gas\\_window.jpg](http://www.oilandgasgeology.com/oil_gas_window.jpg)

# “Timeline” pembentukan planet bumi



Milyar tahun yang lalu

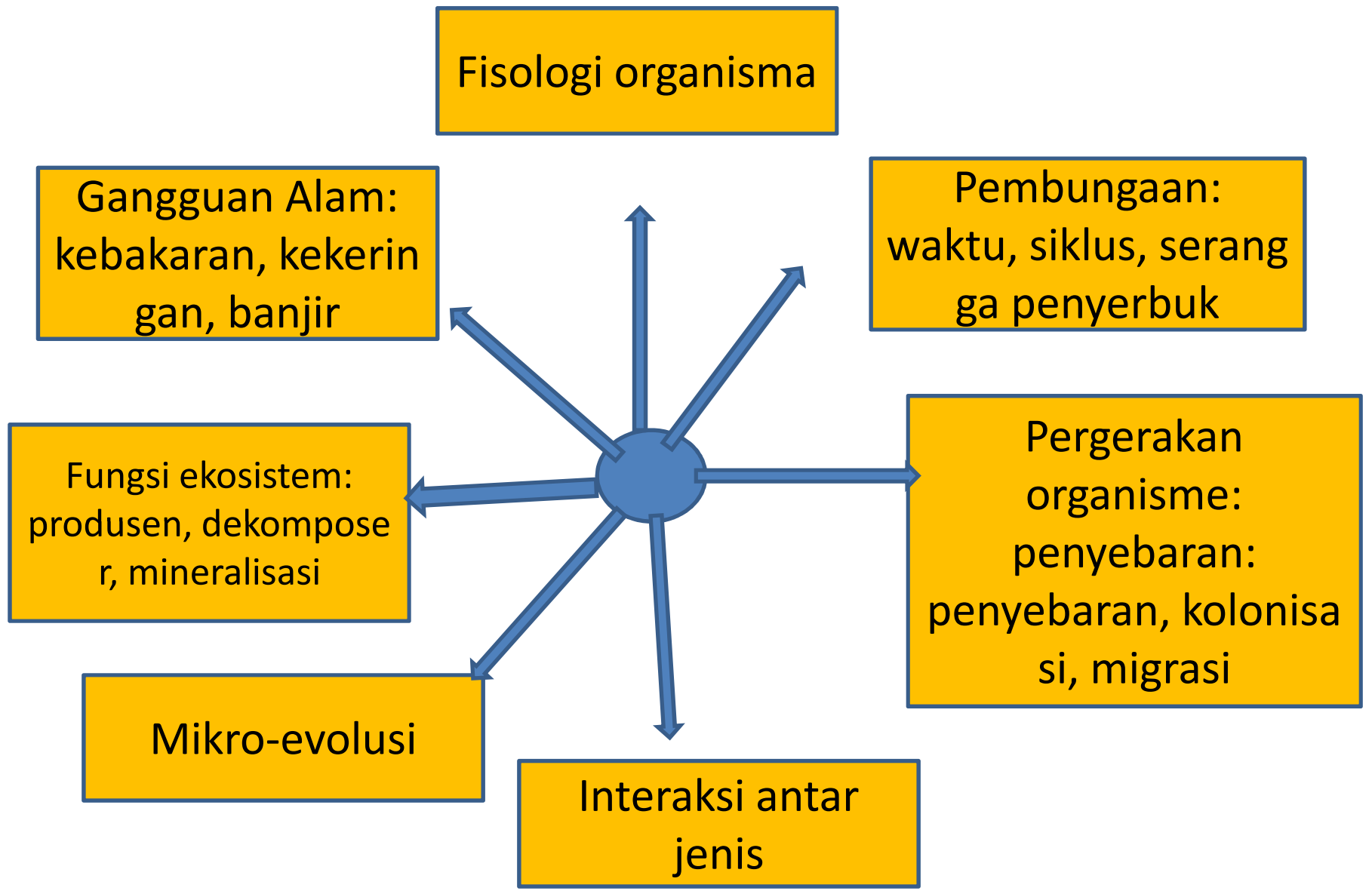
Minyak dibakar ->  
CO2



Ada apa dengan bumi yang sedang memanas ?



Ekosistem Raksasa pada bumi yang telah terkondisikan sesuai kebutuhan kehidupan yg dirintis oleh mikroba, tumbuhan, hewan, telah terganggu akibat aktivitas manusia....☹



Gangguan pada Biodiversitas

## Efek Perubahan Iklim terhadap ekosistem

- Merubah tempat hidup dan cara mahluk hidup berinteraksi
- Berdampak pada satu jenis dan merambat ke jenis lain melalui rantai makanan
- Pegunungan dan ekosistem arktik (kutub) sangat rentan
- Dapat mengakibatkan kepunahan jenis-jenis yang terdapat pada ekosistem yang rentan

# Efek Perubahan iklim terhadap Pertanian

- Kenaikan suhu dan penambahan karbon dioksida pada atmosfer dapat meningkatkan pertumbuhan tanaman
- Banjir atau kekeringan dapat mengakibatkan penurunan produksi
- Ternak dapat memiliki resiko yang buruk secara langsung akibat kenaikan suhu
- Secara tidak langsung, ternak dapat dipengaruhi oleh ketersediaan pakan yang cocok (kualitasnya bagus)
- Pada perikanan, kenaikan suhu akan merubah “species range”
- Air menjadi habitat yang lebih baik bagi jenis-jenis invasif
- Waktu siklus hidup ikan akan berubah

<http://www.epa.gov/climatechange/impacts-adaptation/>

# Efek Perubahan Iklim terhadap hutan

- Perubahan frekuensi dan intensitas gangguan hutan termasuk kebakaran, peledakan populasi serangga, keberadaan jenis invasif
- Perubahan produktivitas hutan
- Memperparah kerusakan hutan yang berasal dari pengemangan lahan dan polusi udara

# Take Home #1



- When faced with a change in environmental condition, a population of a species can get MAD:
  - MIGRATE to a more favorable location
  - ALREADY be adapted
  - DIE

- Miller Chapter 5
- Powerpoint Adapted from:  
<http://yhspatriot.yorktown.arlington.k12.va.us/~mzito/APES/PPTs/Evolution.ppt>

# “Ecological - Economic conflicts”



Aktivitas manusia:

- Kerusakan habitat
- Polusi
- Eksploitasi



KERUSAKAN EKOLOGI

KEUNTUNGAN EKONOMI

Kerusakan Biodiversity

Konversi:  
Modal ekologi ke  
Modal ekonomi

Ukuran nilai Etik dan estetika  
bukan \$

Pertumbuhan Ekonomi diukur  
dengan \$



how to compare?



Lalu, bagaimana kita bisa memperlambat terjadinya "global warming"



# Kampus University of California - Berkeley







# Pengembangan bioenergi



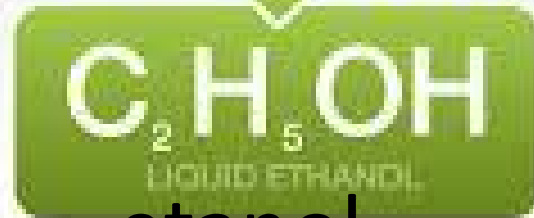
biodiesel



taiwan



# Bioetanol



etanol

## Kurangi konsumsi bahan bakar fosil

**Because greenhouse gas emissions are tied very closely to our energy consumption, using less fossil fuel based energy puts fewer greenhouse gases into the atmosphere.**

**This will help slow global warming.**

Mountaintop removal for coal mining near Rawl, West Virginia.

50% of electricity in the United States is produced from coal.



# Average Electricity Emission Factors

Region/State	CO2 lb/kWh	CO2 tons/MWh	CO2 Metric tons/MWh	CH4 lbs/MWh	NO2 lbs/MWh
South Atlantic	1.35	0.674	0.612	0.0127	0.0207
North Carolina	1.24	0.621	0.563	0.0105	0.0203
Virginia	1.16	0.582	0.528	0.0137	0.0192
<u>West Virginia</u>	1.98	0.998	0.897	0.0137	0.0316

# Kitchen Light Fixture



**Three 60 Watt Bulbs**



## We can make some simple substitutions

Replacing just 1 incandescent light bulb with 1 compact florescent bulb saves about **150 pounds of carbon dioxide per year!**



If every American household replaced just 5 high-use incandescent bulbs with compact florescent lights we'd collectively save more than \$8 billion each year in energy costs and we would prevent the greenhouse gases equivalent to the emissions from nearly 10 million cars.

Source: <http://www.energystar.gov>

# Small changes really add up



Replace your old refrigerator with a new Energy Star:  
Annual savings:  
\$90; 700 pounds CO<sub>2</sub>



Set your thermostat down a few degrees in the winter  
Annual savings:  
\$135; 1400 pounds CO<sub>2</sub>



Drive JUST 10 fewer miles per week  
Annual savings:  
\$80; 520 pounds CO<sub>2</sub>



Wash clothes in cold water only  
Annual savings:  
\$70; 500 pounds CO<sub>2</sub>



Reduce your garbage by 10% through greater recycling or reduced packaging  
Annual savings:  
1200 pounds CO<sub>2</sub>

# Blowing Up Your World

- 1. How many of you leave your bedroom light on when you are not in the room?
- *Turning off lights saves energy and money. The more energy used, the more rivers are dammed or more fossil fuel is burned, causing air pollution and increased levels of carbon dioxide in the atmosphere.*

# Blowing Up Your World

- How many of you walked, bicycled or took public transportation to get to school today, instead of coming by private automobile?

***Our reliance on cars that burn fossil fuels is one of the major causes of increased levels of carbon dioxide in the atmosphere and it is the primary cause of urban smog.***

# Blowing Up Your World

- How many of you, when you drink a soft drink, throw the container into the garbage?
- *Throwing away containers of any kind wastes energy and resources and adds to our waste problem. Many towns are running out of landfill space.*



# Blowing Up Your World

A vibrant assortment of fresh vegetables including bell peppers, tomatoes, corn, and broccoli. The vegetables are arranged in a pile, with a yellow bell pepper in the foreground and a corn cob in the background. The background is dark, making the colors of the vegetables stand out.

**How many of you eat fresh vegetables instead of canned or frozen?**

***Fresh vegetables cook more quickly and are usually more nutritious than frozen or canned foods. Canned and frozen vegetables are often over-processed, contain additives, contribute to air pollution (transport and packaging) and add to our waste problem.***

# Blowing Up Your World

- How many of you use a hairdryer or other energy-consuming convenience appliance, especially in the morning?
- *Hairdryers use a lot of energy. In the morning so much energy demand is put on our grids that power companies have to find other sources of energy just to meet the morning rush hour*

# Blowing Up Your World

- . How many of you, when you go to a store, get a bag for your purchases, even if you have only one or two small items to carry?
- *Making paper and plastic bags uses energy and resources. The bags add to our litter and waste problems, and plastic is not biodegradable. Recycling is not the best answer because collecting and recycling materials requires energy. Instead, carry a reusable cloth bag or a knapsack with you.*





# Blowing Up Your World

**How many of you carry your lunch to school in a lunch box or reusable container?**

***Making paper and plastic bags uses energy and resources.***

# Blowing Up Your World

- How many of you eat take-out or cafeteria food that is served in foam or plastic containers?
- ***Polystyrene and other plastic containers are made from precious petrochemicals, do not decompose in landfills, and release toxic gases when they are burned in incinerators.***

# Blowing Up Your World

- How many of you use handkerchiefs instead of tissues and use cloth towels instead of paper towels?
- *Paper comes from trees. The more of it we use, the more trees that are cut down*

# Blowing Up Your World

- How many are changing incandescent bulbs for new compact fluorescent bulbs?

**Changing one bulb could save 150 pounds of carbon dioxide per year!**



# Tingkat kepedulian terhadap lingkungan

- You're an environmentalist!
- you're starting to save the world.
- Lots of room for improvement.
- You're exiled to the town dump!





Planet bumi merupakan hasil interaksi antara faktor hayati dan nir-hayati yang panjang shg menjadi tempat yg memungkinkan bagi kehidupan manusia

Aktivitas manusia telah merubah keadaan planet bumi sehingga merugikan bagi kehidupan manusia itu sendiri

Dampak dari perubahan tersebut sangat rumit

Untuk menekan perubahan itu, manusia diharuskan untuk memenuhi kehidupannya dengan cara yang bijak

Valuasi ekosistem: membandingkan ekosistem hutan tropis dengan kelapa sawit (Kalimantan:

Kearifan lokal berbasis keanekaragaman hayati: obat herbal

Kenaikan paras air laut mengakibatkan daerah pantai tergenang air laut:  
Efek global warming terhadap pertanian/perikanan

Terganggunya siklus hidup serangga/hama tertentu sehingga terjadi peledakan populasi: contoh peledakan ulat bulu

Biomaterial

Kepedulian terhadap lingkungan