

# **Biology**

## **the study of life**

### **Lecture 15**

- Life (a life form: an organism )
  - can be defined as an organized **genetic** unit capable of metabolism, reproduction, & evolution (Purves et al., 2003)
  - There is order to life.
  - Life must carry out many processes to maintain itself.
  - Evolutionary adaptation exists.

## What do you mean by...

- Genetic: refers to heredity material and information
- Metabolism: total chemical activity of a living organism
- Reproduction: sexual or asexual creation of offspring
- Evolution : genetic change that gets passed on to the next generation

# Cell Theory

1. All life forms, (termed organisms) are made up of **cells**.
2. The cell is the fundamental unit of life.
3. All cells come from preexisting cells.

Cells have traits defining them,  
but differ greatly from one-another.

- Some life forms are made of one cell and are called **unicellular**.
- Life forms composed of many cells are called **multicellular**.
- All cells are contained by a water-insoluble **plasma membrane**, have genetic material, and carryout biochemistry related to metabolism and reproduction.

# What does it mean to be alive?

## Life forms

### 1. Respire- to exchange gas used in energetics

- (usually Oxygen is taken in and used to fuel chemical reactions, carbon dioxide is often the by-product and is released)

### 2. Metabolize- Take in nutrients and use them to needed materials

- Catabolize : breakdown
- Anabolize: to build up

### 3. Reproduce- produce more of the same species

- **Duplicates or creates new life: Passes on DNA**

### 4. Respond to the environment

- Motion towards or away from items (including growth)
- Release of defensive chemicals

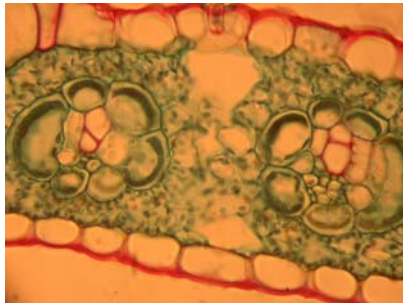
### 5. Are made of 1 or more cells



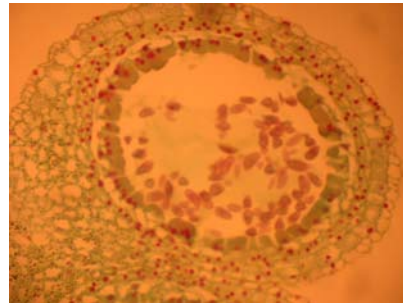
Cells are the basic building blocks of life.  
All life is made up of one or more cells.



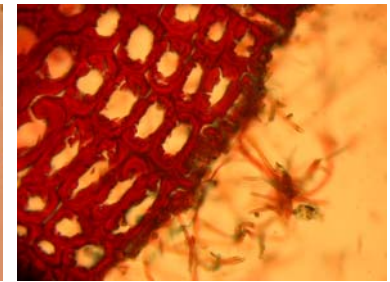
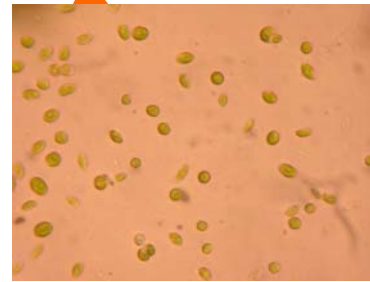
Protists (amoeba, Paramecium) are unicellular



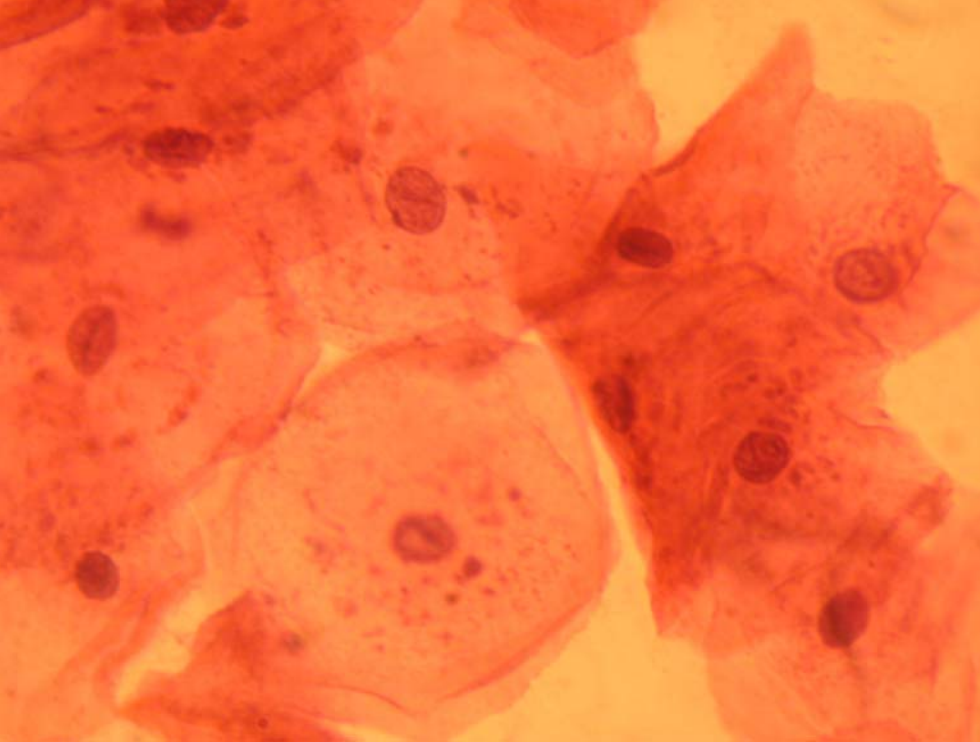
Leaf  
multicellular



Flower anther  
multicellular

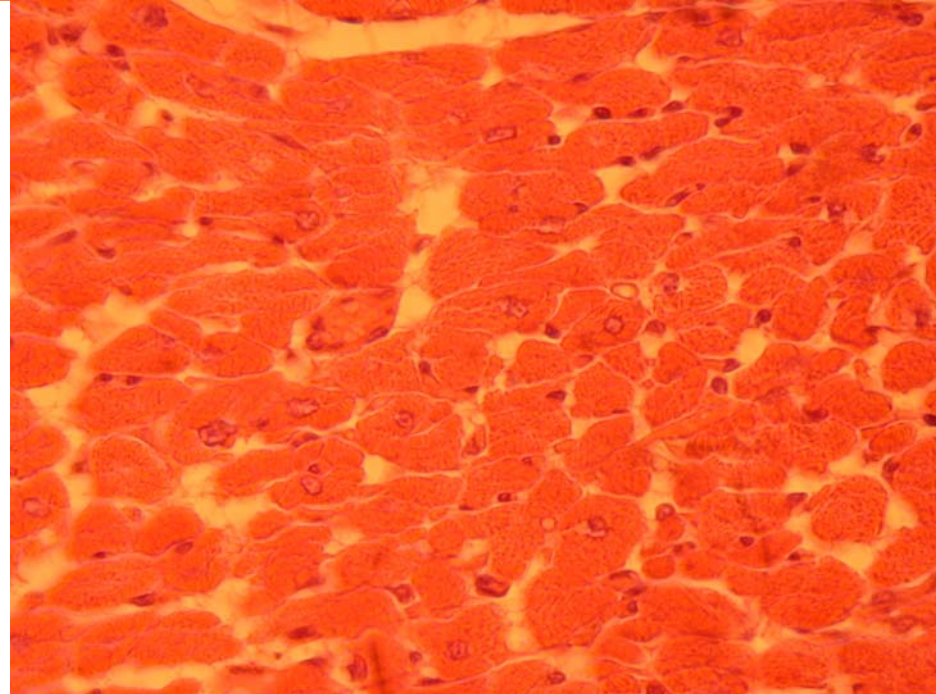


Lichen(algae & fungus)  
unicellular & multicellular



Humans are  
multicellular ,  
two examples:  
our epithelial cells  
(skin, lining of  
intestine...)

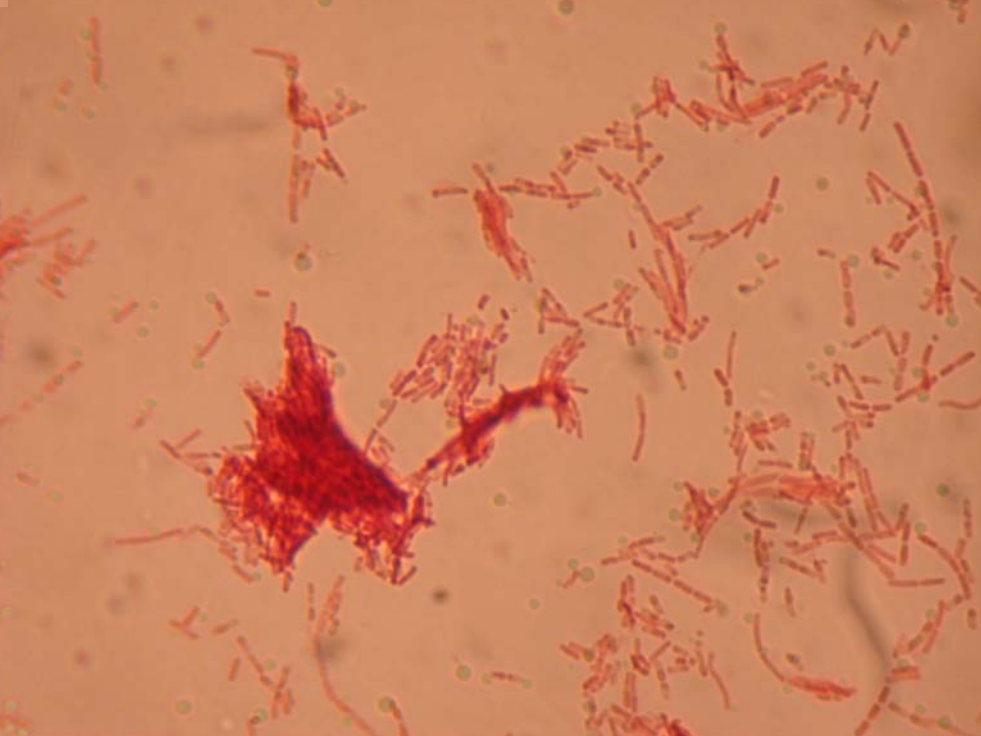
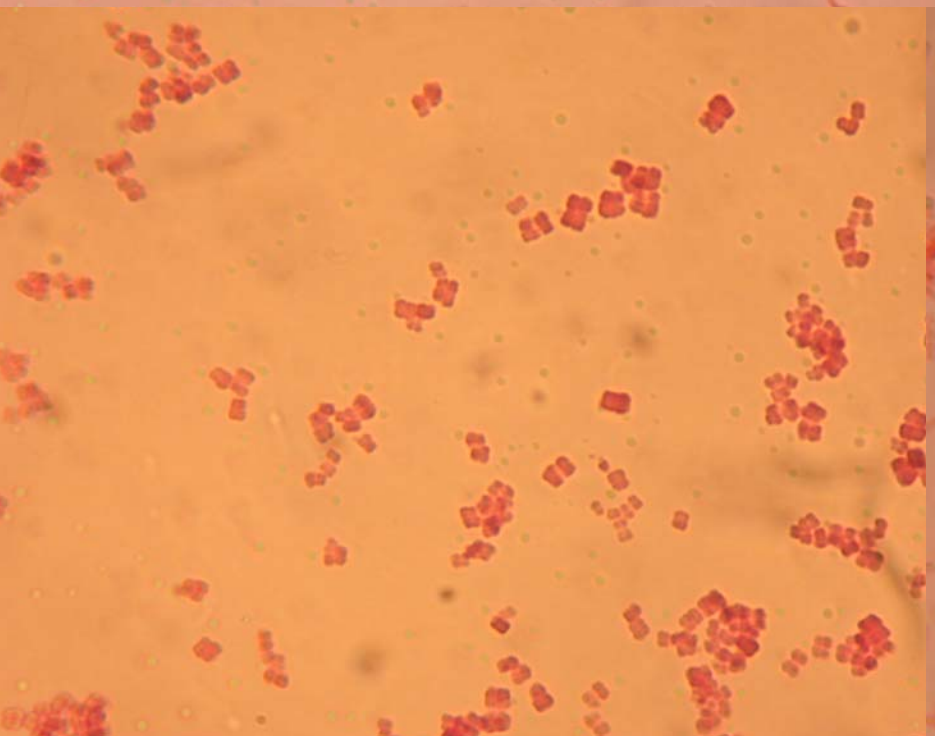
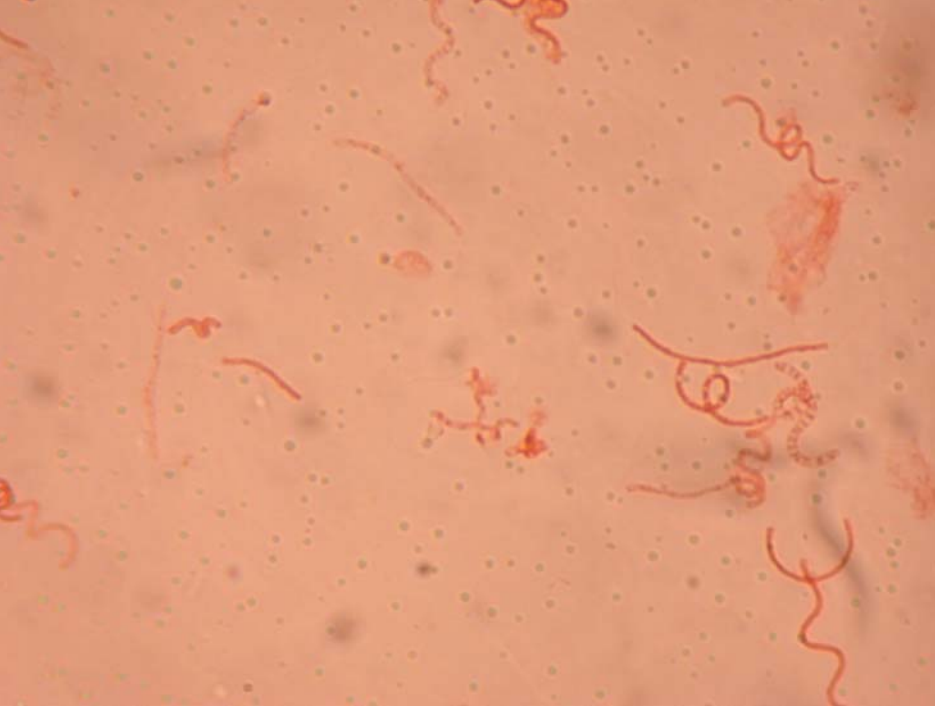
One type of our  
muscle cells  
(heart : cardiac)





Bacteria are found  
in the soil, water &  
every where...

They are  
unicellular



Complex multicellular organisms  
have specialized cells  
(like human, trees, mushrooms, ...)

Some multicellular life forms have different types  
of tissues, with specific functions:

Organization of such life forms is

cells → tissues → organs → systems → an organism

# Organization of life

- Hierarchy of life units, from smallest to largest:
  - Life Molecules (made of atoms)
  - Cells (life is composed of one or more)
  - Tissues (specialized cells that coordinate function)
  - Organs (several tissues that work to create a system)
  - Organisms (recognizable self contained individual )
  - Populations (groups of organisms of the same species)
  - Communities (mix of different species populations)
  - Biosphere (communities exchanging energy with one another-global)

# Example: nerve cell

- Multiple Nerve cells make up nerve tissue.
- Nerve tissue makes up organs.
- The brain and spinal cord are examples of organs made up of nervous tissue.
- All organs made up of nervous tissue collectively are called the nervous system
- Most multicellular animals have multiple systems, nervous system, circulatory system , skeletal/muscular system , reproductive system....

# Cell Variation

- Size & Structure (outside and in)
- Organelle: Subcellular structures with a specific function
- 2 major groups of cell types  
**Procaryotic & Eucaryotic**

# Procaryotic cells: bacterial cells (prenucleus)

- **Very small** compared to eucaryotic
- DNA is not contained in an organelle (there is not a nucleus) it floats in the cytoplasm
- DNA is circular, called a plasmid
- Most have a thick, sugary/protein cell wall for protection
- Reproduce by fission (double and split into 2 cells)
- Generalized cells, can carryout many different functions to survive

# Eucaryotic cells: true nucleus (everything but bacteria)

- All have a nucleus to house the DNA
- Most do not have plasmids
- Most eucaryotic cells do not have a cell wall, if they do it is for structural support not protection from desiccation or anything else.
- Large compared to procaryotic cells
- Cells are duplicated by mitosis, but some can undergo meiosis, the formation of sex cells
- Contain many different types of organelles, highly specialized cells



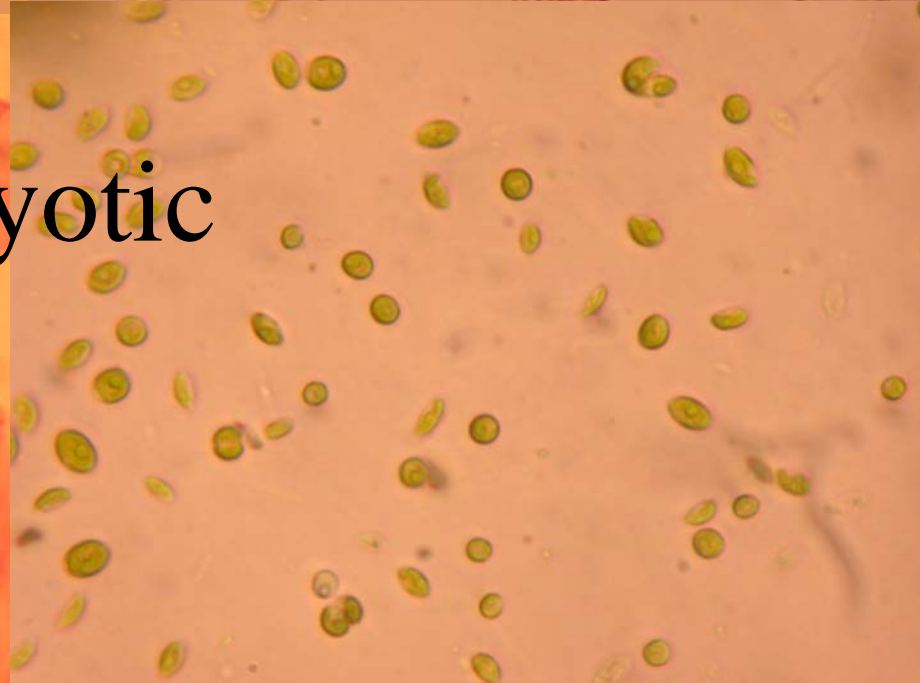
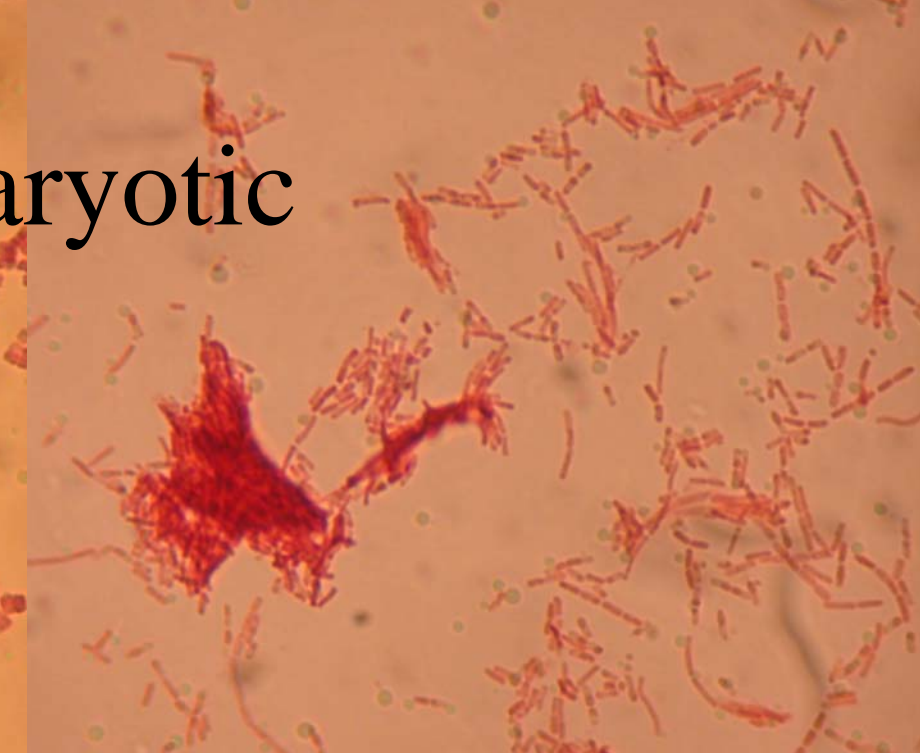
Procaryotic

This panel shows a microscopic view of procaryotic organisms. The organisms are small, reddish, rod-shaped structures, likely bacteria, scattered across the field of view. They appear to be arranged in small clusters or chains.



Eucaryotic

This panel shows a microscopic view of eucaryotic organisms. The organisms are large, orange, irregularly shaped structures, likely plant cells or fungi, with visible nuclei and other internal organelles.





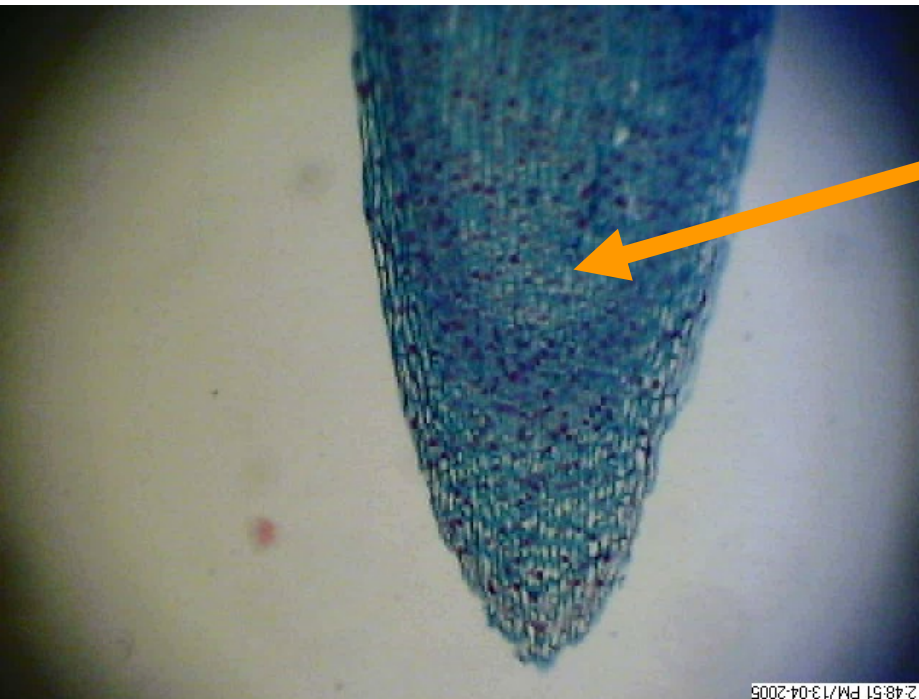
# All cells usually have DNA.

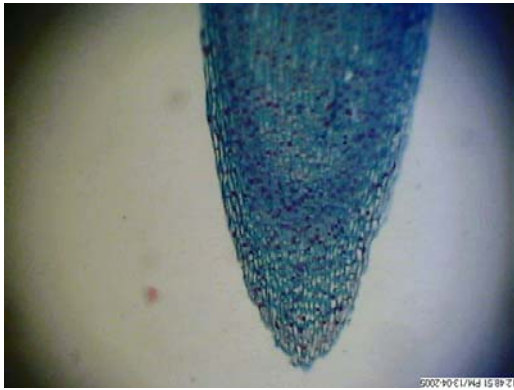
- Eucaryotic cells contain it in the nucleus

Stains can be used to see where and what the DNA is doing, the red areas below are chromosomes.

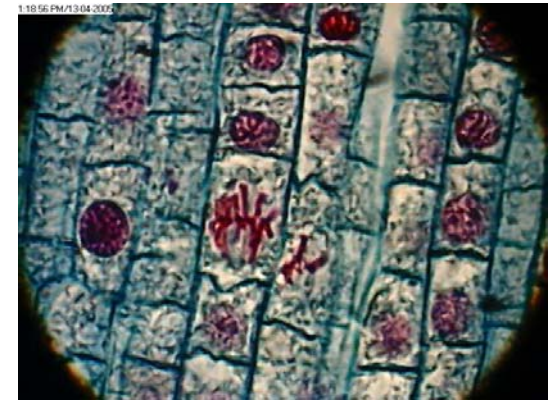
Onion root tip 10x

Onion root tip magnified 40x





# DNA



- All of the cells in the root tip, have the same component of DNA. But it is unique for individuals.
- The onion DNA is the instructions and regulations for the growth and maintenance of the onion plant.
  - Blue print, instructions, fingerprint
    - Depending on which cell it is in, the DNA has different gene activity.

# How do we group and name life ?

## Comparative anatomy (structure) & physiology (biochemical interactions)

- Morphology
  - general shape of the entire life form
- Specific Structures
  - Some groups are unique based on structures
- Life processes previously listed (biochemistry)
  - Especially important for microbes
- DNA :genetics
  - Phylogenetics is the grouping of life based on a similar ancestor and today usually DNA is the focus. (not always)