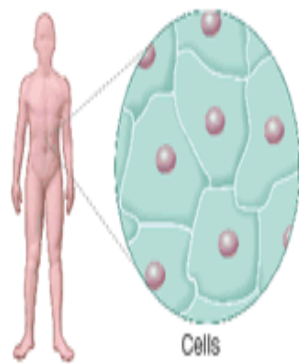


# LIVING ORGANISM...

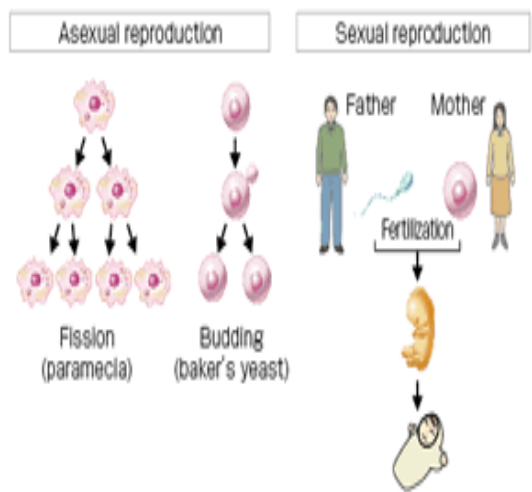
Living organisms have the following **characteristics**

1. They are made from structures called "cells".
2. They reproduce by genetic material called "**DNA.**"
3. They respond to stimuli from the environment.
4. They synthesize an energy substance called "adenosine triphosphate (**ATP**)" from the environment, and they live and grow using that energy.

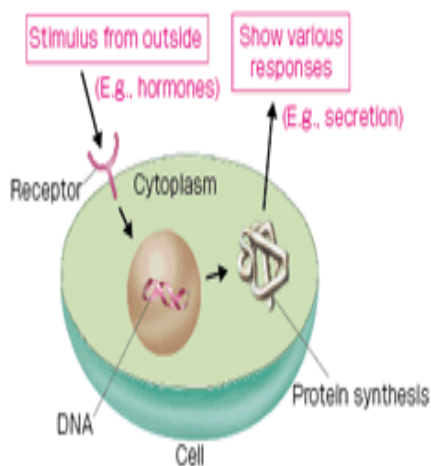
(1) Made of cells



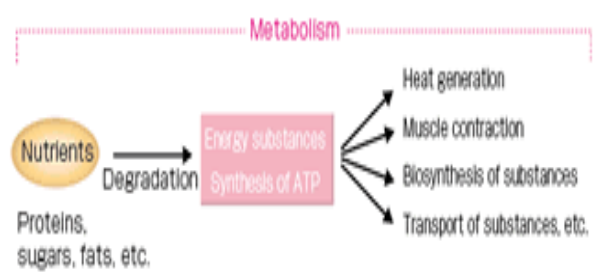
(2) Self-replicate



(3) Respond to stimuli from the environment



(4) Synthesize energy substances, live, and grow



+ ZOOM

**Fig. 1-1. Four Characteristics of Living Organisms**

Now let's look at these characteristics in more detail.

(1) All living organisms are made of cells, which are the units of life. A cell comprises a plasma membrane consisting of a phospholipid bilayer. There are various kinds of cells, from liver cells. The smallest size visible through the naked eye is generally about 0.1 mm (100  $\mu\text{m}$ ) and through a light microscope is about 0.2  $\mu\text{m}$  (200 nm); anything less than 1  $\mu\text{m}$  cannot be seen clearly without an electron microscope.

(2) Another obvious major characteristic of living organisms is that they produce offspring that are the same as themselves. Unicellular organisms under normal nutrition conditions produce offspring by **asexual reproduction**, such as by **dividing** (protozoa, etc.) or **budding** (baker's yeast). In a **sexual reproduction**, the cells of the offspring have the same traits as the cells of their parents (the characteristics that surface) as long as their DNA does not **mutate**. Multicellular organisms, however, undergo sexual reproduction and produce offspring that inherits half of each parent's genes.

(3) The third characteristic of living organisms is their response to stimuli. The plasma membrane contains proteins called "**receptors**," which receive stimuli from the outside environment. When outside stimuli such as chemical substances or heat reach the receptors, a series of various chemical reactions occurs in the cytoplasm. Finally, DNA is transcribed and new proteins are synthesized. This system of chain reactions is called "signal transduction".

(4) The final characteristic of living organisms is that they carry out **metabolism** (synthesis and degradation of substances) in their cells. Metabolism is a process in which organisms synthesize **ATP** to store energy, and then release that energy by hydrolysis, obtaining heat in the process.