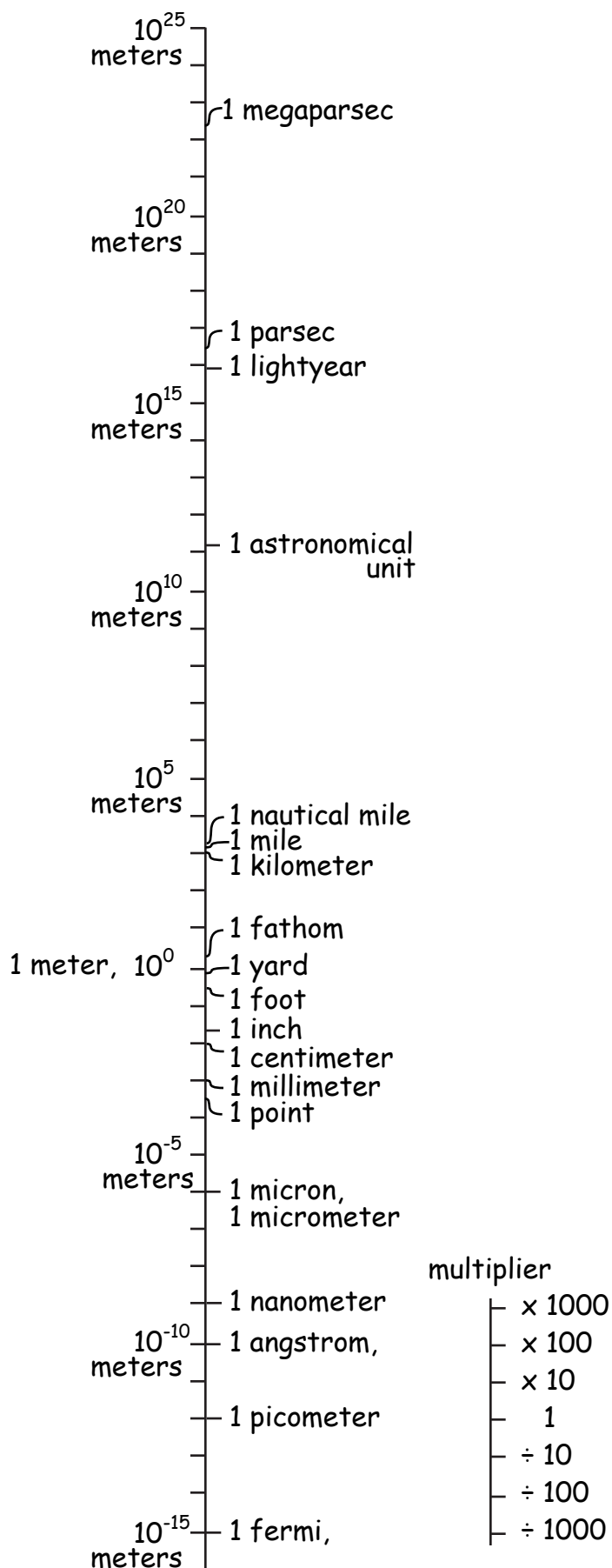
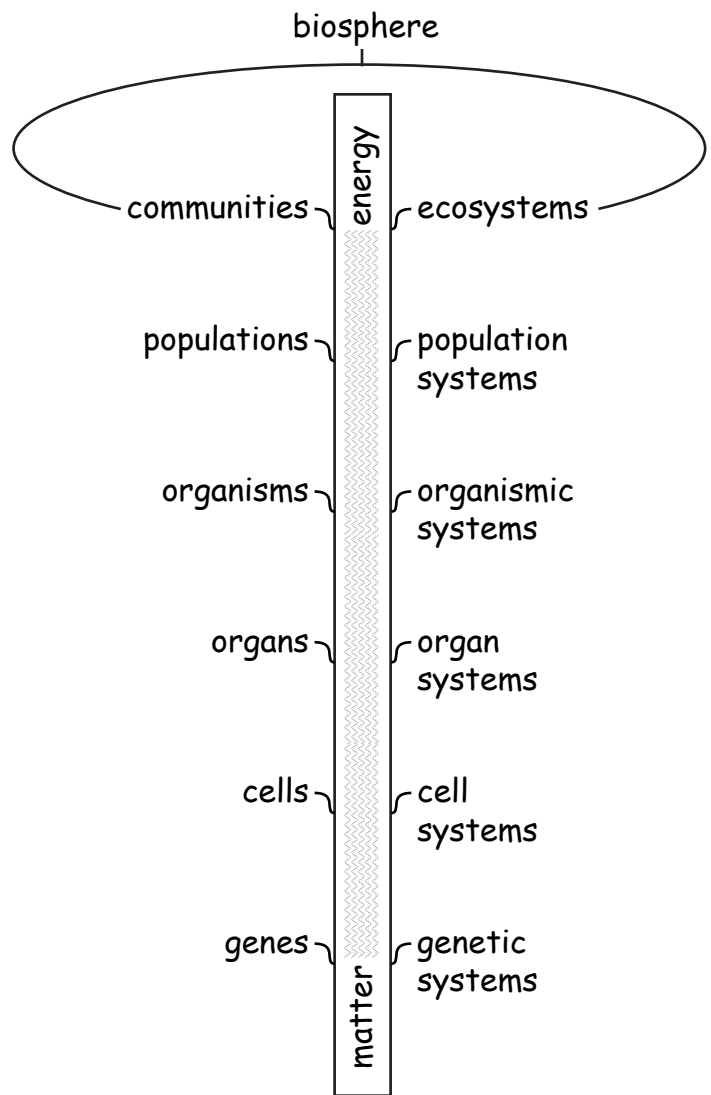


## units of length



## level spectrum of biological organization



living components successively combine with non-living components giving rise to biological systems. A **system** can be defined as a regulary interacting or interdependent group of items forming a unified whole.

## metric number names

|        |       |            |
|--------|-------|------------|
| exa-   | E     | $10^{18}$  |
| peta-  | P     | $10^{15}$  |
| tera-  | T     | $10^{12}$  |
| giga-  | G     | $10^9$     |
| mega-  | M     | $10^6$     |
| kilo-  | k     | $10^3$     |
| unit   |       | $10^0$     |
| milli- | m     | $10^{-3}$  |
| micro- | $\mu$ | $10^{-6}$  |
| nano-  | n     | $10^{-9}$  |
| pico-  | p     | $10^{-12}$ |
| femto- | f     | $10^{-15}$ |
| atto-  | a     | $10^{-18}$ |

## Some characteristics of Life

### *Overcoming disorganization*

|                |  |
|----------------|--|
| Order          | Specific relationships between parts or activities |
| Adaptation     | Parts and activities suite organisms setting       |
| Metabolism     | Ordered reactions in biosynthesis and degradation  |
| Movement       | Using own power, organisms move in space           |
| Responsiveness | Organisms perceive reality and react to it         |

### *Continuity*

|              |  |
|--------------|--|
| Reproduction | Organisms give rise to others of the same type   |
| Development  | Ordered sequences of change result in complexity |
| Genes        | Units of inheritance specify phenotypic traits   |

### *Evolution*

Table excerpted from "*The Nature of Life*" by Postletwaith and Hopson.

Consider that life is the summation of multiple relationships falling into three primary categories 1) overcoming entropy, 2) maintaining continuity and 3) evolving over time.

Within the first category, living things manifest inherent order in which specific relationships between parts or activities are established. These parts or activities are adaptive (living things are tuned to their environments), result in metabolism (matter and energy transformation) and support responsiveness to external or internal stimuli (responses that can include movement, changes in growth state or metabolic flux).

Within the second category, living things have the capacity to make copies of themselves (reproduce), experience different life history stages (development or age related changes in structure or function), and encode biological information in units of heredity that specify phenotypic traits.

Within the third category, living things evolve over time through a process of natural selection in which "fitness" costs are minimized. While the precise units of selection remain a subject of debate in biological circles, selection appears to act on multiple levels of biological organization from genes to cells, organisms and populations.

In conclusion, life is an emergent property in which multiple hierarchical levels of structural and functional complexity interact to overcome disorder by converting matter and energy into biomass. This process increases disorder in the surrounding environment and promotes the formation of distributed metabolic networks i.e. trophic relationships between living things sharing the same environment.

Given this more formal definition, one might ask if a virus or a planet is alive.