

Module 1 - Perspectives in Living Systems

LIVING SYSTEMS IN ORAL TRADITIONS

ORAL TRADITIONS

- Telling stories
- Chanting and music
- Creation of visual arts

Myths and legends and folklore are a part of what we call **Indigenous Knowledge Systems and Practices (IKSP)**.

Examples:

- The monkey and the turtle by Jose P. Rizal
- The girl who turned into a fish
- Why the Pina has 100 eyes
-

This knowledge affects not only their forms of **art and oral literature** but includes all aspects of life:

- from knowledge of **geography and climate** that allow them to “**read**” **signs from nature -- the wind, animal behavior, and**

- the **appearance of indicator plants’** leaves and flowers -- to **predict future environmental conditions as accurately as any barometer or weather gauge.**

- This has allowed them to **create** many **inventions and technologies** that relate to the **domestication of food, storage, and preparation; herbal- based medicines; forms of clothing and transportation; astronomy; sustainable agricultural and industrial practices, etc.**

Who were the “**keepers**” of indigenous knowledge?

1. **Elders** are esteemed for their knowledge, and the knowledgeable among them are required to perform special roles.
2. **Storyteller**, with the ability to tell stories in a memorable, engaging way, performs an important teaching function in the life of a tribe; for stories, myths, and legends are how experiences of the tribe, especially of catastrophic events, are recorded and stored.
3. **Hunter**, whose knowledge of wildlife, capacity to read the slightest of signs, and the capability to create tools and weapons, teach the knowledge of the environment without words;
4. **Gatherer**, who knows fruits, animals, and herbs and their uses;
5. **Farmer**, who has knowledge of the seasons and the signs of the wind and sky.

Biocultural knowledge - knowledge rooted both in the natural environment and grounded on the culture

Examples of biocultural knowledge:

1. Medicinal plants

The DOH approved **ten medicinal plants** used in Philippine Traditional Medicine After undergoing clinical studies.

Uses of 10 scientifically validated medicinal plants (Principe and Jose, 2002)

Plant - Uses

1. Lagundi (*Vitex negundo*) - Cough and asthma
2. Sambong (*Blumea balsamifera* L.) - Anti-urolithiasis (kidney stones)
3. Ampalaya (*Momordica charantia* L.) - Lowering blood sugar and anti-diabetes
4. Garlic (*Allium sativum*) - Anti-cholesterol
5. Guava (*Psidium guajava*) - Oral/skin antiseptic
6. Tsaang-gubat (*Carmona cetusa*) - Mouth wash
7. Yerba-Buena (*Mentha arvensis*) - Analgesic or anti-pyretic
8. Niyug-niyogan (*Quisqualis indica*) - Anti-helminthic
9. Acapulco (*Cassia alata*) - Antifungal
10. Ulasimang-bato (*Peperomia pellucida*) - Anti-hyperuricemia

2. Traditional health practices

Suob is a Philippine traditional health practice used during **pregnancy and postnatal care**. It is similar to **steaming and mother-roasting practices** in other SEA cultures.

3. Biodiversity management

- **B'laan**
 - placing a half sack of upland rice on top of small altar made of sapling called by the blaen "Tnê"
 - "**Tnê**" - blaen belief performs prior to planting for protection of pesticides and insecticides in the field

- T'boli

- erection of the "**but b'nek**" or the **spirit house** - where the seeds are taken during the planting period
- alignment of the moon and "**blotik ehek**" or the star for planting - proper time to plant rice because the earth will be dry, hence no worms and maya birds will not eat the corn and rice

- Subanen - three distinct seasons within the agricultural cycle

- **pendupi**, from June to December, characterized by winds blowing from the southwest;
- **miyan**, from December to January, a time of winds and northeast monsoon rains; and
- **pemeres**, from March to April, the hot and dry season.

LIVING SYSTEMS FROM ANTIQUITY TO RENAISSANCE

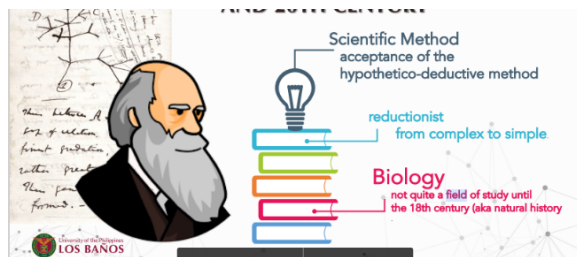


Sumerians (Mesopotamia and Modern Day Iraq) and their Knowledge of Biology (4500 – 1750 BCE)

- The **Sumerian belief system** encompassed both **empirical and themagical**
- **Recorded medical lore**, particularly in the treatment of disease, the use of herbs and animal material as **materia medica**
- Knowledge was kept in **clay tablets** written in cuneiform

Sumerian medical clay tablet – Medical clay tablet from Nippur dated to about 2200 BC is considered the oldest known Sumerian medical book. 2200 BC.

LIVING SYSTEMS IN THE 19TH AND 20TH CENTURY



Characteristics of Science:

- **Consistency** - repeated observations
- **Observability** - evidence of the occurrence
- **Natural** - a natural mechanism must be used to explain why or how
- **Predictable** – predictions can be tested if true or not
- **Testable** – controlled experimentation
- **Tentativeness** – theories are subject to revision

The Scientific Method

- a process for experimentation that is used to explore observations and answer questions.

- Scientists use the scientific method to **search for cause and effect** relationships in nature.
- **A set of guidelines** by which scientists develop hypotheses and theories

- Consists of:
 - ✓ observations
 - ✓ questioning/exploring
 - ✓ hypothesis
 - ✓ experimentation/testing the hypothesis
 - ✓ conclusion
- does not allow biases or expectations to cloud the interpretation of results

Science	Non-Science
Searches for truth and aims to understand the natural world	Searches for truth & aims to understand natural world & beyond
Does not deal with supernatural phenomena	Explains & accepts supernatural phenomena
Cannot provide complete answer to all questions	Has answers to all questions
Explains the natural world without invoking supernatural causes	Explains the natural world by invoking supernatural beings &/or relying on divine intervention
Demands concrete evidence that can be seen or experienced by others	Contented with evidence seen or experienced by a "gifted" or selected few
Uses our senses and devices that extends the capabilities of these senses in its investigations	Uses senses but also extrasensory capabilities of "gifted" individuals

Science	Non-Science
Hypotheses are falsifiable	Hypotheses are not falsifiable
Claims are verifiable by others	Claims are difficult to verify
Nothing is absolute; theories may be modified or replaced	Absolute and dogmatic; the world cannot be changed or questioned
Encourage skepticism and critical thought	Distance from criticism; prefers obedience & submission to authority
Not authoritarian	Authority is source of truth
Aims to be objective and tries to identify source of bias	Objectivity is not a special concern
Open to new ideas & willing to replace long-held theories with new ones that better explains facts about the natural world	New ideas are frowned upon especially when they do not fit the founding document, law or belief system
Utilizes scientific method	Does not utilize scientific method; has other ways

1. Organisms
2. Population
3. Community
4. Ecosystem
5. Ecosphere

Seven basic functions (also known as transcending factors depicted as vertical components)

1. energetics
2. Behavior
3. development
4. evolution, diversity
5. integration
6. Regulation

Salient characteristics that each level of organization shares has also been described by James Miller in his Living System Theory.

These **five major** elements include:

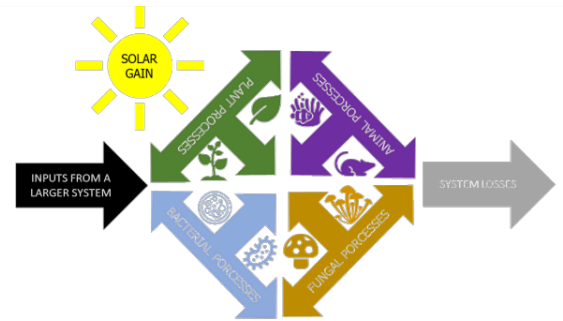
1. structure or the arrangement of the components;
2. Process or any change over time of matter and energy
3. Subsystem which is the totality of structures and their functions;
4. structural and process relationships;
5. systems process that requires the concerted action of many or all parts of the system

The totality of the structures in a system that functions for a specific task is classified into 19 subsystems.

1. **Ingestor** - Brings matter-energy across the system boundary from its environment
2. **Distributor** - Carries inputs from outside the system or outputs from its subsystems around the system to each component.
3. **Converter** - Changes certain inputs to the system into forms more useful for the special processes of that particular system

4. **Producer** - Forms stable associations that endure for significant periods among matter-energy inputs to the system or outputs from its converter, the materials synthesized being for growth, damage repair, or replacement of components of the system, or for providing energy for moving or constituting the system's outputs of products or information markets to its suprasystem
5. **Matter-energy storage subsystem** - Retains in the system, for different periods, deposits of various sorts of matter-energy
6. **Extruder**- Transmits matter-energy out of the system in the form of products or wastes.
7. **Motor** - Moves the system or parts of it to part or all of its environment or moves components of its environment to each other
8. **Supporter** - Maintains the proper spatial relationships among components of the system, so that they can interact without weighing each other down or crowding each other
9. **Input transducer** - Brings markers bearing information into the system, changing them to other matter-energy forms suitable for transmission within it
10. **Internal transducer** - Receives, from other subsystems or components within the system, markers bearing information about significant alterations in those subsystems or components, changing them to other matter-energy forms of a sort that can be transmitted within it

11. **Channel and net** - Composed of a single route in physical space, or multiple interconnected routes, by which markers bearing information are transmitted to all parts of the system
12. **Decoder** - Alters the code of information input to it through the input transducer or internal transducer into a private code that can be used internally by the system
13. **Associator** - Carries out the first stage of the learning process, forming enduring associations among items of information in the system
14. **Memory** - Carries out the second stage of the learning process, storing various sorts of information in the system for different periods of time
15. **Decider** - Receives information inputs from all other subsystem and transmits to them information outputs that control the entire system
16. **Encoder** - Alters the code of information input to it from other information processing subsystems, from a private code used internally by the system into a public code that can be interpreted by other systems in its environment
17. **Output transduce** - Puts out markers bearing information from the system, changing markers within the system into other matter- energy forms that can be transmitted over channels in the system's environment.



- The living system continues indefinitely within the natural cycles to attain sustainability.
- The living system forms a “**feedback mechanism**” with the purpose or goal of keeping this cycle in control.

PROPERTIES OF LIVING SYSTEMS

ORGANISM - CHARACTERISTICS:

1. **Organization** - The form of a living thing shows a highly organized and coordinated set of structures or units that is in harmony to produce a specific function.
2. **Reproduction** - is essential to organisms as it ensures the continuity of the species.
3. **Growth and Development** - is characterized by the increase in size and mass, and involves the process of change that organism goes through as it grows.
4. **Maintenance and repair** -
5. **Movement** -
6. **Metabolism** -
7. **Adaptations** - can allow organisms to become adapted or match to the present environment.

Living systems are **open and closed** systems with purposes and goals.

Living VS Nonliving

Module 3 - Living systems are open and closed systems with purposes and goals

Different forms of energy:

Mechanical energy (kinetic energy)
whose counterpart is potential energy
(stored energy);

Radiant energy (sun);

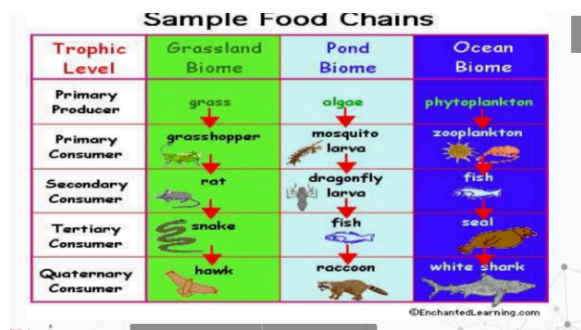
Sound energy;

Chemical energy;

Heat energy;

Electrical energy and

Nuclear Energy.



CONSEQUENCES OF BEING A TOP PREDATOR

- needs to eat more because of lesser amount of energy at the higher trophic levels
- accumulates more toxins or pollutants because of biomagnification

Ecological pyramids - also referred to as trophic pyramids, are graphical representations designed to show relationships between energy and trophic levels in an ecosystem.

DDT or Dichlorodiphenyltrichloroethane

- was a contact poison used to control the spread of the insect-borne diseases like malaria and typhus.

Biological magnification or biomagnification - increasing concentration of persistent, toxic substances at each trophic level, from the primary producers to the different consumer levels

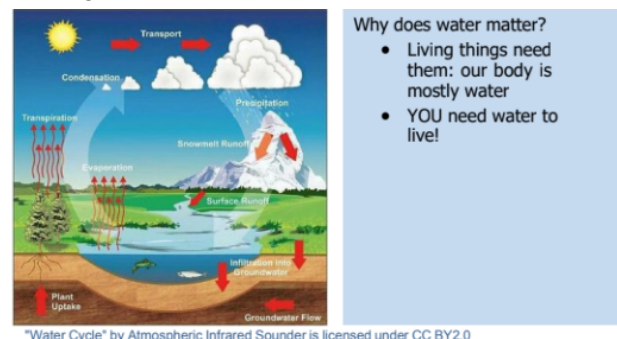
Biogeochemical cycle - recycling of inorganic matter between living organisms and their environment

Five most common elements associated with organic molecules

1. Hydrogen
2. Oxygen (water)
3. Carbon
4. Nitrogen
5. Phosphorus

4 Different cycles

1. Water cycle

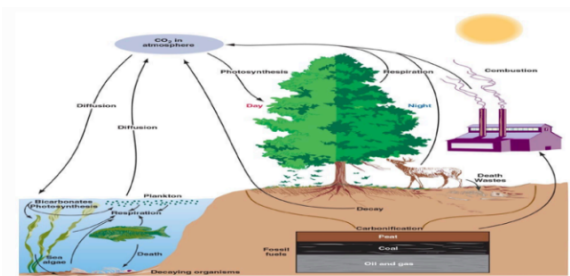


Our planet Earth is **rich** in water. Yet, the amount of freshwater which we need to live is so small. Over **68%** of the freshwater on Earth is found in **icecaps and glaciers**, and just over **30%** is found in **groundwater**. Only about **0.3%** of our freshwater is found in the surface water of **lakes, rivers, and swamps**.

2. Carbon cycle

Why does carbon matter?

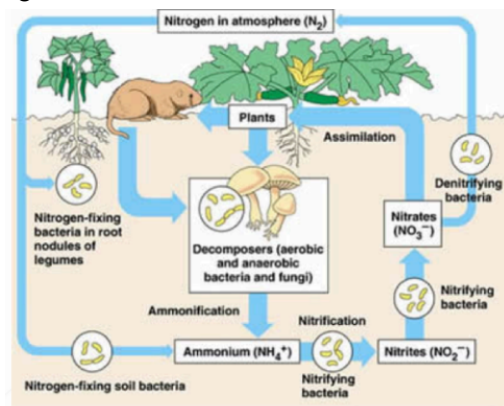
- **18%** of your body consists of carbon atoms
- no carbon= no plasma membranes of your cells, sugar molecules you use for fuel, or even the DNA that literally serves as your body's user manual
- also part of our modern-day industries



3. Nitrogen cycle

Why does nitrogen matter?

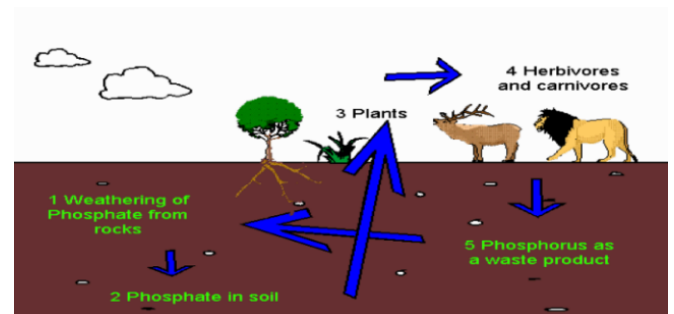
- **Nitrogen** - key component of the bodies of living organisms; found in all proteins and DNA
- also part of our modern-day industries
- common limiting nutrient in nature and agriculture



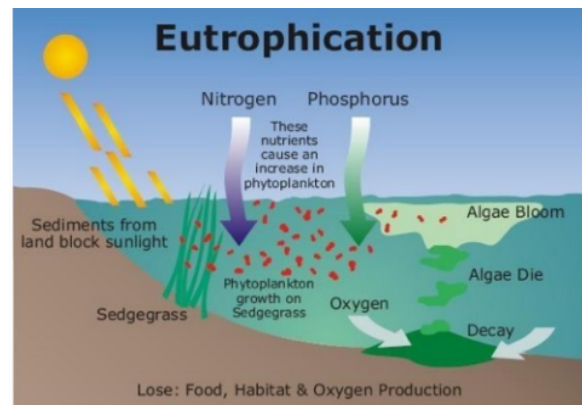
4. Phosphorus cycle

Why does phosphorus matter?

- **Phosphorous** - essential nutrient found in the macromolecules of humans and other organisms, including DNA also part of our modern-day industries
- often the limiting nutrient, and thus limits growth, in aquatic ecosystems



Eutrophication - nitrogen and phosphorous are carried in runoff to lakes and rivers, they can result in blooms of algae.



The algae may deplete oxygen from the water and create a **dead zone**.