TAXONOMY AND BINOMIAL NOMENCLATURE

MISSION MBBS | NEET 2024

# THE LIVING WORLD - L2

ZOOLOGY | CLASS 11

PUSHPENDU SIR

# Recall: Characteristics of Living Beings

- Growth
- Reproduction
- Metabolism
- Cellular Organisation
- Consciousness









# Our Living World is Very Diverse!

# Diversity of Living World

- **1.7 to 1.8 million** living organisms have been discovered so far
- About **1.25 million species of animals and 0.55 million species of plants** have been studied, described and named for identification


Cervo
Veado
Olen
Deer


Let's have one common name which we all can understand









# Introduction to Nomenclature

## Nomenclature

The process of **naming of a particular organism** such that it is known by **the same name** all over the world


You will be surprised at the number of names that are there in India for the same mango fruit!

## Vernacular Names

- Kannada : Mavina kaaya
- Tamil : Mambazham
- Telugu: Mamidi
- Bengali: Aaam
- Gujarati: Keri
- Marathi: Aamba
- Hindi : Aam









# Types of Nomenclature

# Monomial Nomenclature

- **One word** to name organisms
- **Cons**: Difficult to use unique names as more and more organisms were discovered

# Trinomial Nomenclature

- Recognise **subspecies** within a species
- Each name has three parts
  - **First part:** Genus
  - **Second part:** Species
  - **Third part:** Subspecies
- **Cons:** Discarded for lack of justification for sub speciation

*Corvus splendens splendens*
(Indian crow)

# Polynomial Nomenclature

- System of nomenclature **involving more than two names**
- Cons:
  - Polynomials were **not standardized**
  - **Different** polynomials existed for the same plant
  - **Cumbersome** to remember

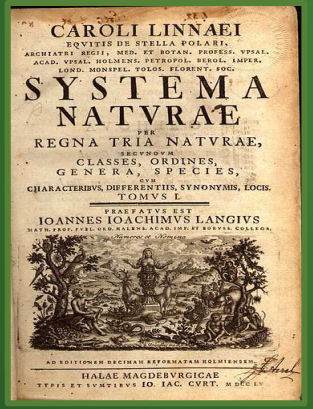
Example: *Ranunculus calycibus retroflexis pedunculis falcatis caule erecto folius compositis*

Which naming system is the most widely accepted?

# Binomial Nomenclature

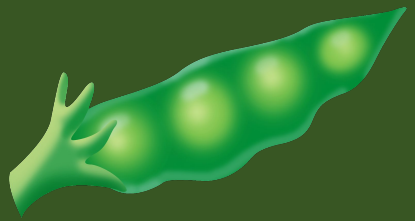
- Proposed by **Carolus Linnaeus** in his book **Systema Naturae** and **Species Plantarum**

Carolus Linnaeus




# Binomial Nomenclature

- Two terms are used to name a living organism
  - **Generic name**
  - **Specific epithet**



Eg: *Pisum sativum* (Pea)

**Generic name** | **Specific name**

# Who introduced the term species?

A Linnaeus

B Hugo De Vries

C John Ray

D Huxley

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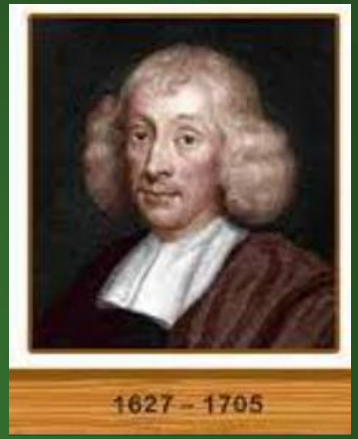
B Hugo De Vries

C **John Ray**

D Huxley




**John Ray**

How does nomenclature help?

## Significance of Nomenclature

- Ensures that each organism **has only one name**
- Description of any organism enables people to arrive at the same name


KNOW THE
RULES





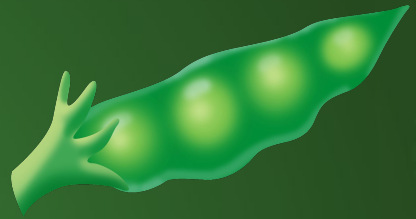




# Rules of Nomenclature

## Rules of Nomenclature

- **Generally written in Latin**
- **First word**: Represents the genus
  - Starts with a capital letter
- **Second component**: Specific epithet
  - Starts with a small letter
- When handwritten: Separately underlined
- When printed: In italics



**Eg: *Pisum sativum* (Pea)**

## Rules of Nomenclature

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***Pisum sativum***

**Generic name**

## Rules of Nomenclature

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***Pisum sativum***

**Specific name**

## Rules of Nomenclature

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***Pisum sativum***

## Rules of Nomenclature

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***Pisum sativum***

## Rules of Nomenclature

- **Name of the author** appears after the specific epithet, i.e., and is written in an abbreviated form
- E.g., ***Mangifera indica* Linn**. It indicates that this species was first described by Linnaeus.

# Did You Know?

# Did You Know?

- In any kingdom, two generic names **cannot be the same**
- Specific names **do get** repeated

*Mangifera indica*

*Tamarind indica*

# Did You Know?

- Animal species having the **same name** for both genus and species are known as **tautonyms**

**Eurasian eagle owl**
*Bubo bubo*

**European grass snake**
*Natrix natrix*





# Let's Solve a Question!




Identify the scientific name that has been written correctly.

A *MANGIFERA INDICA*

B trypanosoma gambiense

C *Ficus Benghalensis*

D *Apis indica*

Identify the scientific name that has been written correctly.

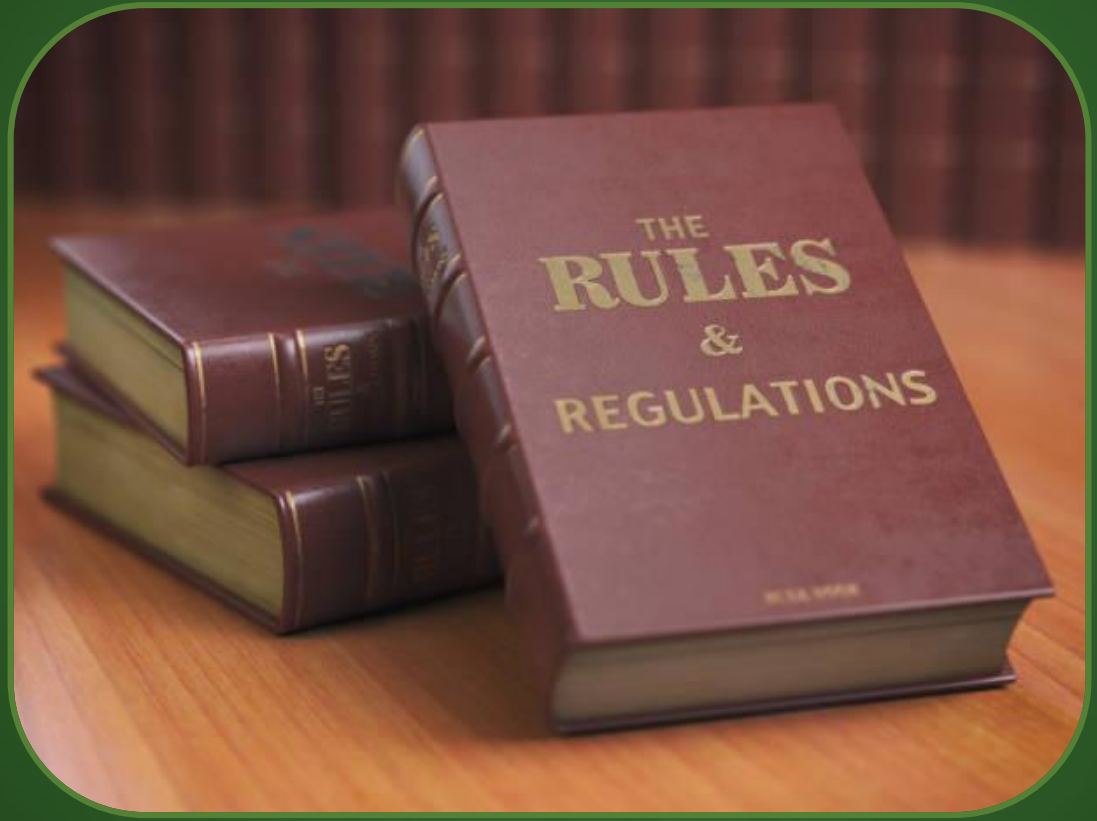
A *MANGIFERA INDICA*

B *trypanosoma gambiense*

C *Ficus Benghalensis*

D ***Apis indica***

# Various Rulebooks for Different Organisms



# Various Rulebooks for Different Organisms

- International Code for Botanical Nomenclature (ICBN)
- International Code of Zoological Nomenclature (ICZN)
- International Code of Viral Nomenclature (ICVN)
- International Code of Bacteriological Nomenclature (IC Bac N)
- International Code of Nomenclature for Cultivated Plants (ICNCP)





# Let's Solve a Question!




# To which group of organisms does the ICBN apply to?

A Viruses

B Animals

C Plants

D Bacteria

# To which group of organisms does the ICBN apply to?

A Viruses

B Animals

C Plants

D Bacteria

# Discussion

## Plants

- ICBN stands for **International Code of Botanical Nomenclature.**
- It is the set of rules and recommendations for the formal scientific names that are given to plants.

# Can you find a specific book from here?


Let’s Bring
Some Order!!

HISTORIA DE LA FILOSOFÍA
BERTRAND RUSSELL
HISTORIA UNIVERSAL
J. M. ROBERTS
HISTORIA DE LA LITERATURA UNIVERSAL
HESÍODO
TEOGONÍA
SUMMA LITERARIA
6
Franz Kafka
Narrativa Completa
Seix Barral
HOMERO
ODISEA
Vicios ancestrales
Antonio Gala
El manuscrito carmesí
Isaac Asimov
Historia de los Egipcios

Arrangement based on specific criteria helps in studying diversity of life too!!

# Classification

Process by which anything is **grouped into convenient categories** based on some easily observable characters

# Basis of Earliest Classification

Basic needs of food

Shelter

Clothing

# Basis of Modern Classification

External characteristics

Structure of cell

Development process

Ecological information of organisms

What image do you see when you think of a dog ?

Suppose I was to say mammals, what would come to your mind?

The scientific term for these categories is **taxa**.









# Taxonomy

# Taxonomy


The branch of study that deals with principles and procedures of **identification, classification and nomenclature of organisms**

# Steps of Modern Taxonomy

Characterisation

↓

Identification

↓

Classification

↓

Nomenclature

# Steps of Modern Taxonomy

The organism to be studied is described for all its **morphological and other characteristics**

**Characterisation**

↓

**Identification**

↓

**Classification**

↓

**Nomenclature**

# Steps of Modern Taxonomy

Based on the studied characteristics, the **identification of organism** is carried out to know whether it is similar to any of the known group or taxa

**Characterisation**

↓

**Identification**

↓

**Classification**

↓

**Nomenclature**

# Steps of Modern Taxonomy

**Characterisation**

↓

**Identification**

↓

**Classification**

↓

**Nomenclature**

**Arrangement of organisms** into groups or categories on the basis of their affinities or relationships

# Steps of Modern Taxonomy

Characterisation

↓

Identification

↓

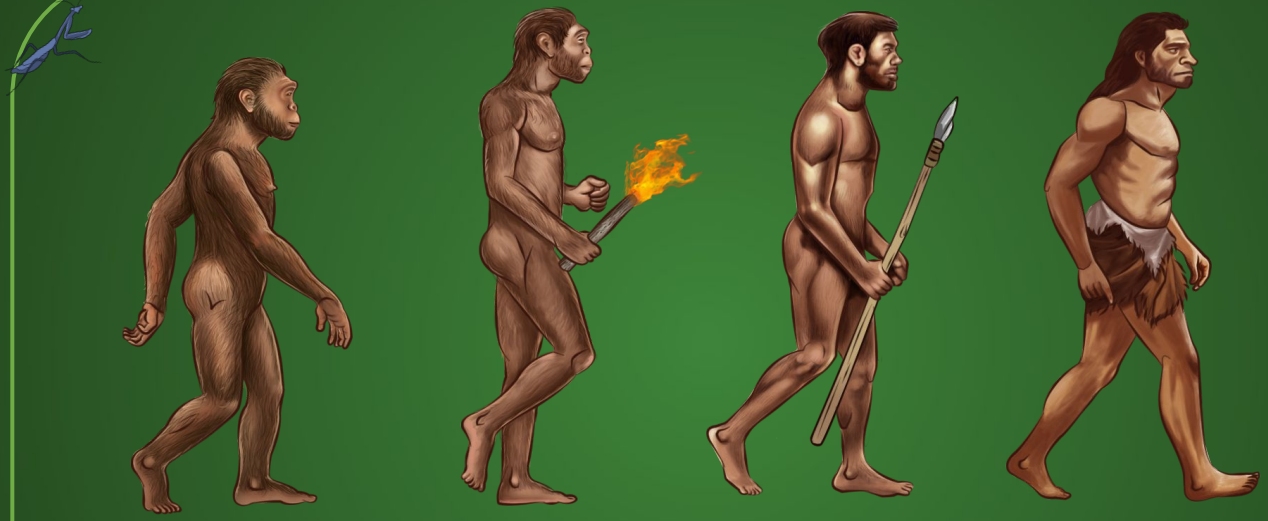
Classification

↓

Nomenclature

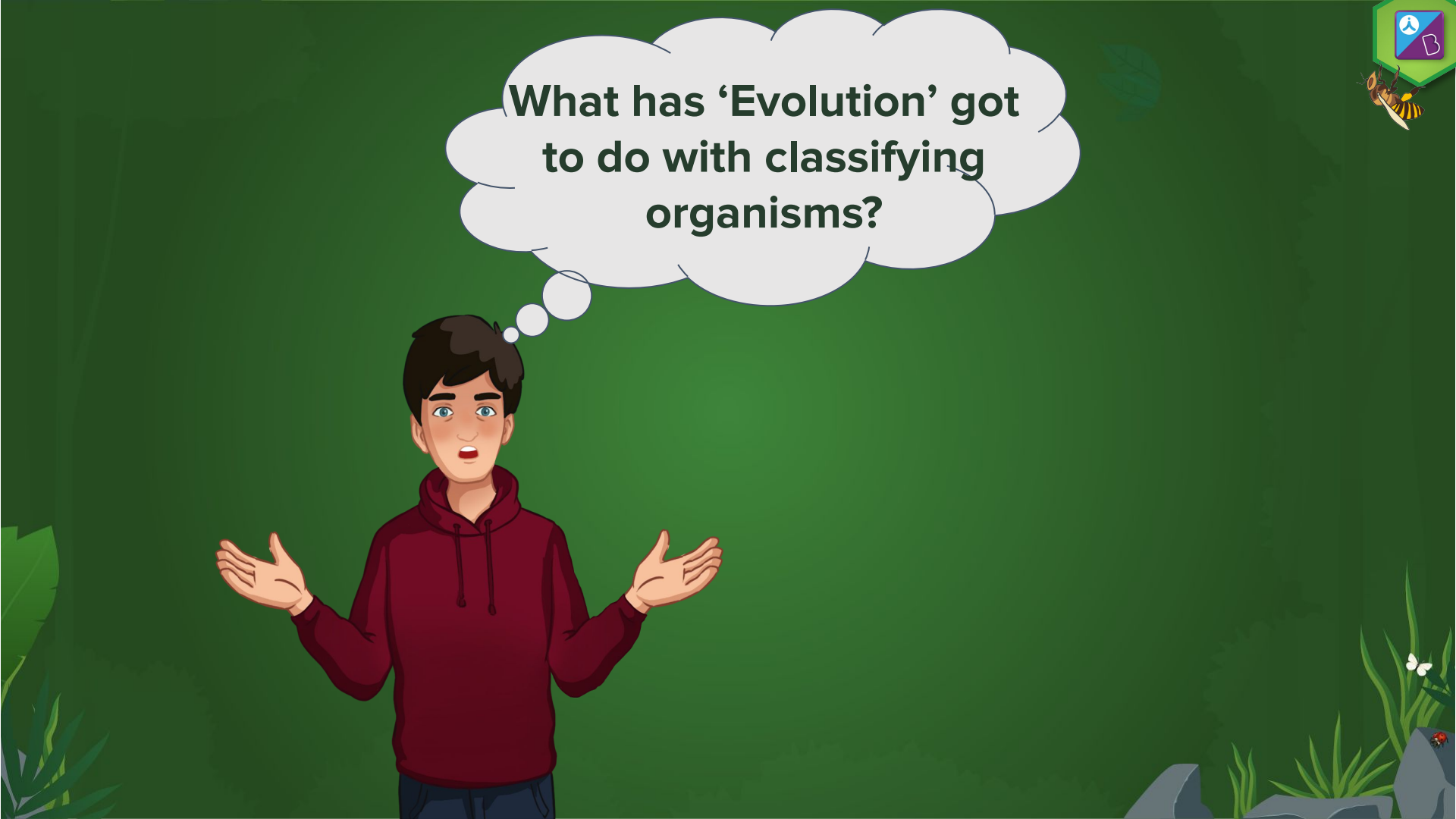
**Provide distinct and proper names** to organisms as per the established **universal practices and rules**

# Do you know what is Evolution?



# Evolution

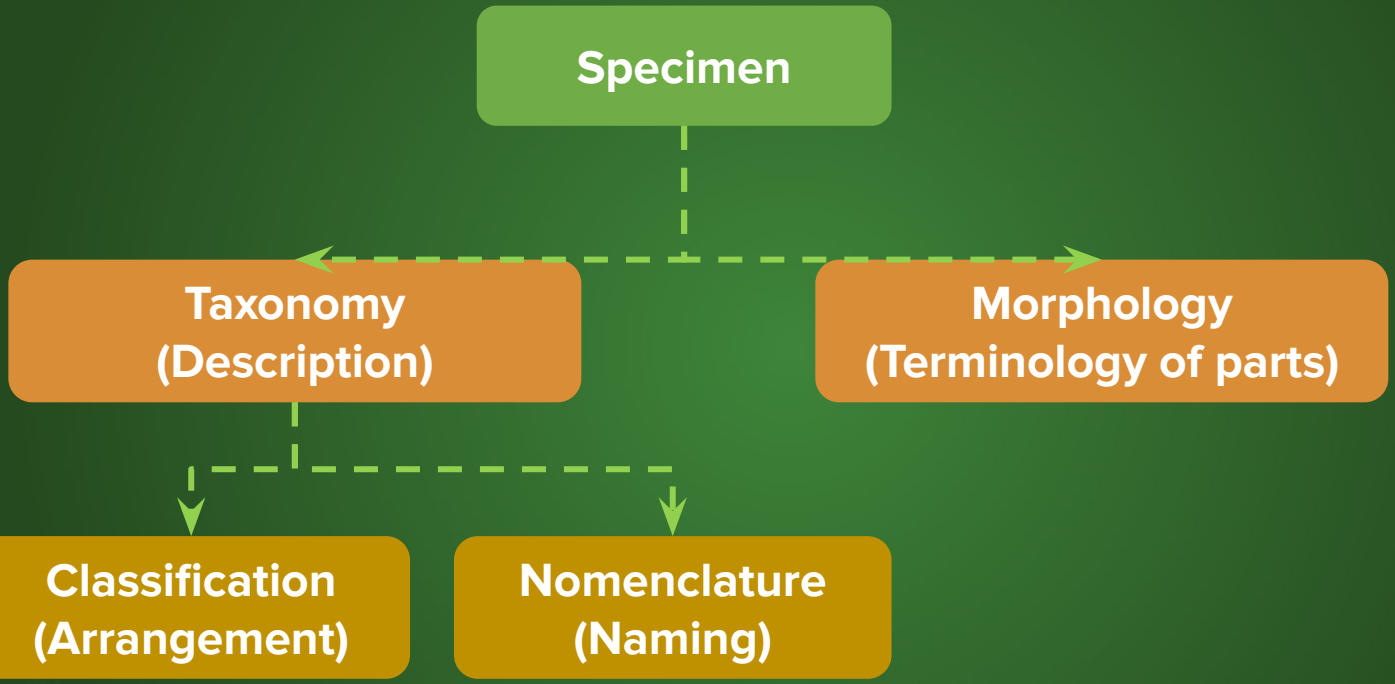
Evolution is the gradual process of **change and development** in an organism.


What has ‘Evolution’ got to do with classifying organisms?

# Systematics

- Study of **the evolutionary relationship** between organisms
- Important tool **for identifying and classifying** newly discovered organisms

Taxonomy, systematics, classification are often used synonymously but technically **they are not the same.**

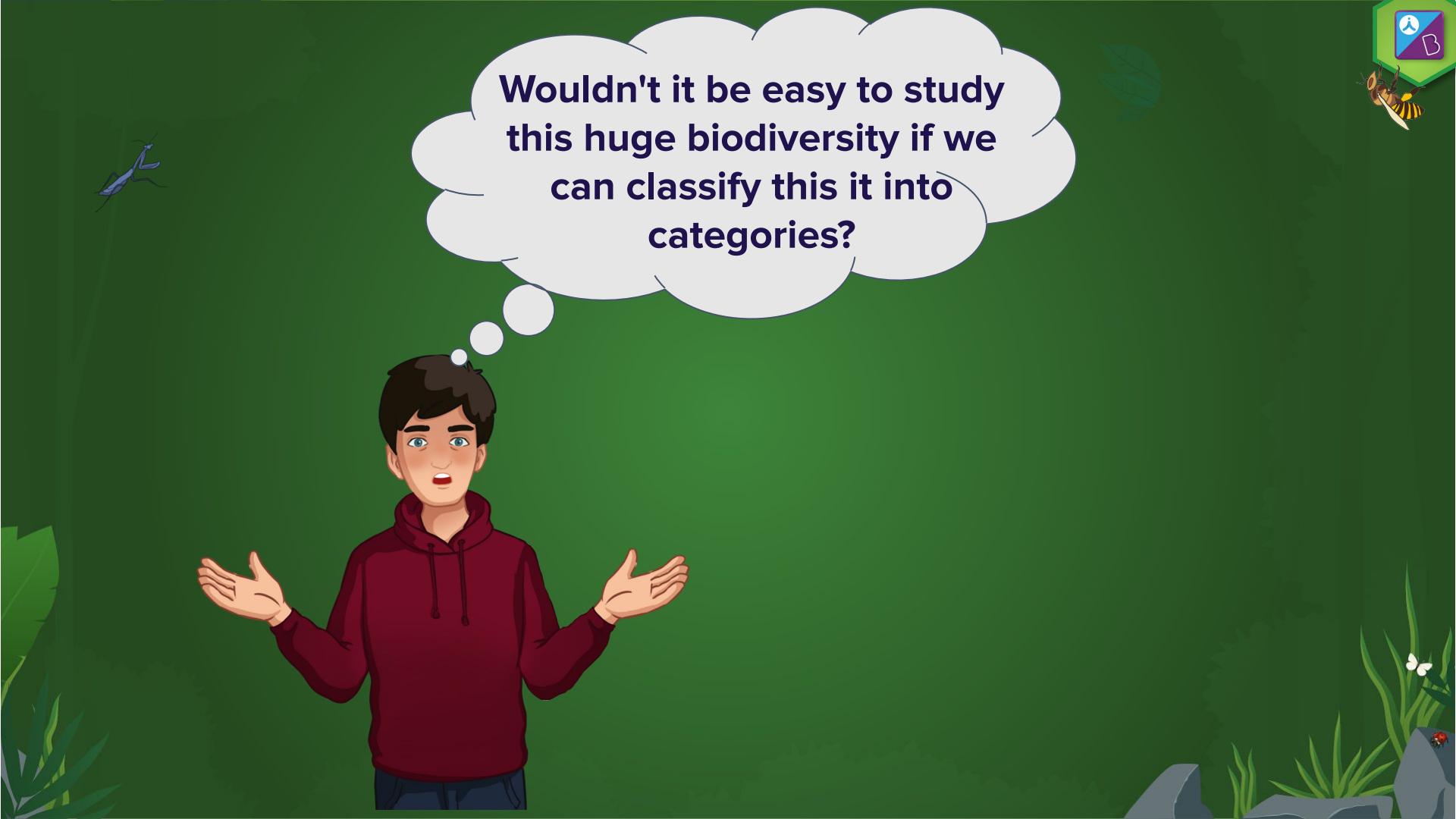

Specimen
Taxonomy
(Description)
Morphology
(Terminology of parts)
Classification
(Arrangement)
Nomenclature
(Naming)





# Be ready to be awed!!!





Wouldn't it be easy to study this huge biodiversity if we can classify this it into categories?









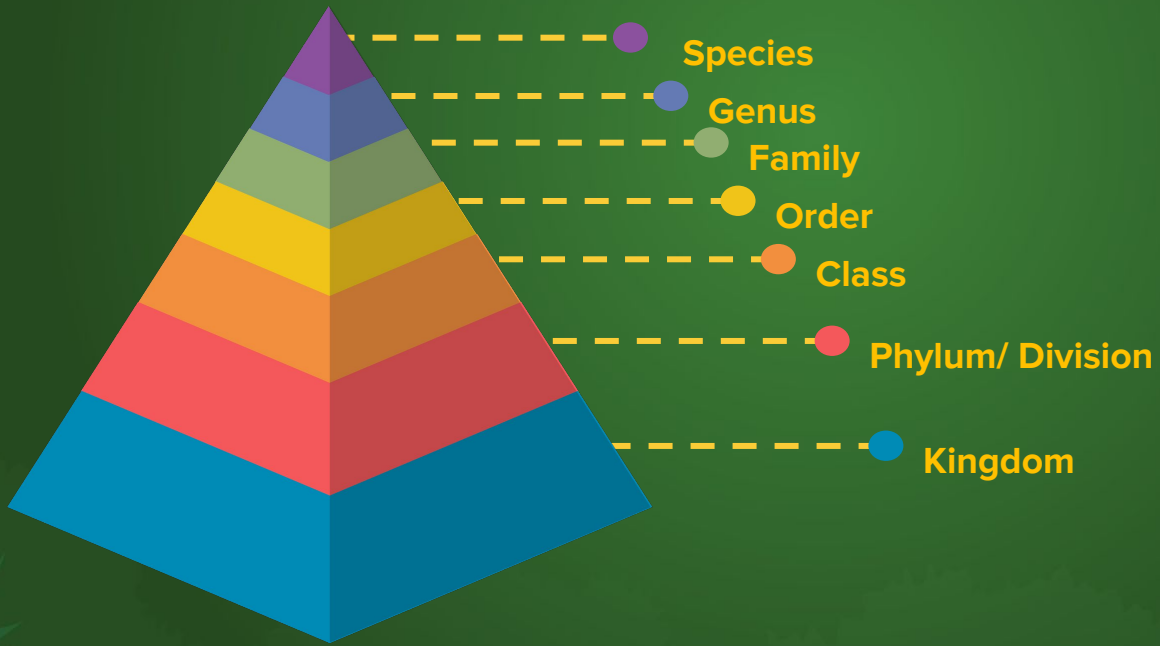
# Taxonomic Categories

# Mnemonic Time!

| Kids | Play | Cricket | On | Fine | Grassy | Space |
|---|---|---|---|---|---|---|
| Kingdom | Phylum | Class | Order | Family | Genus | Species |

# Taxonomic Categories

Taxon → Taxonomical Category → Taxonomical Hierarchy



# Taxonomic Categories

Increase in number of organisms

- Kingdom
- Phylum
- Sub Phylum
- Class
- Order
- Family
- Genus
- Species

Decrease in similar characters.

Taxonomic hierarchy with the categories

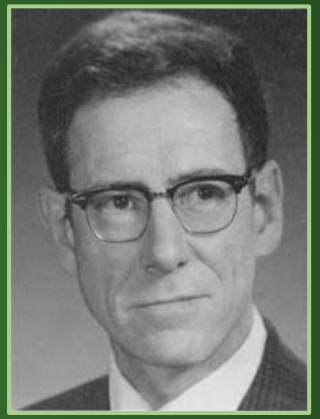
# Taxonomic Categories

## Kingdom

- **Highest category** of biological classification
- Includes all organisms which **share a set of distinguishing common characters**

# Taxonomic Categories

**Kingdom**



R. H. Whittaker proposed 5 kingdoms of organisms

**5 Kingdoms**

- **Animal**
- **Protists**
- **Bacteria**
- **Plants**
- **Fungi**

# Taxonomic Categories

## Phylum Or Division

1. Category below kingdom
2. Based on common features
3. In kingdom plantae, it is called division

# Taxonomic Categories

## Phylum Or Division

### Phylum chordata

Urochordata

Cephalochordata

Vertebrata

# Taxonomic Categories

## Phylum Or Division

### Division thallophyta

*Ulva*

*Chara*

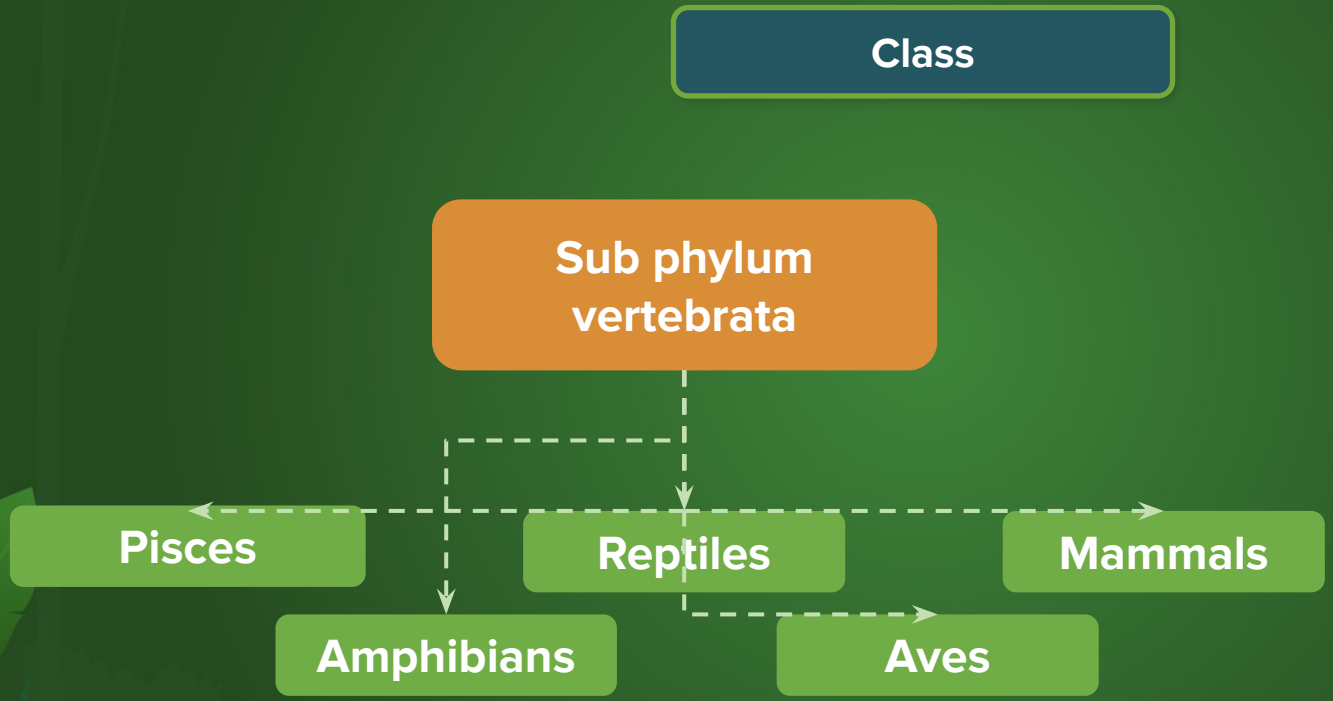
*Cladophora*

# Taxonomic Categories

## Class

- Made up one or more related orders
- In plants: It ends in suffixes **- phyceae, - opsida and - ae**
- In animals: The suffix **is not fixed**

# Taxonomic Categories



# Taxonomic Categories

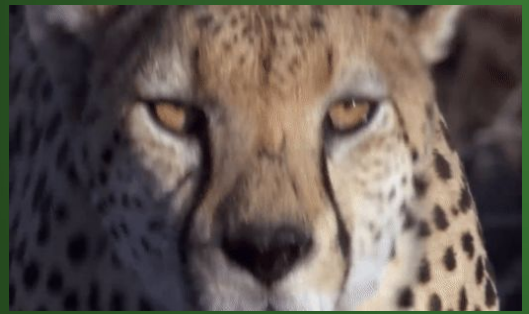
## Order

- Assemblage of families resembling one another in a few characters
- Ends in **suffix - ales** in plants

# Taxonomic Categories

## Order

- **Order Carnivora** contains related families of Canidae, Felidae



# Taxonomic Categories

## Family

- Group of **related genera**
- **In plants**: Characterized on the basis of both vegetative and reproductive features

# Taxonomic Categories

## Family

### Family Felidae

# Taxonomic Categories

**Genus**

**Genus**

- Category **below family**
- **First word** of a scientific name

**Monotypic**

- Have single species
- E.g., *Homo sapiens*

**Polytypic**

- Have several species
- E.g., *Panthera, Solanum*

# Taxonomic Categories

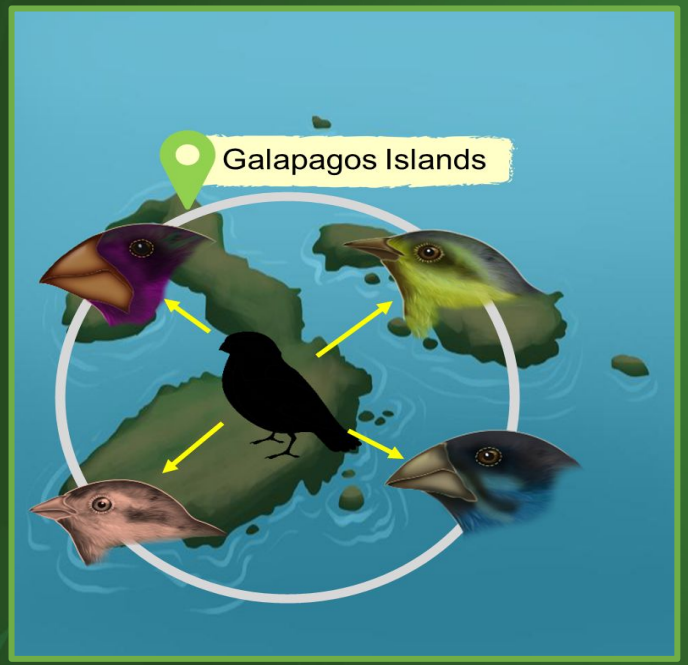
## Species

- **Lowest category** of classification
- **Second word** of a scientific name

It is a basic unit for **understanding taxonomy as well as evolution**

# Taxonomic Categories

## Species




- **Allopatric species**: Species which are created due **to geographical isolation**

# Taxonomic Categories

## Species

- **Sympatric species**: Species created as a result of **reproductive isolation**

**The hawthorn fly** is an example of sympatric speciation based on a preference of **egg-laying location**

# Organisms with their Taxonomic Categories









# Taxonomic Categories

**Man**

| | |
|---|---|
| Kingdom | Animalia |
| Phylum | Chordata |
| Sub Phylum | Vertebrata |
| Class | Mammalia |
| Order | Primate |
| Family | Hominidae |
| Genus | *Homo* |
| Species | *sapiens* |

# Taxonomic Categories

**Housefly**

| | |
|---|---|
| Kingdom | Animalia |
| Phylum | Arthropoda |
| Class | Insecta |
| Order | Diptera |
| Family | Muscidae |
| Genus | *Musca* |
| Species | *domestica* |

# Taxonomic Categories

**Mango**

| | |
|---|---|
| Kingdom | Plantae |
| Division | Angiospermae |
| Class | Dicotyledonae |
| Order | Sapindales |
| Family | Anacardiaceae |
| Genus | *Mangifera* |
| Species | *indica* |

# Taxonomic Categories

**Wheat**

| | |
|---|---|
| Kingdom | Plantae |
| Division | Angiospermae |
| Class | Monocotyledonae |
| Order | Poales |
| Family | Poaceae |
| Genus | *Triticum* |
| Species | *aestivum* |





# Past Year NEET Questions




Q1

Match Column-I with Column-II for housefly classification and select the correct option using the codes given below: (NEET 2016 II)

| Column I | Column II |
|---|---|
| a. Family | 1. Diptera |
| b. Order | 2. Arthropoda |
| c. Class | 3. Muscidae |
| d. Phylum | 4. Insecta |

A a-4, b-2, c-1, d-3

B a-3, b-1, c-4, d-2

C a-3, b-2, c-4, d-1

D a-4, b-3, c-2, d-1

# Discussion

**Taxonomically it is as below:**

**Housefly**

| | |
|---|---|
| Phylum | Arthropoda |
| Class | Insecta |
| Order | Diptera |
| Family | Muscidae |
| Genus | *Musca* |
| Species | *domestica* |

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A a-4, b-2, c-1, d-3

**B a-3, b-1, c-4, d-2**

C a-3, b-2, c-4, d-1

D a-4, b-3, c-2, d-1

Q2

Which of the following is against the rules of IUCN? (NEET 2019)

A. Handwritten scientific names should be underlined

B. Every species should have a generic name and a specific epithet

C. Scientific names are in Latin and should be italicized

D. Generic and specific names should be written starting with small letters

# Discussion

## Rules of Nomenclature

- Generally written in **Latin**
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# Keep Learning!