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Typification

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Type concept

Type

- A type is an objective, permanent standard of reference by which a scientific name is defined.

It is the "anchor" or "name-bearer" for a specific name-bearing taxon (family, genus and species).

- Without a type, a scientific name would have no definite reference point.

Type specimen

- For a taxon, the type is a **single, specific animal specimen** (or sometimes a series of specimens) on which the original published description is based.
- This specimen is preserved in a museum or collection and can be examined by anyone.
- It serves as the permanent reference for what that species name means.

Typification

- Typification is the formal, published process of designating a type for a taxon.
- It involves specifying which specimen(s) represent the type material.
- This process is governed by the International Code of Zoological Nomenclature (ICZN), specifically Articles 61-75.

Example: When you use the name *Panthera leo* (lion), there is a specific holotype specimen preserved in a museum somewhere that defines what this name means **scientifically.**

Need of Types

Reason	Explanation
Permanence	Provides an unchanging, physical reference that lasts forever (if properly preserved)
Objectivity	Removes ambiguity about what a name refers to
Universality	Ensures all scientists worldwide refer to the same organism when using a species name
Stability	Prevents confusion and allows taxonomic decisions to be made consistently
Dispute Resolution	Allows resolution of taxonomic conflicts through examination of the type specimen

33.
BROWN
CR.

Lew. Muſ.

DESCRIPTION. LENGTH ſix inches. Bill an inch long, moderately bent, and duſky brown; in the middle a pale orange ſpot: the plumage on the upper parts of the body brown: ſides of the neck the ſame, edged with white: throat and breaſt barred brown and white: belly very pale brown: tail at leaſt two inches and a half long, even at the end, and of a brown colour: quills brown, with pale edges: legs black: claws the ſame, long, and hooked.

PLACE. Said to inhabit ſome part in the *South Seas*, but where uncertain.

fuſca. 40. C. fuſca, gula et pectore fuſco alboque lineatis.
Brown Creeper. *Lath. ſyn.* I. 2. *p.* 732. *n.* 33.
Habitat in terra maris auſtralis, 6 *pollices longa.*
Roſtri *medium macula pallide aurantia;* pennae *ad colli latera margine albo;* abdomen *pallidius;* cauda *aequalis;* pedes *nigri;* ungues *nigri, longi, adunci.*

The Rules of the Game

ICZN sets the rule for typification.

Key ICZN Concepts About Types:

- **Article 61:** Principle of Typification
- **Article 72:** General provisions (type series, name-bearing types, eligibility)
- **Article 73:** Name-bearing types fixed in original publication (holotypes and syntypes)
- **Article 74:** Name-bearing types fixed subsequently (lectotypes)
- **Article 75:** Name-bearing types for extinct or lost originals (neotypes)
- **Recommendations 72A-72F & 73A-73J:** Detailed guidelines for proper typification procedure

Fundamental Principle

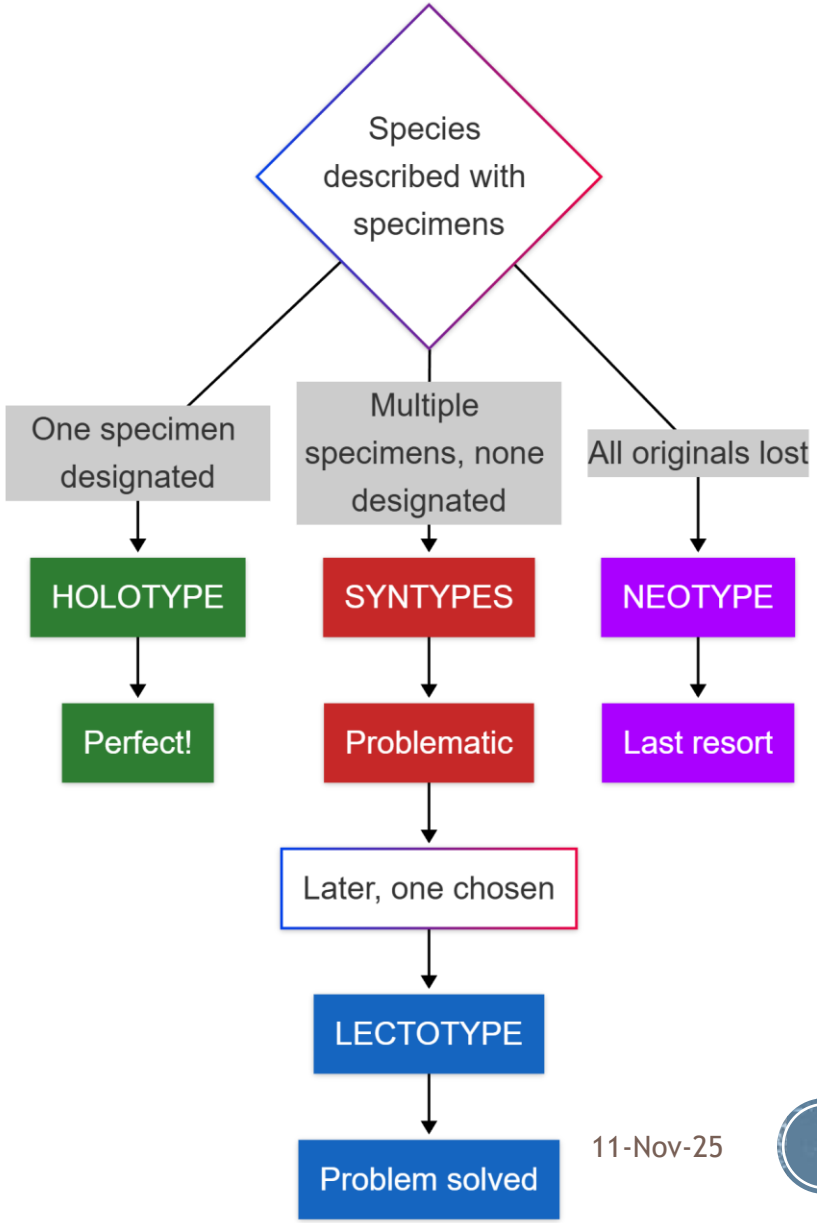
- **ICZN Art. 61.1:** Each nominal taxon in the family, genus or species groups has actually or potentially a name-bearing type. The fixation of the name-bearing type of a nominal taxon provides the objective standard of reference for the application of the name it bears. It is the "anchor" or "name-bearer" for a specific name-bearing taxon (family, genus and species).
- **ICZN Art. 61.1.3:** Once fixed, name-bearing types are stable and provide objective continuity; change only through Articles 74-75 or Commission's plenary power (Art. 81).

Types That Actually Fix a Name

Only certain types formally "fix" or "bear" a scientific name according to the ICZN.

Three Name-Bearing Types (ICZN Art. 72.1.2):

- **Holotype** – Single specimen, designated by original author (ICZN Art. 73.1)
- **Lectotype** – Selected later from syntypes (ICZN Art. 74.1)
- **Neotype** – Designated when originals lost (ICZN Art. 75.1)
- **Syntypes** – Multiple specimens if no holotype designated (ICZN Art. 73.2)



The Single Specimen of Choice

Holotype

The single specimen upon which a new nominal species-group taxon is based in the original publication.

Characteristics

- Explicitly designated by the original author in the original publication
- Clearly marked and identified in the original description
- Serves as the permanent reference for that species name
- Only one holotype per species name (ICZN Art. 73.1)
- Must be housed in a recognised research museum or institution

Required data

- Specimen's size and condition
- Location (type locality), date, and collector's name
- Sex and developmental stage
- Host species (if it's a parasite)
- Unique collection number (Register number)
- Morphological Characteristics
- Preservation Method

Example: *Adult male, collected from the forests of Andringitra, Madagascar, 15 May 2023, by J. Smith. Preserved in 70% ethanol. Deposited in the California Academy of Sciences (CAS Catalogue Number: CAS-2023-1456). Measurements: Snout-vent length 45 mm, head width 12 mm. Sex: male; developmental stage: adult. Diagnostic characters: bright blue colouration with red stripe on dorsum.*

Understanding the Type Series

Definition

Type series of a nominal species-group taxon consists of all specimens included by author in new nominal taxon (whether directly or by bibliographic reference), **except any that author expressly excludes**.

Paratype

- Each specimen of a type series **other than the holotype** is used by the original author in his or her description.
- **Importance:** Very valuable because they show variation within newly described species.
- **Status: Do NOT have name-bearing function** (ICZN Art. 72.1.3) but are useful for comparative studies.
- **ICZN Art. 72.4.5:** When a holotype is designated, remaining type series specimens are paratypes (not syntypes).

Allotype

- A single specimen of **opposite sex to the holotype**, explicitly designated by original author.
- Useful in curatorial practice when sexual dimorphism is pronounced.
- **NOT formally regulated by the ICZN**; it is simply a **curatorial convention** (Recommendation 72A).
- **No Name-Bearing Function:** Like paratypes, allotypes do **NOT formally fix the name**; only holotype does.

Syntype (=Cotype)

The Historical Problem

- 18th & 19th centuries: Scientists did not always explicitly designate a single holotype when describing a species
- An author might describe new species based on 5, 10, or even 50 specimens without saying, "This one specimen is THE type"
- This created ambiguity and confusion about which specimen name actually refers to
- ICZN Art. 72.3: Modern species (after 1999) must have a holotype designated originally

Definition (Article 73.2)

Syntypes are specimens of a type series that collectively constitute the name-bearing type

Fundamental Principle

- If you have 5 syntypes from 5 different localities, which one represents the **type locality**?
- If they differ in morphology, which represents the **true species**?
- This ambiguity can block taxonomic progress
- ICZN Art. 72.10: When syntypes exist, they collectively constitute name-bearing type (equal status).

Lectotype

Definition

One of a series of syntypes subsequently selected as the single name-bearing type specimen after the original species establishment

How it works? (ICZN Art. 74.1)

- Later scientist (a "reviser") carefully studies all old syntypes
- After careful comparison, the reviser designates one of the syntypes as the **Lectotype** in a formal, published paper
- This specimen is now a **single, name-bearing type**; all ambiguity is removed
- Remaining syntypes automatically become **Paralectotypes** (ICZN Art. 73.2.2, 74.1.3)

Paralectotype

- **Definition:** Any specimen of a former syntype series remaining after designation of lectotype
- Paralectotypes are like paratypes but derived from the lectotype designation rather than the holotype
- They assist in taxonomic work but have no name-bearing function
- Eligible for neotype selection if lectotype lost (ICZN Rec. 75A)

The Last Resort in Nomenclature

The extreme situation

- Holotype is lost in a museum fire
- Entire syntype series destroyed in war
- Specimens deteriorate beyond recognition
- Museum collection is discarded
- Original material cannot be located after extensive searches

What happens to the scientific name if all original type material is gone?

Under very strict conditions, **Neotype** can be designated

Neotype

Definition (Art. 75.1)

A substitute specimen selected as the name-bearing type to replace the holotype, lectotype, syntype, or prior neotype, when there is a need to define nominal species objectively and no name-bearing type is believed to be extant (in existence).

Critical conditions for Neotype designations

- All original types proven LOST or DESTROYED (ICZN Art. 75.1)
  - Not just misplaced or "not found yet"
  - But demonstrably gone forever (fire, war, deliberate discard, etc.)
  - Author must have diligently searched for originals
- Published evidence of loss/destruction (ICZN Rec. 75A):
  - Neotype is not done lightly
  - The author must document why they believe the original is gone
  - The history of the specimen and the institution must be investigated
- Neotype selected from (ICZN Art. 75.3.5 & Rec. 75A):
  - Preference 1: Surviving paratypes or paralectotypes (if available)
  - Preference 2: Material from type locality (topotypic material)
  - Last resort: Material from locality resembling the original collection site
  - Must match original description as closely as possible
- Full publication and justification (ICZN Art. 75.1):
  - Must be formally published in a peer-reviewed venue
  - Must include detailed reasoning and comparative data
  - Should cite ICZN Article 75 explicitly
- Institutional deposit (ICZN Art. 75.3.7):
  - Neotype must be deposited in a recognised, accessible institution
  - Information about the neotype and justification must be published
  - Museum records must clearly mark its status

Supplementary Types (Non-Nomenclatural)

These are NOT name-bearing types but useful in taxonomic and comparative work

Plesiotype (Hypotype)

A specimen on which subsequent descriptions or figures are based (not the original description)

- Used to redescribe species, provide better figures, or give new information
- **Status:** Has no name-bearing function (ICZN Art. 72.1.3)
- **Importance:** Valuable for confirming species identity and understanding morphological variation
- **When used:** In revision or monographic studies of a group
- Often published with detailed figures/measurements not in the original description

Example: *1950s monographer studying frogs might designate plesiotypes to illustrate diagnostic characters not clearly shown in the original 1850 description.*

Typical Specimens (Non-Nomenclatural) (ICZN Glossary)

These specimens are NOT formal name-bearers, but provide important comparative and geographic data

Topotype

A specimen collected from exact same locality as the original type material (type locality)

- **Why valuable (ICZN context):** Helps verify species variation is not due to geographic differences
- **Uses:** Comparative anatomy, understanding intraspecific variation, and verifying geographic distribution
- **Status:** Not part of the original type series but extremely useful for confirmation
- **Importance:** Demonstrates consistency at a specific locality
- **Example:** If the holotype from "Borneo, 1995," the topotype would be a specimen from Borneo collected later

Metatype

A specimen that has been compared by the original author with the holotype and determined to be conspecific (same species)

- Shows the original author recognised other specimens as belonging to the same species
- **Status:** Curatorial term with no formal ICZN standing
- Provides author's confidence in species boundaries

Typical Specimens (Non-Nomenclatural) (ICZN Glossary)

These specimens are NOT formal name-bearers, but provide important comparative and geographic data

Isotype

A duplicate specimen of the holotype, collected at the same time and place as the holotype

- **When issued:** When the author had multiple specimens from a single collecting event and designated one as the holotype
- **Value:** Often distributed to other museums, so multiple institutions have reference material
- **Status:** Not part of the type series formally but closely related
- **Importance:** Provides backup reference in geographically dispersed institutions

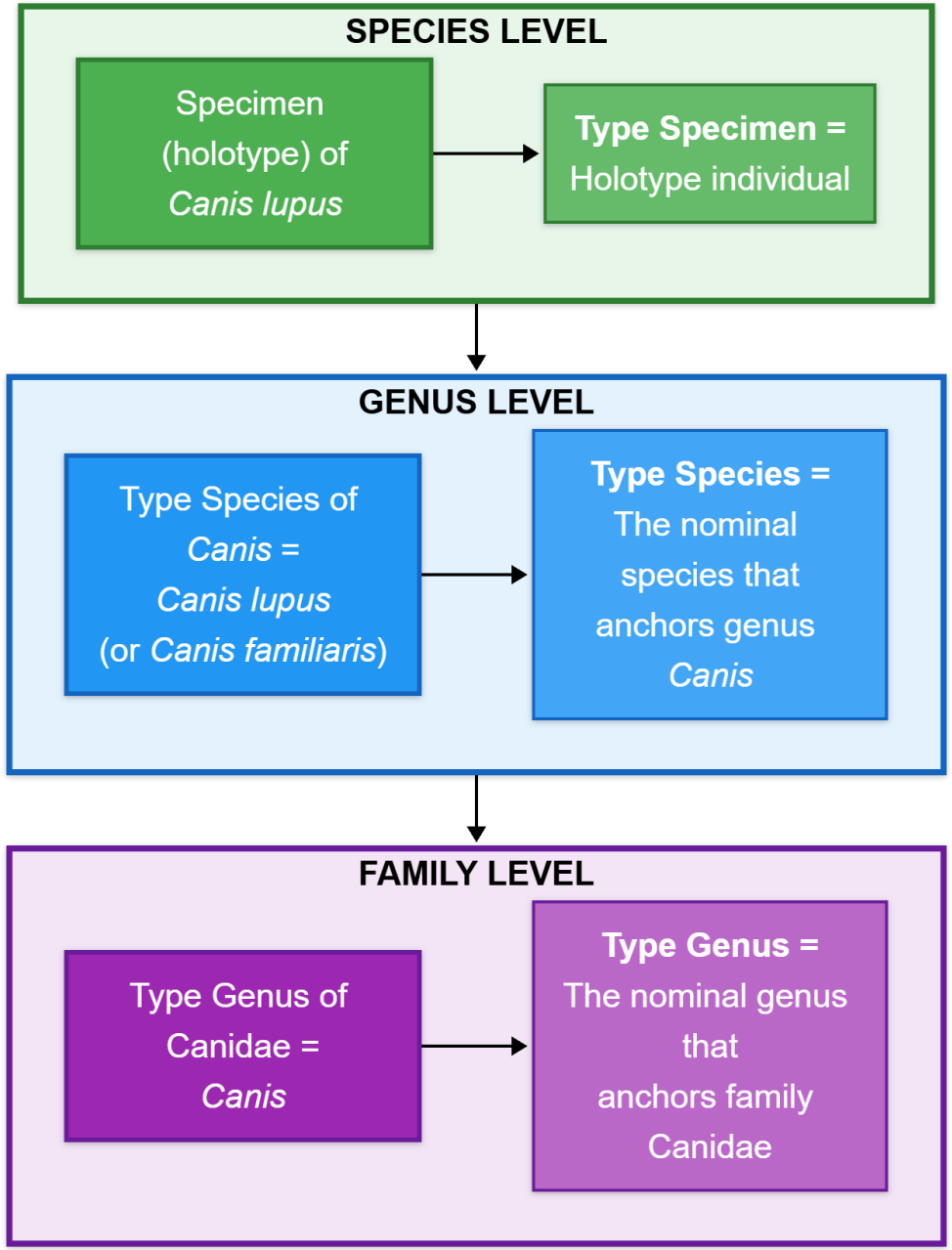
Homotype

A specimen compared by a later researcher (not the original author) to the holotype and verified as belonging to the same species

- Results from subsequent taxonomic work and verification
- **Value:** Confirms species boundaries and recognises variation
- **Use:** In monographs and revisions

Three levels of typification

Taxonomic Level	Name-Bearing Type	Called	ICZN Article
Species	Specimen (holotype, lectotype, neotype, syntypes)	Type Specimen	Art. 72-75
Genus	A nominal species (e.g.,*Panthera leo*)	Type Species	Art. 67-70
Family	A nominal genus (e.g.,*Panthera*)	Type Genus	Art. 63-65



Type Species (or Generitype)

Definition (Art. 67.1)

The name-bearing type of a nominal genus or subgenus is a nominal species called the 'type species'

How it works?

- When a new genus is established, one species is designated (or implied) as "type species" for that genus
- This species name becomes permanently linked with the genus name
- If the genus must be split into multiple genera later, the type species automatically keeps the original genus name
- **ICZN Art. 67.1.1:** Nominal genus and nominotypical subgenus have the same type species.

Example: The type species for the genus *Panthera* (big cats) is *Panthera leo* (the lion). If *Panthera* were split into separate genera, *P. leo* would retain the name *Panthera leo*. While, for example, Tiger might be moved to a different genus, e.g., *Tigris tigris*, while maintaining its species name.

Fixation of type species

- **Original Designation** by the author
- **Monotypy:** only one species in that genus
- **Absolute tautonym** Ex. *Rattus rattus*
- **Linnean tautonym:** Applies to species created before 1758. In this case, the species was called with either the genus name or the species was wrongly grouped into another genus with the Pre-Linnean name. For example: *Anas cygnus* -> *Cygnus cygnus*
- **Subsequent designation:** Later author designates type species from original genus composition. Only first such designation is valid.

Type species ≠Genotype

ICZN Recommendation 67A

Only the term 'type species' or a strictly equivalent term in another language should be used in referring to the name-bearing type of nominal genus or subgenus. To avoid ambiguity, the term **'genotype'**, which has widespread use in different senses in genetics, **should not be used instead of 'type species.'**

Historical issue

- Some older literature used term **"Genotype"** to mean "type species of genus"
- This practice is obsolete and **STRICTLY FORBIDDEN** by modern ICZN standards

Why Forbidden?

- Extreme confusion with the genetic term "genotype" (genetic makeup of an organism)
- - Using "genotype" for taxonomy causes massive miscommunication

The genotype of *Panthera* is *Panthera leo*. ✗

The type species of *Panthera* is *Panthera leo*. ✓

Type Genus

Definition (Art. 63)

The name-bearing type of a nominal family-group taxon is a nominal genus called the type genus on which the family-group name is based.

Fixation of type genus

- **Article 64:** The author can choose ANY genus in the family, regardless of which genus has the oldest name. This is at author's discretion.
- **Article 64A:** An author who wishes to establish a nominal family-group taxon should choose as its type genus a genus that is both well-known and representative of the family-group taxon.

Family Name	Type Genus	Connection
Felidae	Felis	Felis + -idae = Felidae
Canidae	Canis	Canis + -idae = Canidae
Hominidae	Homo	Homo + -idae = Hominidae
Phasianidae	Phasianus	Phasianus + -idae = Phasianidae
Columbidae	Columba	Columba + -idae = Columbidae

The Importance of Type Concept in Zoology

Resolving Taxonomic Disputes (ICZN Art. 61.1.1):

- When taxonomists disagree about what a species name means, they examine the type specimen
- Type specimen is the final arbiter
- ICZN provides an objective standard for settling disputes

Describing New Species (ICZN Art. 72.3 & 73):

- Every time a zoologist describes a new species, they must:
  - **Designate holotype explicitly** (ICZN Art. 73.1.1)
  - Preserve it in a museum (ICZN Art. 75.3.7)
  - Provide full documentation (ICZN Rec. 73C)
  - Publish all label data (ICZN Rec. 72E)

Museum Curation (ICZN Rec. 72F):

- Museum professionals must:
  - Properly label and preserve type specimens (Rec. 72D)
  - Maintain detailed records (Rec. 72F)
  - Make types available to researchers (Rec. 72F.3)
  - Communicate information about types (Rec. 72F.5)

Taxonomy and Systematics (ICZN Art. 72.10):

- Type specimens are a reference library of animal diversity
- They anchor all of the taxonomy
- **ICZN Art. 72.10:** "Holotypes, syntypes, lectotypes and neotypes are bearers of scientific names of all nominal species-group taxa. They are international standards of reference providing objectivity in zoological nomenclature."

Conservation and Legal Issues (ICZN Context):

- When determining if a population is a new endangered species or a known species, the type specimen provides objective evidence
- Type specimens document biodiversity status at a specific time

Publication and Peer Review (ICZN Standards):

- Scientific journals require:
  - Holotypes designated (ICZN Art. 73.1.1)
  - Types deposited in recognised museums (ICZN Rec. 72F)
  - Full data provided for verification (ICZN Rec. 73C)
  - Museum catalogue numbers published (ICZN Rec. 72E)

Why types will always matter

Stability in Changing World (ICZN Art. 61.1.3):

- Species definitions may be revised based on new data
- Specimens may be reclassified based on molecular evidence

But holotype remains ultimate reference point – "Once fixed, name-bearing types are stable"

- ICZN ensures stability despite taxonomic revision

Permanence in Taxonomy (ICZN Art. 72.10):

- New technologies (DNA, microCT, etc.) allow new studies of types
- Types from the 1800s still provide definitive answers
- **Physical specimens are the foundation of all zoological knowledge** – ICZN Art. 72.10
- Types are "held in trust for science"

Bridging Past and Future (ICZN Context):

- Types preserve the work of historical naturalists
- Allow modern researchers to verify and improve on past work
- Connect current taxonomy to historical roots
- Ensure the cumulative nature of science

Emerging Considerations (Modern ICZN Practice)

Digital Imaging:

- High-resolution 3D scans of types
- Online accessibility without handling delicate specimens
- Global research access while preserving originals
- Complements ICZN requirement for accessibility

Molecular Data:

- DNA extraction from museum specimens (careful with holotypes)
- Molecular typing complements the morphological type concept
- **Question:** Can DNA data change the name application? **Answer (ICZN context):** Generally no – type is fixed by ICZN
- Enhances research without altering nomenclatural status

Climate Change & Conservation:

- Types of extinct species are increasingly important
- Reference specimens for species on the brink of extinction
- Historical types show species as existed before human impact
- Crucial for documenting biodiversity loss

Testing Your Understanding (MCQ)

- **Q1:** What is holotype according to ICZN Article 73.1?
  A) Most common form of species
  B) Single specimen designated by original author as name-bearing type
  C) Any specimen used to describe species
  D) Specimen from type locality
- **Q2:** If author describes new species using 10 specimens but doesn't designate holotype, what are these called?
  A) Paratypes
  B) Neotypes
  C) Syntypes
  D) Holotypes
- **Q3:** ICZN Art. 61.1 states name-bearing type provides what for name application?
  A) Suggestion for scientific opinion
  B) Objective standard of reference
  C) Historical context only
  D) Genetic information
- **Q4:** Term "genotype" for type species of genus is:
  A) Preferred modern terminology
  B) Acceptable ICZN alternative
  C) Genetic makeup of organism
  D) Forbidden by ICZN Rec. 67A
- **Q5:** Under what circumstances can neotype be designated per ICZN Art. 75.1?
  A) When researcher prefers different specimen
  B) When all original type material proven lost/destroyed
  C) When specimen too fragile to handle
  D) When new genetic data suggests different species
- Explain why types are necessary in zoology?
- Distinguish holotype and paratype
- What purpose of designating lectotype

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The END

The type concept ensures that zoology is a cumulative science – that each discovery builds on those before it, with NO AMBIGUITY about what we are talking about

ICZN link