

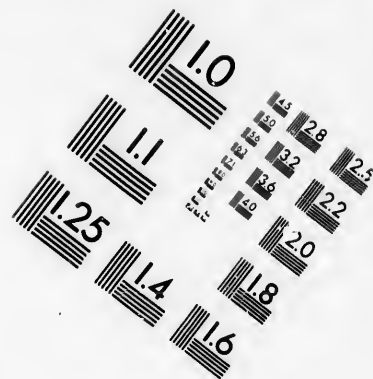
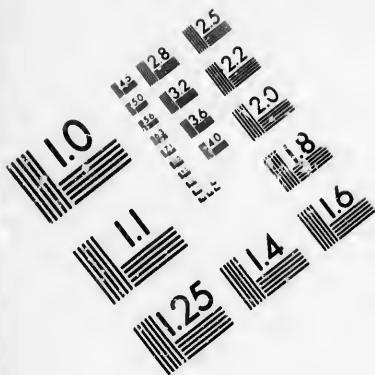
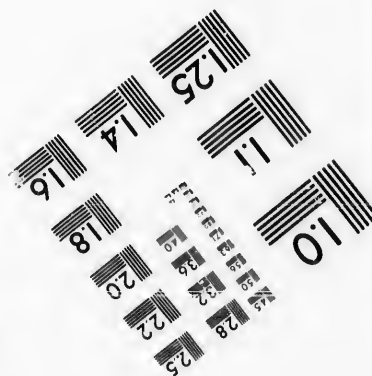
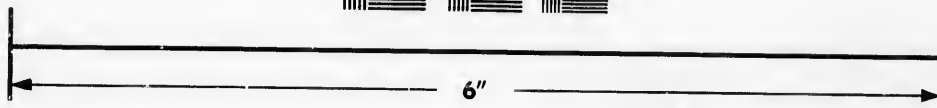
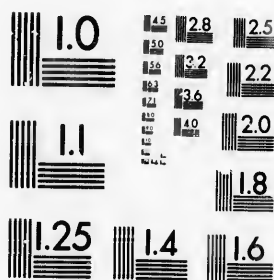


IMAGE EVALUATION TEST TARGET (MT-3)



Photographic
Sciences
Corporation

23 WEST MAIN STREET
WEBSTER, N.Y. 14580
(716) 872-4503

**CIHM/ICMH
Microfiche
Series.**

**CIHM/ICMH
Collection de
microfiches.**



Canadian Institute for Historical Microreproductions / Institut canadien de microreproductions historiques

© 1986

Technical and Bibliographic Notes/Notes techniques et bibliographiques

The Institute has attempted to obtain the best original copy available for filming. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of filming, are checked below.

L'Institut a microfilmé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de filmage sont indiqués ci-dessous.

- ☒ Coloured covers/
Couverture de couleur
- ☐ Covers damaged/
Couverture endommagée
- ☐ Covers restored and/or laminated/
Couverture restaurée et/ou pelliculée
- ☐ Cover title missing/
Le titre de couverture manque
- ☐ Coloured maps/
Cartes géographiques en couleur
- ☐ Coloured ink (i.e. other than blue or black)/
Encre de couleur (i.e. autre que bleue ou noire)
- ☐ Coloured plates and/or illustrations/
Planches et/ou illustrations en couleur
- ☐ Bound with other material/
Relié avec d'autres documents
- ☐ Tight binding may cause shadows or distortion
along interior margin/
La reliure serrée peut causer de l'ombre ou de la
distorsion le long de la marge intérieure
- ☐ Blank leaves added during restoration may
appear within the text. Whenever possible, these
have been omitted from filming/
Il se peut que certaines pages blanches ajoutées
lors d'une restauration apparaissent dans le texte,
mais, lorsque cela était possible, ces pages n'ont
pas été filmées.
- ☐ Additional comments:/
Commentaires supplémentaires:

- ☐ Coloured pages/
Pages de couleur
- ☐ Pages damaged/
Pages endommagées
- ☐ Pages restored and/or laminated/
Pages restaurées et/ou pelliculées
- ☒ Pages discoloured, stained or foxed/
Pages décolorées, tachetées ou piquées
- ☒ Pages detached/
Pages détachées
- ☒ Showthrough/
Transparence
- ☐ Quality of print varies/
Qualité inégale de l'impression
- ☐ Includes supplementary material/
Comprend du matériel supplémentaire
- ☐ Only edition available/
Seule édition disponible
- ☐ Pages wholly or partially obscured by errata
slips, tissues, etc., have been refilmed to
ensure the best possible image/
Les pages totalement ou partiellement
obscurcies par un feuillet d'errata, une pelure,
etc., ont été filmées à nouveau de façon à
obtenir la meilleure image possible.

This item is filmed at the reduction ratio checked below/
Ce document est filmé au taux de réduction indiqué ci-dessous

10X	12X	14X	16X	18X	20X	22X	24X	26X	28X	30X	32X
					✓						

The copy filmed here has been reproduced thanks to the generosity of:

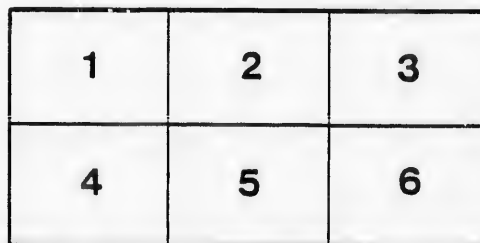
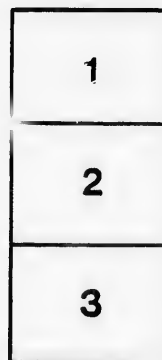
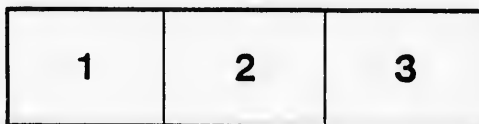
Législature du Québec
Québec

The images appearing here are the best quality possible considering the condition and legibility of the original copy and in keeping with the filming contract specifications.

Original copies in printed paper covers are filmed beginning with the front cover and ending on the last page with a printed or illustrated impression, or the back cover when appropriate. All other original copies are filmed beginning on the first page with a printed or illustrated impression, and ending on the last page with a printed or illustrated impression.

The last recorded frame on each microfiche shall contain the symbol ➡ (meaning "CONTINUED"), or the symbol ▼ (meaning "END"), whichever applies.

Maps, plates, charts, etc., may be filmed at different reduction ratios. Those too large to be entirely included in one exposure are filmed beginning in the upper left corner, left to right and top to bottom, as many frames as required. The following diagrams illustrate the method:



L'exemplaire filmé fut reproduit grâce à la générosité de:

Législature du Québec
Québec

Les images suivantes ont été reproduites avec le plus grand soin, compte tenu de la condition et de la netteté de l'exemplaire filmé, et en conformité avec les conditions du contrat de filmage.

Les exemplaires originaux dont la couverture en papier est imprimée sont filmés en commençant par le premier plat et en terminant soit par la dernière page qui comporte une empreinte d'impression ou d'illustration, soit par le second plat, selon le cas. Tous les autres exemplaires originaux sont filmés en commençant par la première page qui comporte une empreinte d'impression ou d'illustration et en terminant par la dernière page qui comporte une telle empreinte.

Un des symboles suivants apparaîtra sur la dernière image de chaque microfiche, selon le cas: le symbole ➡ signifie "À SUIVRE", le symbole ▼ signifie "FIN".

Les cartes, planches, tableaux, etc., peuvent être filmés à des taux de réduction différents. Lorsque le document est trop grand pour être reproduit en un seul cliché, il est filmé à partir de l'angle supérieur gauche, de gauche à droite, et de haut en bas, en prenant le nombre d'images nécessaire. Les diagrammes suivants illustrent la méthode.

*With regards of
the author*

14

SYNOPSIS
OF THE
Course of Zoology,
UNIVERSITY OF M'GILL COLLEGE.
SESSION 1859-60.

Montreal, Published by B. Dawson & Son.

SYNOPSIS
OF THE
Course of Zoology,
UNIVERSITY OF M'GILL COLLEGE.
SESSION 1859-60.

Professor J. W. DAWSON, LL.D., F.G.S. &c.

Introductory.—Objects and limits of the Science—methods of study—
uses and advantages.

I. GENERAL VIEWS OF ANIMAL LIFE.

Organised and Unorganised Bodies—Division of the Organised into
the Animal and Vegetable. The former, how distinguished from
the latter, by sensation and voluntary motion, and by peculiarities
of form, chemical composition, manner of nutrition and reproduc-
tion.

II. ANIMAL HISTOLOGY.

The elementary cell, its material, parts, growth, reproduction and me-
tamorphoses.
Tissues resulting from cells.—Areolar, cartilaginous, osseous, muscular,
nervous,—modifications of, and substitutes for them in the lower
animals—Microscopic examination of tissues.

III. FUNCTIONS OF THE ANIMAL.

- (a) Functions of the Animal Life,—sensation, general and special—
voluntary motion—instinct and intelligence.
- (b) Functions of the Vegetative Life,—nutrition, including digestion,
secretion, respiration and circulation ; reproduction.

IV. CLASSIFICATION OF ANIMALS.

- (a) Observation of forms and structures,—relations of these to functions and uses—relations to type or plan—homology and affinity, as distinguished from analogy and adaptation.
- (b) The species in Zoology,—its elementary character as the unit of the science—its determination, by unity of form, structure and instinct, and continuous reproduction,—its constancy and limits of variation.
- (c) Genera, orders and classes in Zoology,—their general basis in homology—and the special distinctive grounds on which they are founded—natural and artificial arrangements—proper limits of the genus—evils of undue multiplication of genera.
- (d) Provinces of the Animal Kingdom.
 - 1—Vertebrata.
 - 2—Articulata.
 - 3—Mollusca.
 - 4—Radiata.

Type of structure in each province—limits of the provinces—relative rank in nature.

V. DESCRIPTIVE ZOOLOGY.

(In the course of the Lectures examples will be given of species representing each order or family in the following arrangement, with especial reference to Canadian Zoology, and notices of Geographical and Geological distribution. The classification adopted is based on a comparison of the conclusions of the best authorities on the several groups, with the view of exhibiting to the student the natural affinities of animals in the clearest possible manner.)

Province I.—RADIATA.

- Class 1. Protozoa—Animalculæ, Sponges.
- “ 2. Acalephæ—Jelly fishes, and Hydroid polyps.
- “ 3. Anthozoa—Sea Anemones, Coral Animals.
- “ 4. Echinodermata—Sea urchins, Star fishes.

Class I.—PROTOZOA.

Order 1. *Rhizopoda* :—

- (a) Without shells—ex. *Amoeba*, *Actinophrys*
- (b) Calcareous foraminated shells, *Foraminifera*—
ex. *Orbulina*, *Entosolenia*, *Miliolina*, *Polystomella*.
- (c) Silicious shells, *Polycisina*—ex. *Podocystir*, *Lithocyclia*, *Haliomma*.

Order 2. *Porifera*—ex. *Spongia*, *Halichondria*, *Tethea*, *Spongiilla*.Order 3. *Infusoria*—ex. *Lucophrys*, *Loxodes*, *Vorticella*. True limits of this class, how separated from plants, gemmules polyps, &c.

Class II.—ACALEPHÆ.

Order 1. *Hydroidea*, or Hydroid Polyps—ex. *Hydra*, *Tubularia*, *Campanularia*, *Sertularia*." 2. *Siphonophora*, or Physogrades—ex. *Physalia*." 3. *Discophora*, or Pulmogrades.(a) Bare-eyed—ex. *Madeeria*, *Sarsia*, &c.(b) Clothed-eyed—ex. *Rhizostoma*, *Cyanea*, &c." 4. *Ctenophora*, or Ciliogrades—ex. *Cydippe*, *Beroë*, *Cestum*.

Larval Polype forms of Acalephæ, and general embryonic relations of Acalephs and Hydroids.

Class III.—ANTHOZOA, OR POLYPI.

Order 1. *Zoantharia*, or Actinoids.Fam. 1. *Actiniadæ*—ex. *Actinia*." 2. *Xeniidæ*—ex. *Zoanthes*." 3. *Madreporidæ*—ex. *Fungia*, *Caryophyllia*, *Astræa*, *Meandrina*, &c.Order 2. *Alcyonaria*, or Alcyonoids.Fam. 1. *Alcyonidæ*—ex. *Alcyonium*." 2. *Pennatulidæ*—ex. *Pennatulæ*." 3. *Tubiporidæ*—ex. *Tubipora*." 4. *Corallidæ*—ex. *Corallium*, *Gorgonia*, &c.

Reproduction of Anthozoa; formation of coral reefs.

Class IV.—ECHINODERMATA.

Order 1. *Crinoidea*—ex. *Comatula*, *Pentacrinus*," 2. *Asteroidea*—ex. *Asterias*, *Ophiura*, *Euryale*." 3. *Echinoidea*—ex. *Echinus*, *Clypeaster*, *Cidaris*." 4. *Holothuridea*—ex. *Holothuria*." 5. *Sipunculoidea*—ex. *Sipunculus*.

Reproduction and larval forms of Echinoderms.

Province II.—MOLLUSCA.

Class 1. *Polyzoa* or *Bryzoa*.—Sea Mats &c." 2. *Tunicata*—Tunicates." 3. *Brachiopoda*—*Terebratulæ*, &c." 4. *Lamellibranchiata*—Ordinary bivalve shell-fish." 5. *Pteropoda*—*Clios*, *Hyaleas*." 6. *Gasteropoda*—Univalve shell-fish and sea slugs." 7. *Cephalopoda*—Cuttle-fishes, Nautili.(a) *Acephalous*.

Class I.—POLYZOA or BRYOZOA.

(a) (*Infundibulata*.)Order 1. (*Cheilostomata*.)Fam. 1. *Catenicellidæ*—ex. *Catenicella*.

- Fam. 2. *Serioporiadae*—ex. Hippothoa.
 " 3. *Salicornariadae*—ex. Salicornia.
 " 4. *Cellulariadae*—ex. Cellularia.
 " 5. *Cabereadae*—ex. Caberea.
 " 6. *Bicellariadae*—ex. Bicellaria.
 " 7. *Gemellariadae*—ex. Gemellaria.
 " 8. *Flustradae*—ex. Flustra.
 " 9. *Membraniporidae*—ex. Membranipora, Lepralia.
 " 10. *Celiporidae*—ex. Cellepora.
 " 11. *Escharidae*—ex. Eschara, Retepora.

Order 2. (*Cyclostomata*.)

- Fam. 1. *Crisiadae*—ex. Crisia.
 " 2. *Idmoncadae*—ex. Idmonea.
 " 3. *Tubuliporadae*—ex. Tubulipora.
 " 4. *Discoporidae*—ex. Discopora.

Order 3. (*Ctenostomata*.)

- Fam. 1. *Vesiculariadae*—ex. Bowerbankia.
 " 2. *Alcyoniadae*—ex. Alcyonidium.

Order 4. (*Pedicellinae*.)

- Fam. 1. *Pedicellinidae*—ex. Pedicellina.

(b) (*Hippocrepia*.)

- Fam. 1. *Cristatellidae*—ex. Cristatella.
 " 2. *Plumatellidae*—ex. Alcyonella.
 " 3. *Paludicellidae*—ex. Paludicella.

Questions as to affinities of Polyzoa.

Class II.—TUNICATA.

Order 1. (*Ascidiae*.)

- Fam. 1. *Ascidiidae*—ex. Cynthia, Ascidium.
 " 2. *Botryllidae*—ex. Botryllus.
 " 3. *Clavellinae*—ex. Perophora.
 " 4. *Pyrosomidae*—ex. Pyrosoma.

Order 2. (*Biphora*.)

- Fam. 1. *Salpidae*—ex. Salpa.

Class III.—BRACHIOPODA.

- Fam. 1. *Terebratulidae*—ex. Terebratula.
 " 2. *Spiriferidae*—ex. Spirifer.
 " 3. *Rhynchonellidae*—ex. Rhynchonella, Atrypa,
 Pentamerus.
 " 4. *Orthis*—ex. Orthis, Leptæna.
 " 5. *Productidae*—ex. Productus, Chonetes.
 " 6. *Craniidae*—ex. Crania.
 " 7. *Discinidae*—ex. Discina.
 " 8. *Lingulidae*—ex. Lingula, Obolus.

Class IV.—LAMELLIBRANCHIATA.

(a) (*Asiphonida*.)

- Fam. 1. *Ostrea*—ex. Ostrea, Anomia, Pecten, Spondylus, Plicatula.
 " 2. *Aviculida*—ex. Avicula, Meleagrina, Pinna.
 " 3. *Mytilida*—ex. Mytilus, Modiola, Lithodermus.
 " 4. *Arcada*—ex. Arca, Cucullaea, Nucula, Leda.
 " 5. *Trigonida*—ex. Trigonina.
 " 6. *Unionida*—ex. Unio, Anodon, Alasmodon.

(b) (*Siphonida*.)

- Fam. 7. *Chamida*—ex Chama, Dicerias.
 " 8. *Hippuritida*—ex. Hippurites, Radiolites.
 " 9. *Tridacnida*—ex. Tridacna, Hippopus.
 " 10. *Cardiada*—ex. Cardium.
 " 11. *Lucinida*—ex. Lucina, Corbis, Kellia.
 " 12. *Cycladida*—ex. Cyclas, Cyrena, Pisidium.
 " 13. *Cyprinida*—ex. Cyprina, Astarte, Cardita.
 " 14. *Venerida*—ex. Venus, Cytherea, Petricola.
 " 15. *Mactrida*—ex. Mactra, Gnathodon.
 " 16. *Tellinida*—ex. Tellina, Sanguinolaria, Donax.
 " 17. *Solenida*—ex. Solen, Machaera.
 " 18. *Myacida*—ex. Mya, Saxicava, Glycimeris.
 " 19. *Anatinida*—ex. Anatina, Pandora.
 " 20. *Gastrochaenida*—ex. Gastrochaena.
 " 21. *Pholadida*—ex. Pholas, Teredo.

(b) *Encephalous*.

Class V.—PTEROPODA.

(a) With external shell.

- Fam. 1. *Hyaleida*—ex. Hyalea, Cleodora, Conularia.
 " 2. *Limacinida*—ex. Limacina, Spirialis.

(b) Without external shell.

- Fam. 3. *Clidæ*—ex. Clio, Pelagia.

Class VI.—GASTEROPODA.

Order 1. *Nucleobranchiata*, or *Heteropoda*.

- Fam. 1. *Firolida*—ex. Carinaria.
 " 2. *Atlantida*—ex. Atlanta, Bellerophon, Maclurea.

Order 2. *Opisthobranchiata*.(a) (*Nudibranchiate*).

- Fam. 1. *Elysida*—ex Elysia.
 " 2. *Phyllirhoidæ*—ex. Phyllirhoe.
 " 3. *Acolida*—ex. Aeolis, Glaucus.
 " 4. *Tritoniada*—ex. Tritonia.
 " 5. *Dorida*—ex Doris.

(b) (*Tectibranchiate*).

- Fam. 6. *Phyllidiada*—ex. Phyllidia.

Fam. 7. *Pleurobranchidae*—ex. *Pleurobranchus*, *Umbrella*.

" 8. *Aplysiidae*—ex. *Aplysia*.

" 9. *Bullidae*—ex. *Bulla*, *Scaphander*.

" 10. *Tornatellidae*—ex. *Tornatella*.

Order 3. *Pulmonifera*.

(a) (*Operculate*.)

Fam. 1. *Aciculidae*—ex. *Acicula*.

" 2. *Cyclostomidae*—ex. *Cyclostoma*.

(b) (*Inoperculate*.)

Fam. 3. *Auriculidae*—ex. *Auricula*.

" 4. *Limnaeidae*—ex. *Limnaea*, *Ancylus*, *Physa*, *Planorbis*.

" 5. *Oncidiidae*—ex. *Oncidium*.

" 6. *Limacidae*—ex. *Limax*, *Testacella*.

" 7. *Helicidae*—ex. *Helix*, *Succinea*, *Bulimus*, *Achatina*, *Pupa*.

Order 4. *Prosobranchiata*.

(a) Without siphons. (*Holostomata*.)

Fam. 1. *Chitonidae*—ex. *Chiton*.

" 2. *Dentaliidae*—ex. *Dentalium*.

" 3. *Patellidae*—ex. *Patella*, *Acmœa*.

" 4. *Calyptraeidae*—ex. *Calyptraea*, *Crepidula*, *Pileopsis*.

" 5. *Fissurellidae*—ex. *Fissurella*, *Puncturella*.

" 6. *Haliotidae*—ex. *Haliotis*, *Pleurotomaria*, *Murchisonia*, *Ianthina*.

" 7. *Turbinidae*—ex. *Turbo*, *Trochus*, *Euomphalus*.

" 8. *Neritidae*—ex. *Nerita*.

" 9. *Paludinidae*—ex. *Paludina*, *Ampullaria*.

" 10. *Turritellidae*—ex. *Turritella*, *Vermetus*, *Scaloria*, *Caecum*.

" 11. *Littorinidae*—ex. *Littorina*, *Rissoa*, *Lacuna*.

" 12. *Melanidae*—ex. *Melania*.

" 13. *Cerithiidae*—ex. *Cerithium*, *Aporrhais*.

" 14. *Pyramidellidae*—ex. *Odostomia*, *Loxonema*.

" 15. *Naticidae*—ex. *Natica*, *Velutina*.

(b) With siphons. (*Siphonostomata*.)

Fam. 1. *Cypraeidae*—ex. *Cypraea*.

" 2. *Volutidae*—ex. *Voluta*.

" 3. *Conidae*—ex. *Conus*, *Bela*.

" 4. *Buccinidae*—ex. *Buccinum*, *Purpura*, *Nassa*, *Harpa*, *Columbella*, *Olivia*.

" 5. *Muricidae*—ex. *Murex*, *Triton*, *Trichotropis*, *Pyruca*, *Fusus*.

" 6. *Strombidae*—ex. *Strombus*, *Pteroceras*.

Class VII.—CEPHALOPODA.

Order 1. (*Tetrabranchiata*.)

Fam. 1. *Nautilidae*—ex. Nautilus, Lituities.

" 2. *Orthoceratidae*—ex. Orthoceras, Gomphoceras, Cyrtoceras, &c.

" 3. *Ammonitidae*—ex. Ammonites, Hamites, Baculites, &c.

Order 2. (*Dibranchiata*.)

(a) Decapoda.

Fam. 1. *Teuthidae*—ex. Loligo, Belotueuthis, Onychoteuthis.

" 2. *Belemnitidae*—ex. Belemnites.

" 3. *Sepiidae*—ex. Sepia.

" 4. *Spirulidae*—ex. Spirula.

(b) Octopoda.

Fam. 1. *Octopodidae*—ex. Octopus.

" 2. *Argonautidae*—ex. Argonauta.

Province III.—ARTICULATA.

Class 1. *Annulata*—Worms.

" 2. *Crustacea*—Soft-shell-fish.

" 3. *Myriapoda*—Centipedes, Millipedes.

" 4. *Insecta*—Insects.

" 5. *Arachnida*—Mites, spiders, scorpions.

Class I.—ANNULATA.

Order 1. *Trematoda*—ex. Echinococcus, Taenia, Bothrycephalus, Planaria.

" 2. *Nematoidea*—ex. Gordius, Trichina, Ascaris, Strongylus.

" 3. *Suctoria*—ex. Sanguisuga.

" 4. *Terricola*—ex. Lumbricus, Nais.

" 5. *Tubicolæ*—ex. Serpula, Sabella, Amphitrite, Terebella, Spirorbis.

" 6. *Errantia*—ex. Arenicola, Syllis, Nereis, Aphrodite.

Class II.—CRUSTACEA.

Sub Class 1. (*Rotifera*.)—ex. Rotifer, Hydatina, Stephanoceros.

(Various opinions relating to the affinities of Rotifers, and uncertainties attending them at present.)

Sub Class 2. (*Entomostraca*.)

Order 1. *Xiphosura*—ex. Limulus.

" 2. *Trilobites*—ex. Asaphus, Calymene, Trinucleus.

" 3. *Phyllopoda*—ex. Branchipus.

" 4. *Cladocera*—ex. Daphnia

Order 5. *Ostrapoda*—ex. Cypris, Cytherina.

" 6. *Copepoda*—ex. Cyclops.

" 7. *Cirrepedia*.

Fam. 1. *Balanidae*—ex. Balanus, Coronula.

" 2. *Verrucidae*—ex. Verruca.

" 3. *Lepadidae*—ex. Lepas.

" 8. *Epizoa*—ex. Peniculus, Lerneæ, Achtheres.

Sub Class 3. (*Malacostraca*.)

(a) *Edriophthalmia*—Sessile eyes.

Order 1. *Laemodipoda*—ex. Caprella.

" 2. *Isopoda*—ex. Oniscus, Fluvicola, Limnoria, Cymothes.

" 3. *Amphipoda*—ex. Gammarus.

(b) (*Podophthalmia*).—Stalked eyes.

" 4. *Stomapoda*—ex. Squilla.

" 5. *Decapoda*.

(a) *Macroura*—ex. Homarus, Astacus, Crangon.

(b) *Anomoura*—ex. Pagurus, Remipes.

(c) *Brachyura*—ex. Cancer, Pinnotheres.

Class III.—MYRIAPODA.

Order 1. *Chilognatha*—ex. Julus.

" 2. *Chilopoda*—ex. Scolopendra, Lithobius.

Class IV.—INSECTA.

Order 1. *Aptera*—ex. Lepisma, Podura, Pediculus.

" 2. *Aphaniptera*—ex. Pulex.

" 3. *Diptera*.

Fam. 1. *Hippoboscidae*—ex. Hippobosca.

" 2. *Oestridæ*—ex. Gasterophilus.

" 3. *Muscidae*—ex. Musca, Chlorops, Oscinis.

" 4. *Tabanidae*—ex. Tabanus.

" 5. *Tipulidae*—ex. Cecidomyia, Chironomus, Simulium.

" 6. *Culicidae*—ex. Culex.

" 4. *Lepidoptera*.

(a) *Heterocera*.

Fam. 1. *Pterophorina*—ex. Pterophorus.

" 2. *Tineina*—ex. Tinea.

" 3. *Tortricina*—ex. Tortrix, Lozotaenia.

" 4. *Pyalidina*—ex. Pyralis, Hespera.

" 5. *Geometrina*—ex. Caperæ, Electra.

" 6. *Noctuina*—ex. Catocala, Plusia.

" 7. *Bombycina*—ex. Clisiocampa, Tropœa, Samia, Arctia, Spilosoma, Saturnia.

" 8. *Sphingina*—ex. Sphinx, Deilephila, Aegeria.

(3) *Rophalocera*.

- Fam. 1. *Hesperidae*—ex. *Hesperia*.
 " 2. *Lycanidae*—ex. *Chrysophanus*.
 " 3. *Nymphalidae*—ex. *Argynnis*, *Vanessa*.
 " 4. *Heleconidae*—ex. *Danais*.
 " 5. *Papilionidae*—ex. *Papilio*, *Colias*.

Order 5. *Hymenoptera*.

- (a) *Securifera*—ex. *Cimbex*, *Tenthredo*, *Tremex*.
 (b) *Pupivora*—ex. *Pelecinus*, *Pimpla*, *Ophion*, *Cynips*, *Chrysis*.
 (c) *Aculeata*.
 Heterogyna—ex. *Formica*, *Myrmica*.
 Fossores—ex. *Pepsis*, *Pelopaeus*.
 Diploptera—ex. *Vespa*.
 Anthophila—ex. *Apis*, *Bombus*.

Order 6. *Hemiptera*.

- (a) *Heteropterous*.
 Fam. 1. *Geocorisae*—ex. *Pentatoma*, *Cimex*, *Coreus*,
 Gerris.
 " 2. *Hydrocorisae*—ex. *Nepa*, *Ranatra*, *Notonecta*.
 (b) *Homopterous*.
 Fam. 3. *Cicadariae*—ex. *Cicada*, *Fulgora*.
 " 4. *Aphidii*—ex. *Aphis*.
 " 5. *Gallinsecta*—ex. *Coccus*.

Order 7. *Strepsiptera*.

Ex. *Xenas*, *Stylops*.

Order 8. *Neuroptera*.

- (a) *Subulicornes*.
 Fam. 1. *Libellulidae*—ex. *Libellula*, *Agriion*.
 " 2. *Ephemeridae*—ex. *Ephemera*.
 (b) *Planipennes*.
 Fam. 3. *Hemerobiidae*—ex. *Hemerobius*, *Osmylus*.
 " 4. *Perlidae*—ex. *Perla*.
 (c) *Plicipennes*.
 Fam. 5. *Phryganidae*—ex. *Phryganea*.

Order 9. *Orthoptera*.

- (a) *Cursoria*.
 Fam. 1. *Blattidae*—ex. *Blatta*.
 " 2. *Mantidae*—ex. *Mantis*, *Phyllium*, *Spectrum*.
 (b) *Saltatoria*.
 Fam. 3. *Achetidae*—ex. *Acheta*.
 " 4. *Gryllidae*—ex. *Gryllus*.
 " 5. *Locustidae*—ex. *Locusta*.

Order 10. *Coleoptera*.

- (a) *Pseudotrimeria*.
 Fam. *Coccinellidae*—ex. *Coccinella*.

- (b) *Pseudotetramera*.
 Fam. *Chrysomelidae*—ex. Cassida, Chrysomela.
Cerambycidae—ex. Clytus.
Pryonidae—ex. Orthosoma.
Curculionidae—ex. Ceutorhynchus, Balaninus.
- (c) *Heteromera*.
 Fam. *Meloidae*—ex. Meloe, Cantharis.
Tenebrionidae—ex. Tenebrio.
- (d) *Pentamera*.
 Fam. *Malachiidae*—ex. Malachius.
Lampyridae—ex. Lampyris.
Lycidae—ex. Lycus.
Elateridae—ex. Elater.
Buprestidae—ex. Buprestis, Stenuris.
Lucanidae—ex. Lucanus.
Scarabaeidae—ex. Melolontha.
Dermestidae—ex. Dermestes.
Staphylinidae—ex. Ocypus.
Sylphidae—ex. Necrophorus.
Gyrinidae—ex. Gyrinus.
Dytiscidae—ex. Dytiscus.
Carabidae—ex. Harpalus, Chlaenius, Calosoma,
 Carabus.
Cicindelidae—ex. Cicindela.

Class VII.—ARACHNIDA.

Order 1. *Dermophysa*—ex. Demodex.

“ 2. *Trachearia*—ex. Sarcoptes, Ixodes, Phalangium,
 Chelifer.

“ 3. *Pulmo-trachearia*.

Fam. 1. *Mygalidae*—ex. Mygale, Cteniza.

“ 2. *Araneidae*—ex. Epeira, Aranea.

“ 3. *Lycoridae*—ex. Tarantula, Salticus.

Order 4. *Pulmonaria*.

Fam. 1. *Phrynidae*—ex. Phrynus.

“ 2. *Scorpionidae*—ex. Scorpio.

Place of the higher Articulates in the system—mode of collection
 and preservation of specimens.

Province IV.—VERTEBRATA.

Class 1. *Pisces*—Fishes.

“ 2. *Reptilia*—Reptiles and Batrachians.

“ 3. *Aves*—Birds.

“ 4. *Mammalia*—Mammals.

Class I.—PISCES.

Cuvier's Classification:—

(a) *Osseous Fishes*, including, 1 Acanthopterygii; 2 Malacopterygii Abdominales; 3 Malacopterygii Sub-brachiales; 4 Malacopterygii Apoda; 5 Lophobranchii; 6 Plectognathi,
 (b) *Cartilaginous Fishes*—(Chondropterygii); 7 Sturiones; 8 Plagiostomi; 9 Cyclostomi.

Agassiz' Classification:—

Ctenoidei.

Cycloidei.

Placoidei.

Ganoidei.

Uses of these systems and objections to them.

*Muller's Classification.*Order 1. *Dermopteri*—ex. Amphioxus, Petromyzon." 2. *Malacopteri*.*Muraenidae*—ex. Muraena.*Clupeidae*—ex. Clupea.*Salmonidae*—ex. Salmo.*Cyprinidae*—ex. Cyprinus. Leuciscus, Catostomus.*Esocidae*—ex. Esox.*Siluridae*—ex. Pimelodus.Order 3. *Pharyngognathi*.*Scomber-esocidae*—ex. Scomber-Esox, Exocetus.*Cteno-Labridae*—ex. Ctenolabrus, Tautoga.*Cyclo-Labridae*—ex. Labrus.Order 4. *Anacanthini*.*Ophidiidae*—ex. Ophidium, Ammodytes.*Gadidae*—ex. Morrhua, Merlangus.*Pleuronectidae*—ex. Hypoglossus, Platessa.Order 5. *Acanthopteri*.*Percidae*—ex. Perca, Lucio-Perca, Centrarchus, Pomotis.*Sclerogenidae*—ex. Trigla, Cottus, Gasterosteus.*Scomberidae*—ex. Scomber, Thynnus.*Labyrinthobranchidae*—ex. Anabas.*Blenniidae*—ex. Anarrhicas.*Lophiidae*—ex. Lophius, Maltha.Order 6. *Plectognathi*.*Balistidae*—ex. Balistes.*Ostracionidae*—ex. Ostracion.

Order 7. *Lophobranchii*.*Syngnathidae*—ex. *Syngnathus*, *Hippocampus*.Order 8. *Ganoidei*.*Lepidosteidae*—ex. *Lepidosteus*.*Polypteridae*—ex. *Polypterus*.*Amiidae*—ex. *Amia*.*Sturionidae*—ex. *Accipenser*.

Extinct genera of Ganoids.

Order 9. *Protopteri*.*Sirenidae*—ex. *Lepidosiren*.Order 10. *Holocephali*.*Chimaeroidae*—ex. *Chimaera*.Order 11. *Plagiostomi*.*Cestracionidae*—ex. *Cestracion*.*Carcharidae*—ex. *Carcharias*.*Lamnidae*—ex. *Lamna*, *Selache*.*Galeidae*—ex. *Mustelus*.*Spinacidae*—ex. *Spinax*.*Scymnidae*—ex. *Scymnus*.*Zygaenidae*—ex. *Zygaena*.*Pristidae*—ex. *Pristis*.*Raiidae*—ex. *Raia*, *Pastinaca*, *Cephaloptera*.

Class II.—REPTILIA.

Order 1. *Batrachia* or Amphibia.(a) *Apoda*—ex. *Caecilia*.(b) *Amphipneusta*—ex. *Siren*, *Proteus*, *Menobrachus*,
Menopoma.(c) *Urodela*—ex. *Salamandra*, *Triton*.(d) *Anura*—ex. *Rana*, *Bufo*, *Hyla*.

Question of the right of Batrachians to constitute a separate Class.

Order 2. *Chelonia*.(a) *Chelonii*.*Cheloniidae*—ex. *Chelonia*.(b) *Amydæ*.*Trionycidae*—ex. *Aspidonectes*.*Chelydriæ*—ex. *Chelydra*.*Emydeæ*—ex. *Chrysemys*, *Emys*, *Cistudo*, *Glyptemys*.*Testudinidae*—ex. *Testudo*.Order 3. *Ophidia*.*Crotalidae*—ex. *Crotalus*, *Pelias*.*Coluberidae*—ex. *Coluber*, *Tropidonotus*, *Calamaria*,
Heterodon.*Boiidae*—ex. *Boa*, *Wenona*.*Typhlopidae*—ex. *Rena*.

Order 4. *Sauria*.*Scincidae*—ex. *Scincus*, *Anguis*.*Lacertinidae*—ex. *Lacerta*, *Zootoca*.*Monitoridae*—ex. *Monitor*.*Gekkotidae*—ex. *Platydictylus*.*Chamelonidae*—ex. *Chameleon*.*Iguanidae*—ex. *Iguana*, *Phrynosoma*, *Amblyrhynchus*.*Agamidae*—ex. *Draco*.

Notices of other Families.

Extinct Families—*Palaeosauridae*.*Dinosauridae*.*Dicynodontidae*.*Pterodactyli*.*Enaliosauri*.Order 5. (*Loricata*)—ex. *Gavialis*, *Crocodylus*, *Alligator*.Extinct genera.—*Teleosaurus*, *Stenosaurus*.

Class III.—AVES.

Order 1. (*Natatores*.)Fam. 1. *Anatidae*—ex. *Mergus*, *Fuligula*, *Anas*, *Anser*." 2. *Laridae*—ex. *Sterna*, *Larus*." 3. *Procellariidae*—ex. *Thalassidroma*." 4. *Pelecanidae*—ex. *Phalacrocorax*." 5. *Colymbidae*—ex. *Colymbus*." 6. *Alcidae*—ex. *Uria*." 7. *Podicepsidae*—ex. *Podiceps*, *Fulica*.Order 2. (*Grallatores*.)Fam. 1. *Phalaropidae*—ex. *Phalaropus*." 2. *Recurvirostridae*—ex. *Himantopus*." 3. *Charadriidae*—ex. *Charadrius*." 4. *Rallidae*—ex. *Rallus*, *Gallinula*." 5. *Scolopacidae*—ex. *Numenius*, *Totanus*, *Scolopax*." 6. *Ardeidae*—ex. *Ardea*.Order 3. (*Cursores*.)Fam. 1. *Struthionidae*—ex. *Struthio*." 2. *Apterygidae*—ex. *Apteryx*.Extinct genera—*Epiornis*, *Dinornis*.Order 4. (*Rasores*.)Fam. 1. *Tetraonidae*—ex. *Tetrao*, *Ortyx*." 2. *Cracidae*—ex. *Crax*, *Penelope*." 3. *Phasianidae*—ex. *Meleagris*." 4. *Columbidae*—ex. *Ectopistes*, *Columba*.Order 5. (*Insessores*.)(a) *Contirostres*.

Corvidæ—ex. *Corvus*.
Fringillidæ—ex. *Fringilla*, *Emberiza*.
Ampelidæ—ex. *Bombycilla*.

(b) *Dentirostres*.

Laniidæ—ex. *Lanius*.
Muscicapidæ—ex. *Muscicapa*.
Merulidæ—ex. *Turdus*.
Sylviadæ—ex. *Sylvia*, *Syalia*, *Regulus*.
Vireonidæ—ex. *Vireo*.
Certhiadæ—ex. *Certhia*.

(c) *Fissirostres*.

Hirundinidæ—ex. *Hirundo*, *Chaetura*, *Chordeiles*.
Caprimulgidæ—ex. *Caprimulgus*.
Halcyonidæ—ex. *Alcedo*.

(d) *Scansores*.

Picidæ—ex. *Picus*.
Cuculidæ—ex. *Coccyzus*.
Psittacidæ—ex. *Conurus*.

(e) *Tenuirostres*.

Trochilidæ—ex. *Trochilus*.

Order 6. (*Raptores*.)

Vulturidæ—ex. *Cathartes*, *Gypaetos*.
Strigidæ—ex. *Bubo*, *Surnia*.
Falconidæ—ex. *Aquila*, *Circus*, *Falco*.

Class IV.—MAMMALIA.

(a) *Ovo-Vivipara*.

Sub Class 1. *Lyencephala*.

Order 1. *Monotremata*—ex. *Ornithorhyncus*, *Echidna*.

" 2. *Marsupialia*.

(a) (*Phytophagous*)—ex. *Phascalomys*, *Macropus*, *Phascolarctos*, *Petaurus*.

(b) (*Sarcophagous*)—ex. *Didelphys*, *Chironectes*, *Myrmecobius*, *Peracyon*.

(b) *Vivipara*.

Sub Class 2. *Lissancephala*.

Order 1. *Rodentia*—ex. *Mus*, *Arctomys*, *Arvicola*, *Sicurus*,
Tamias, *Jaculus*, *Lepus*, *Hystrix*, *Castor*.

" 2. *Insectivora*—ex. *Sorex*, *Condylura*.

" 3. *Cheiroptera*—ex. *Vespertilio*.

" 4. *Bruta*—ex. *Myrmecophaga*, *Dasypus*, *Manis*, *Bradypus*.

Extinct Genera—*Megatherium*, *Myiodon*.

Sub Class 3. *Gyrencephala*.

- | | | |
|--------------|---|--|
| Mutilata. | { | Order 1. <i>Cetacea</i> —ex. <i>Balæna</i> , <i>Balænoptera</i> ,
Physeter, Monodon, Beluga, Phocæna. |
| | | " 2. <i>Sirenia</i> —ex. <i>Manatus</i> . |
| | { | " 3. <i>Pachydermata</i> . |
| | | (a) Proboscideæ—ex. <i>Elephas</i> . |
| | | (b) Perissodactyla—ex. <i>Rhinoceros</i> ,
<i>Tapirus</i> , <i>Equus</i> . |
| Ungulata. | | (c) Artiodactyla—ex. <i>Sus</i> , <i>Hippo-</i>
<i>potamus</i> . |
| | | Extinct Pachyderms. |
| | " | 4. <i>Ruminantia</i> —ex. <i>Bos</i> , <i>Ovis</i> , <i>Capra</i> ,
<i>Camelus</i> . |
| | { | " 5. <i>Carnivora</i> —ex. <i>Felis</i> , <i>Ursus</i> , <i>Mustela</i> . |
| Unguiculata. | | " 6. <i>Quadrumana</i> —ex. <i>Lemur</i> , <i>Pithecia</i> ,
<i>Hylobates</i> , <i>Simia</i> , <i>Troglodytes</i> . |

Sub Class 4. *Archencephala*.

- Order 1.
- Bimana*
- ex.
- Homo*
- .

PRESERVATION OF SPECIMENS.

(The following directions are extracted from those issued by the Smithsonian Institution, and will be illustrated, as far as possible, in the class-room.)

I.—VERTEBRATA.

I.—PRESERVING THE SKIN.

IMPLEMENTS FOR SKINNING.—The implements generally required in skinning vertebrated animals are : 1. A sharp knife or a scalpel. 2. A pair of sharp-pointed scissors, and one with strong short blades. 3. Needles and thread for sewing up the incisions in the skin. 4. A hook by which to suspend the carcass of the animal during the operation of skinning. To prepare the hook, take a string, of from one to three feet in length, and fasten one end of it to a stout fish-hook which has had the barb broken off. By means of a loop at the other end, the string may be suspended to a nail or awl, which, when the hook is inserted into the body of an animal, will give free use of both hands in the operation of skinning.

PRESERVATIVES.—The best material for the preservation of skins of animals consists of powdered arsenious acid, or the common arsenic of the shops. This may be used in two ways, either applied in dry powder to the moist skin, or else mixed with alcohol or water to the consistency of molasses, and put on with a brush. A little camphor may be added to the alcoholic solution. There are no satisfactory substitutes for arsenic ; but, in its entire absence, corrosive sublimate, arsenical soap, camphor, alum, &c. may be employed.

The proper materials for stuffing out skins will depend much upon the size of the animal. For small birds and quadrupeds, cotton will be the most convenient ; for the larger, tow. For those still larger, dry grass, straw, sawdust, bran, or other vegetable substances, may be used. Whatever substance is used, care must be taken to have it perfectly dry. Under no circumstances should animal matter, as hair, wool, or feathers, be employed.

BIRDS.

Whenever convenient, the following notes should be made previous to commencing the operation of skinning, as they will add much to the value of the specimens :—

1. The length, in inches, from tip of bill to the end of the tail ; the distance between the two extremities of the outstretched wings ; and the length of the wing from the carpal or wrist-joint. The numbers may be recorded as follows : 44, 66, 12 (as for a swan), without any

explanation ; it being well understood that the above measurements follow each other in a fixed succession. These numbers may be written on the back of the label attached to each specimen.

2. The color of the eyes, that of the feet, bill, gums, membranes, caruncles, &c.

3. The date, the locality, and the name of the collector.

4. The sex. All these points should be recorded on the label.

Immediately after a bird is killed, the holes made by the shot, together with the mouth and internal or posterior nostrils, should be plugged up with cotton, to prevent the escape of blood and the juices of the stomach. A long narrow paper cone should be made ; the bird, if small enough, thrust in, head foremost, and the open end folded down, taking care not to break or bend the tail feathers in the operation.*

When ready to proceed to skinning, remove the old cotton from the throat, mouth, and nostrils, and replace it by fresh. Then take the dimensions from the point of the bill to the end of the tail, from the tip of one wing to that of the other, when both are extended, and from the tip of the wing to the first or carpal-joint, as already indicated.

This being done, make an incision through the skin only, from the lower end of the breast bone to the anus. Should the intestines protrude in small specimens, they had better be extracted, great care being taken not to soil the feathers. Now proceed carefully to separate the skin on each side from the subjacent parts, until you reach the knee, and expose the thigh ; when, taking the leg in one hand, push or thrust the knee up on the abdomen, and loosen the skin around it until you can place the scissors or knife underneath, and separate the joint with the accompanying muscles. Place a little cotton between the skin and body to prevent adhesion. Loosen the skin about the base of the tail, and cut through the vertebrae at the last joint, taking care not to sever the basis of the quills. Suspend the body by inserting the hook into the lower part of the back or rump, and invert the skin, loosening it carefully from the body. On reaching the wings, which had better be relaxed previously by stretching and pulling, loosen the skin from around the first bone, and cut through the middle of it, or, if the bird be small enough, separate it from the next at the elbow. Continue the inversion of the skin by drawing it over the neck, until the skull is exposed. Arrived at this point detach the delicate membrane of the ear from its cavity in the skull, if possible, without cutting or tearing it ; then, by means of the thumb-nails, loosen the adhesion of the skin to the other parts of the head, until you come to the very base of the mandibles, taking care to cut through the white nictitating membrane of the eye, when exposed, without lacerating the ball. Scoop out the eyes, and, by making one cut on each

* Crumpled or bent feathers may have much of their elasticity and original shape restored by dipping in hot water.

side of the head, through the small bone connecting the base of the lower jaw with the skull, another through the roof of the mouth at the base of the upper mandible, and between the jaws of the lower, and a fourth through the skull behind the orbits, and parallel to the roof of the mouth, you will have freed the skull from all the accompanying brain and muscle. Should anything still adhere, it may be removed separately. In making the first two cuts, care must be taken not to injure or sever the zygoma, a small bone extending from the base of the upper mandible to the base of the lower jaw-bone. Clean off every particle of muscle and fat from the head and neck, and, applying the preservative abundantly to the skull, inside and out, as well as to the skin, restore these parts to their natural position. In all the preceding operations, the skin should be handled as near the point of adhesion as possible, especial care being taken not to stretch it.

Finely powdered plaster of Paris, chalk, or whiting, may be used with advantage by sprinkling on the exposed surface of the carcass, and inside of skin, to absorb the grease and blood.

The next operation is to connect the two wings inside of the skin by means of a string, which should be passed between the lower ends of the two bones forming the forearm, previously, however, cutting off the stump of the arm, if still adhering at the elbow. Tie the two ends of the strings so that the wings shall be kept at the same distance apart as when attached to the body. Skin the leg down to the scaly part, or tarsus, and remove all the muscle. Apply the arsenic to the bone and skin, and, wrapping cotton around the bone, pull it back to its place. Remove all the muscle and fat which may adhere to the base of the tail or the skin, and put on plenty of the preservative wherever this can be done. Lift up the wing, and remove the muscle from the forearm by making an incision along it, or, in many cases, the two joints may be exposed by carefully slipping down the skin towards the wrist-joint, the adhesion of the quills to the bone being loosened.

The bird is now to be restored to something like its natural shape by means of a filling of cotton or tow. Begin by opening the mouth and putting cotton into the orbits and upper part of the throat until these parts have their natural shape. Next take tow or cotton, and after making a roll rather less in thickness than the original neck, put it into the skin, and push firmly into the base of the skull. By means of this you can reduce or contract the neck if too much stretched. Fill the body with cotton not quite to its original dimensions, and sew up the incision in the skin, commencing at the upper end, and passing the needle from the inside outwards; tie the legs and mandibles together, adjust the feathers, and, after preparing a cylinder of paper the size of the bird, push the skin into it so as to bind the wings closely to the sides. The cotton may be put in loosely, or a body the size of the original made by wrapping with threads. If the bird have long legs and neck, these had better be folded down over

the body, and allowed to dry in that position. Economy of space is a great object of keeping skins, and such birds as herons, geese, swans, &c., occupy too much room when outstretched.

In some instances, as among the ducks, woodpeckers, &c., the head is so large that the skin of the neck cannot be drawn over it. In such cases skin the neck down to the base of the skull, and cut it off there. Then draw the head out again, and, making an incision on the outside, down the back of the skull, skin the head. Be sure not to make too long a cut, and to sew up the incision again.

The sex of the specimen may be ascertained after skinning, by making an incision in the side near the vertebræ, and exposing the inside surface of the "small of the back." The generative organs will be found tightly bound to this region nearly opposite to the last ribs, and separating it from the intestines. The testicles of the male will be observed as two spheroidal or ellipsoidal whitish bodies, varying with the season and species, from the size of a pin's head to that of a hazel-nut. The ovaries of the female, consisting of a flattened mass of spheres, variable in size with the season, will be found in the same region.

For transportation, each skin of mammals as well as of birds should, when possible, be wrapped in paper.

MAMMALS.

The mode of preparing mammals is precisely the same as for birds, in all its general features. Care should be taken not to make too large an incision along the abdomen. The principal difficulty will be experienced in skinning the tail. To effect this, pass the slipknot of a piece of strong twine over the severed end of the tail, and, fastening the vertebræ firmly to some support, pull the twine towards the tip until the skin is forced off. Should the animal be large, and an abundance of preservative not at hand; the skin had better remain inverted. In all cases, it should be thoroughly and rapidly dried.

The tails of some mammalia cannot be skinned as directed above. This is particularly the case with beavers, opossums, and those species which use their tail for prehension or locomotion. Here the tail is usually supplied with numerous tendinous muscles, which require it to be skinned by making a cut along the lower surface or right side, nearly from one end to the other, and removing the bone and flesh.—It should then be sewed up again, after a previous stuffing.

For the continued preservation of hair or fur of animals against the attacks of moths and other destructive insects, it will be necessary to soak the skins in a solution of corrosive sublimate in alcohol or whiskey, allowing them to remain from one day to several weeks, according to the size. After removal, the hair must be thoroughly washed or rinsed in clean water, to remove as much as possible of the sublimate; otherwise, exposure to light will bleach all the colors. Finely powdered green vitriol, or copperas sprinkled on either hair or

feathers, will have an excellent effect in keeping out moths. Covering with tobacco leaves will also answer the same end.

In some instances, large skins may be preserved by being salted down in casks.

REPTILES.

The larger *lizards*, such as those exceeding twelve or eighteen inches in length, may be skinned, according to the principles above mentioned, although the preservation in spirit, when possible, is preferable for all reptiles.

Large *frogs* and *salamanders* may likewise be skinned, although cases where this will be advisable are very rare.

Turtles and *large snakes* will require this operation.

To one accustomed to the skinning of birds, the skinning of frogs or other reptiles will present no difficulties.

The skinning of a snake is still easier. Open the mouth and separate the skull from the vertebral column, detaching all surrounding muscles adherent to the skin. Next, tie a string around the stump of the neck thus exposed and, holding on by this, strip the skin down to the extremity of the tail. The skin thus inverted should be restored to its proper state, and then put in spirit or stuffed, as convenient.—Skins of reptiles may be stuffed with either sand or sawdust, by the use of which their shape is more easily restored.

Turtles and tortoises are more difficult to prepare in this way, although their skinning can be done quite rapidly. "The breastplate must be separated by a knife or saw from the back, and, when the viscera and fleshy parts have been removed, restored to its position.—The skin of the head and neck must be turned inside out, as far as the head, and the vertebrae and flesh of the neck should be taken from the head, which, after being freed from the flesh, the brain, and the tongue, may be preserved with the skin of the neck. In skinning the legs and the tail, the skin must be turned inside out, and the flesh having been removed from the bones, they are to be returned to their places by redrawing the skin over them, first winding a little cotton or tow around the bones to prevent the skin adhering to them when it dries."—RICHARD OWEN.

Another way of preparing these reptiles is as follows: Make two incisions, one from the anterior end of the breastplate to the symphysis of the lower jaw, and another from the posterior end of the breastplate to the vent or tip of the tail; skin off these regions and remove all fleshy parts and viscera without touching the breastplate itself. Apply preservative, stuff, and sew up again both incisions.

"When turtles, tortoises, crocodiles, or alligators, are too large to be preserved whole in liquor, some parts, as the head, the whole viscera stripped down from the neck to the vent, and the cloaca, should be put into spirit or solution."—R. OWEN.

FISHES.

As a general rule, fishes, when not too large, are best preserved entire in spirits.

Nevertheless, they may be usefully skinned, and form collections, the value of which is not generally appreciated. In many cases, too, when spirit or solutions cannot be procured, a fish may be preserved which would otherwise be lost.

There are two modes of taking the skin of a fish : 1. The whole animal can be skinned and stuffed like a bird, mammal, or reptile. 2. One-half of the fish can be skinned, and nevertheless its natural form preserved.

Sharks, skates, sturgeons, garpikes or garfishes, mudfishes, and all those belonging to the natural orders of *Placoids* and *Ganoids*, should undergo the same process as given above for birds, mammals, and reptiles. An incision should be made along the right side, the left always remaining intact, or along the belly. The skin is next removed from the flesh, the fins cut at their bases under the skin, and the latter inverted until the base of the skull is exposed. The inner cavity of the head should be cleaned, an application of preservative made, and the whole, after being stuffed in the ordinary way, sewed up again. Fins may be expanded when wet, on a piece of stiff cloth which will keep them sufficiently stretched for the purpose. A varnish may be passed over the whole body and fins, to preserve somewhat the color.

In the case of *Ctenoids*, *perches*, and allied genera ; and *Cycloids*, *trouts*, *suckers*, and allied genera ; one-half of the fish may be skinned and preserved. To effect this, lay the fish on the table with the left side up ; the one it is intended to preserve. Spread out the fins by putting underneath each a piece of paper, to which it will adhere on drying. When the fins are dried, turn the fish over, cut with scissors or a knife all round the body, a little within the dorsal and ventral lines, from the upper and posterior part of the head, along the back to the tail, across the base of the caudal fin down, and thence along the belly to the lower part of the head again. The dorsal, caudal, and anal fins, cut below their articulations. This done, separate the whole of the body from the left side of the skin, commencing at the tail. When near the head, cut off the body with the right ventral and pectoral fins, and proceed by making a section of the head and removing nearly the half of it. Clean the inside, and pull out the left eye, leaving only the cornea and pupil. Cut a circular piece of black paper of the size of the orbit and place it close to the pupil. Apply the preservative, fill the head with cotton as well as the body. Turn over the skin and fix it on a board prepared for that purpose. Pin or tack it down at the base of the fins. Have several narrow bands of paper to place across the body in order to give it a natural form, and let it dry. The skins may be taken off the board or remain fixed to it, when sent to their

destination, where they should be placed on suitable boards of proper size, for permanent preservation.

Such a collection of well prepared fishes will be useful to the practical naturalist, and illustrate, in a more complete manner, to the public, the diversified forms and characters of the class of fishes, which specimens preserved in alcohol do not so readily show.

These skins may also be preserved in alcohol.

2.—PRESERVING IN LIQUIDS.

The best material for preserving animals of moderate size is alcohol. When spirits cannot be obtained, the following substitutes may be used:—

I. GOADBY'S SOLUTION.—*The aluminous fluid*, comprises rock salt, 4 ounces; alum, 2 ounces; corrosive sublimate, 4 grains, boiling water, 2 quarts. *The saline solution*, composed of rock salt, 8 ounces; corrosive sublimate, 2 grains; boiling water, 1 quart. To be well stirred, strained, and cooled.

II. A strong brine, to be used as hereafter indicated for Goadby's Solution.

III. In extreme cases, dry salt may be used, and the specimens salted down like herring, &c.

The alcohol, when of the ordinary strength, may be diluted with one-fifth of water, unless it is necessary to crowd the specimens very much. The fourth proof whiskey of the distillery, or the high wines, constituting an alcohol of about 60 per cent., will be found best suited for collections made at permanent stations and for the museum.—Lower proofs of rum or whiskey will also answer, but the specimens must not be crowded at all.

To use Goadby's Solution, the animal should first be macerated for a few hours in fresh water, to which about half its volume of the concentrated solution may then be added. After soaking thus for some days, the specimens may be transferred to fresh concentrated solution. When the aluminous fluid is used to preserve vertebrate animals, these should not remain in it for more than a few days; after this, they are to be soaked in fresh water, and transferred to the saline solution. An immersion of some weeks in the aluminous fluid will cause a destruction of the bones. Specimens must be kept submerged in these fluids.—The success of the operation will depend very much upon the use of a weak solution in the first instance, and a change to the saturated fluid by one or two intermediate steps.

The collector should have a small keg, jar, tin box, or other suitable vessel, partially filled with liquor, into which specimens may be thrown (alive if possible) as collected. The entrance of the spirit into the cavities of the body should be facilitated by opening the mouth, and making a small incision in the abdomen a half or one inch long, or by injecting

the liquor into the intestines through the anus, by means of a small syringe. After the animal has soaked for some weeks in this liquor, it should be transferred to fresh. Care should be taken not to crowd the specimens too much. When it is impossible to transfer specimens to fresh spirits from time to time, the strongest alcohol should be originally used.

To pack the specimens for transportation, procure a small keg, which has been properly swelled, by allowing water to stand in it for a day or two, and from this extract the head by knocking off the upper hoops. Great care must be taken to make such marks on the hoops and head, as will assist in their being replaced in precisely the same relative position to each other and the keg that they originally held. At the bottom of the keg place a layer of tow or rags, moistened in liquor, then one of the specimens, then another of tow and another of specimens, and so on alternately until the keg is *entirely filled* exclusive of the spirit. Replace the head, drive down the hoops, and fill completely with spirits by pouring through the bung-hole. Allow it to stand at least half an hour, and then, supplying the deficiency of the liquor, insert the bung and fasten it securely. An oyster-can or other tin vessel may be used to great advantage, in which case the aperture should be soldered up and the vessel inclosed in a box. A glass jar or bottle may also be employed, but there is always a risk of breaking and leaking. In the absence of tow or rags, chopped straw, fine shavings, or dry grass may be substituted.

It will conduce greatly to the perfect preservation of the specimens, during transportation, if each one is wrapped up in cotton cloth, or even paper. A number of smaller specimens may be rolled successively in the same wrapper. In this way friction, and the consequent destruction of scales, fins, &c. will be prevented almost entirely.

Should the specimens to be packed vary in size, the largest should be placed at the bottom. If the disproportion be very great, the delicate objects at the top must be separated from those below, by means of some immoveable partition, which, in the event of the vessel being inverted, will prevent crushing. The most imperative rule, however, in packing, is to have the vessel perfectly full, any vacancy exposing the whole to the risk of loss.

It is sometimes necessary to guard against the theft of the spirit employed, by individuals who will not be deterred from drinking it by the presence of reptiles, &c. This may be done by adding a small quantity of tartar emetic, ipecacuanha, quassia, or some other disagreeable substance. The addition of corrosive sublimate will add to the preservative power of the spirit.

Specimens of the embryos of animals and of the soft parts obtained by dissection of specimens, may be preserved in any of the ways above indicated.

3. SKELETONS, &c.

Skulls of animals may be prepared by boiling in water for a few hours. A little potash or lye added, will facilitate the removal of the flesh.

Skeletons may be roughly prepared by skinning the animal and removing all the viscera, together with as much of the flesh as possible. The bones should then be exposed to the sun or air until completely dried. Previously, however, the brain of large animals should be removed by separating the skull from the spine, and extracting the contents through the large hole in the back of the head. In case it becomes necessary to disjoint a skeleton, care should be taken to attach a common mark to all the pieces, especially when more than one individual is packed in the same box.

Skulls and skeletons may frequently be picked up, already cleaned by other animals or exposure to weather. By placing small animals near an ant's nest, or in water occupied by tadpoles, or small crustacea, very beautiful skeletons may be obtained. The sea-beach sometimes affords rich treasures in the remains of porpoises, whales, large fishes, as sharks, and other aquatic species.

§ NESTS AND EGGS.

Nests require little preparation beyond packing so as to be secure from crumbling or injury. The eggs of each nest, when emptied may be replaced in it and the remaining space filled with cotton.

Eggs, when fresh, and before the chick has formed, may be emptied by making a small pin-hole at each end, and blowing or sucking out the contents. Should hatching have already commenced, an aperture may be made in one side by carefully pricking with a fine needle round a small circle or ellipse, and thus cutting out a piece. The large kinds should be well washed inside, and all allowed to dry before packing away. If the egg be too small for the name, a number should be marked with ink corresponding to a memorandum list. Little precaution is required in packing, beyond arranging in layers with cotton and having the box entirely filled.

The eggs of reptiles, provided with a calcareous shell, can be prepared in a similar way.

The eggs of fishes, salamanders, and frogs may be preserved in spirits, and kept in small vials or bottles. A label should never be omitted.

II.—INVERTEBRATA.

1. INSECTS, &c.

The harder kinds may be put in liquor, as above, but the vessel or bottles should not be very large. Butterflies, wasps, flies, &c., may be pinned in boxes, or packed in layers with soft paper or cotton. Minute

spe
or s
quil
kill
wat

V
mou
more

It
sects
cork
or el

TH
havin
taine
kill th
to oth
direct

The
would
talline
pinned

Sea-
immers
or any

The
in a dri
for a mi
valves o
soft par

Wing
legs, ea
found in
bottles o

It is
the vario
account o
general q
always be

1. In a
soils, &c.,

species should be carefully sought under stones, bark, dung, or flowers, or swept with a small net from grass or leaves. They may be put in quills, small cones of paper, or in glass vials. They can be readily killed by immersing the bottles, &c., in which they are collected in hot water, or exposing them to the vapor of ether.

When possible, a number of oz. or 2 oz. vials, with very wide mouths, well stopped by corks, should be procured, in which to place the more delicate invertebrata, as small crustacea, worms, mollusca, &c.

It will frequently be found convenient to preserve or transport insects pinned down in boxes. The bottoms of these are best lined with cork or soft wood. Beetles are pinned through the right wing-cover or elytra; all other insects through the middle of the thorax.

The traveller will find it very convenient to carry about him a vial having a broad mouth closed by a tight cork. In this should be contained a piece of camphor or still better, of sponge soaked in ether, to kill the insects collected. From this the specimens should be transferred to other bottles. They may, if not hairy, be killed by immersing directly in alcohol.

The camphor should always be fixed in the box containing insects, as it would break the feet and antennæ of the latter if in a loose and crystalline state. It may be kept in a piece of muslin or canvas, and then pinned at the bottom of the box.

2. RADIATES, MOLLUSKS &c.

Sea-urchins and star-fishes may also be dried, after having been quite immersed for a minute or two in boiling water, and packed up in cotton, or any soft material which may be at hand.

The hard parts of coral, and shells of mollusca may also be preserved in a dried state. The soft parts are removed by immersing the animals for a minute or two in hot water, and washing clean afterwards. The valves of bivalve shells should be brought together by a string. The soft parts of shell-fish, &c., should when possible be preserved in alcohol.

Wingless insects, such as spiders, scorpions, centipedes or thousand-legs, earth-worms, hair worms, and generally all worm-like animals found in the water, should be preserved in alcoholic liquor, and in small bottles or vials.

3. MINUTE MICROSCOPIC ORGANISMS.

It is very desirable to procure specimens from many localities, of the various forms of microscopic animals and plants, not only on account of their intrinsic interest, but for their relation to important general questions in physical and natural science. These will almost always be found to occur in the following localities:—

1. In all light-colored clays or earths, as found in peat bogs, meadows, soils, &c., particularly when these are remarkably light.

2. In the mud from the bottom of lakes and pools. A small handful of this mud or of the confervoid vegetation on the bottom, if dried *without squeezing*, will retain the Diatomaceæ and Desmidiæ.

3. In the mud (dried) from the bottom and along the margins of streams in any locality. The muds from brackish and from fresh waters will differ in their contents.

4. In soil from the banks of streams. The surface and subsoils should both be collected.

5. In the soundings brought up from the bottom of the sea or lakes. These should be collected from the greatest possible depths. If an armature be used to the lead, it should be of soap rather than fatty matter, as being more readily removed from the organisms. The mud which adheres to anchors, to rocks, &c., below *high-water-mark*, as well as below *low-water*, should also be carefully gathered.

6. In bunches of damp moss from rocks, roofs of houses, trees, boat pumps, &c.

7. In the deposits in the gutters and spouting of roofs of houses.

8. In the dust which at sea collects upon the sails or decks of vessels. When not in sufficient quantity to be scraped off, enough may be obtained for examination by rubbing a piece of soft clean paper over the surface affected.

Specimens of all these substances should be gathered, and, when moist, dried *without squeezing*. The quantity may vary from a few grains to an ounce, depending on the mode of transportation to be adopted. *Every specimen, as collected, should have the date, locality, depth below the surface, collector, &c., marked immediately upon the envelope.*

For further directions, and for information respecting nets, dredges, cabinets, &c., "Davies' Practical Naturalist's Guide,"* is recommended to the Student.

* McLachlan and Stewart, Edinburgh.

Course of Natural History,
UNIVERSITY OF MCGILL COLLEGE,
From the Calendar for 1859-60.

I. ZOOLOGY AND COMPARATIVE PHYSIOLOGY, (Second year's Students.)

1. *General Views of Animal Life*, and of the relation of the animal to the plant.
2. *Animal Histology*.—The elementary cell and its metamorphoses.—Microscopic examination of tissues.
3. *Functions of Animals*.—With especial reference to the physiology of the lower animals.
4. *Principles of Classification*.—Type or homology.—Analogy and adaptation.—True nature of the species, genus, and other groups in Zoology.
5. *Descriptive Zoology*.—The Radiata, Mollusca, Articulata and Vertebrata, illustrated by typical examples, and as far as possible by Canadian species.—Notices of Geographical distribution of animals.
6. *Instruction and Illustrations* in collecting and preserving specimens, and determining species.

Text-Books.—Synopsis by the Professor. Owen's Lectures.

II. BOTANY.—(Third year's Students.)

1. *Vegetable Histology*, or the Study of the Elementary Tissues of Plants, with a description of the Microscope and its uses in Botanical Investigations.
2. *Vegetable Anatomy and Physiology*, or the Structure and Functions of the Nutritive and Reproductive Organs of Plants.
3. *Vegetable Nutrition*, and General Phenomena connected with Plant Life.
4. *Taxological Botany*, or the Classification of Plants—with a description of the most important Natural Orders, under the Divisions. *Exogenæ, Endogenæ and Cryptogamia*.
5. *Geographical Botany*, or the distribution of Plants over the Globe.

Text book.—Gray's Botanical Text-Book.

III. GEOLOGY AND PALÆONTOLOGY.—(Fourth year's Students.)

1. *Mineralogy*.—Chemical and Physical characters of Minerals, including Crystallography; Methods of determining Minerals, with examples; Descriptive Mineralogy, with especial reference to the species important in Geology or useful in the Arts.

2. *Physical Geology*.—Composition of Rocks and their structure on the small scale.—Origin of Rocks, aqueous, volcanic, plutonic, metamorphic.—Arrangement of Rocks on the large scale, stratification, elevation and disturbances, denudation.

3. *Chronological Geology and Palæontology*.—Data for determining the relative ages of formations. Classification according to age. Fauna and Flora of the successive periods. Geology of British America.

4. *Practical and Economical Geology*.—Methods of observation and of making geological surveys. Applications of the science to Mining, Engineering, and Agriculture.

Text-Books:—Nichol's Mineralogy, and Lyell's Elements, Jukes' Manual, Ansted's Elementary Course, or Page's Advanced Text-Book.

IV. PRACTICAL AND HONOR COURSE,—(*Students of the Fourth year and Special Students*).—Students entering for honors must have passed creditably the examinations in Elementary Chemistry, Zoology, Botany and Experimental Physics; and should know the Elements of Drawing. Students entering for practical purposes will be required only to satisfy the Professor of their fitness for the studies of the class.

The course will consist of demonstrations and explanations on the following subjects, with such modifications as may be found necessary to suit the future pursuits of students.—Examination, determination, and description of specimens.—Use of the Blow-pipe and of Chemical methods in Natural History.—Use of the Microscope in original investigation.—Preparation of Specimens for study and preservation.—Special studies in the Zoology, Geology, and Palæontology of British America, with field work when practicable. Students will be required to read such of the following books as may be appointed:—Owen's Lectures on the Invertebrate Animals; Jones' Animal Kingdom:—Lyell's Principles and Elements; De la Beche's Geological Observer; Murchison's Siluria; and for local information, Logan & Hunt's Geology of Canada; Dawson's Acadian Geology; Lyell's Travels in North America. Books of reference will be furnished from the College Library.

