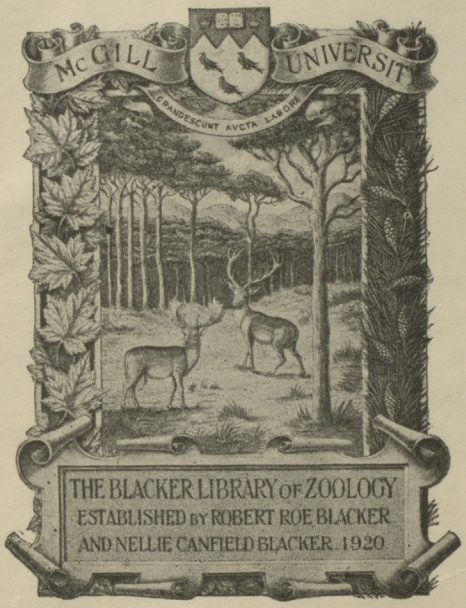
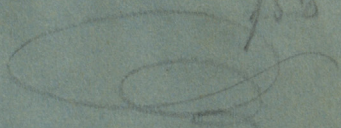
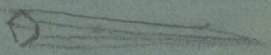
Vernor's
Early original
Notes on
Natural History
- 1853 -



Henry George Vennor
McGill College
Montreal
1853



Foraminifera



— Nat. Hist. Notes — 1

All objects of N. H. have two names the Generic name & the trivial or specific. In Nat Hist we have the Genus, Species, Family, Order, Classes & classes are combined to form the four primary divisions or Departments of the Animal Kingdom.

The genus is founded upon some of the minor peculiarities of anatomical structure.

The Species is founded upon color, size, proportions, sculpture &c. There are also what naturalists call varieties.

A Family consists of several genera which have certain traits in common.

The Families are combined into Orders, &c.

A Type is an ~~ideal~~ image ~~picturesq~~ in our minds, made up of the traits which characterise the group.

The Animal kingdom consists of four great divisions which we call Departments, namely:

I The department of Vertebrates
II The department of Articulates
III The department of Mollusks
IV The department of Radiates.

Number of species of animals now existing more than 50,000.

Vertebrates 20,000
Birds 5000 species
Fishes 6000 known (18 a 20000.)
Mollusks 10,000.

Articulata 100,000
Insects 20,000 known -
Radiata 10,000
The fossils now described
exceed 6000 species;
articulata = outward skeleton

Affinity or Homology - is
the relation between organs
or parts of the body which
are constructed on the same
plan; however much they
vary in form, or even serve
for very different uses.

—

Analogy, on the contrary,
indicates the similarity of
purposes or functions performed
by organs of different structure.

Analogy between Wing Bird & Wing
of a Butterfly - since both are for
flight

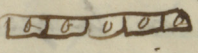
5

cell - wall - fluid nucleus
~~tissues~~ nucleolus.

Tissues - areolar tissue -
Not work of delicate
tissues - elongated cells -
elongated tissue used for making
up tendons - used for
building up & packing up
the soft parts of animal
2 Cartilaginous - Some animals
are nearly all made up of
this - used for ~~lengthening~~ out
bones, ribs - cells in cartilage.
3 Osseous ——— bone of higher
animals - bone phosphate
of lime - cells of cartilage
make strange appearance in
bone.

bone-cells

animals cells in bone differ in
diff animals.
cells also in teeth. cells canals
running from cells thru -
canals more prominent -
4 Muscular tissue -
Common to all animals
fibres composed of minute
cells. fibres of muscles
can contract the muscles

like bundle of rods bound
together. this is the
structure of voluntary muscles.
expanded 
relaxed 

5 Nervous tissue. constitutes
the brain & nervous cords -
made up of fibres -
almost pure white -

But there is no affinity between them, since they differ totally in their anatomical relations.
Affinity between bras W. & monkey.
same structure.
Organised & Unorganised
— Vegetable & Animal cells —
(o) nucleus —
yeast plants single cell 
when adult join —
Sometimes 1000,000 cell added during a night.
Also in Animal Kingdom goes on to greater extent.
Cells of Animal smaller —
liable to change —
Globules of blood. (o) (o)
Galoubles cells ~~so occur~~ are less numerous than the other.
Cells grow in proportion to the bone

Grey nervous matter –
cells strung together, fibers –
muscle moving power
nerve stimulates the will –
Grey nervous cells commanded
by will – waste away
nourishment conveyed below –
Differences between Animals & Plants
The lower animals & lower plants
very nearly allied to one another –
~~Animal~~ 1. Diff. of Chemical Composition
~~& Vegetable~~ C. H O = Plants –
C H O N = Animal –
(2) Animal has large internal
cavities.
Differs here from plant
Presence of a proper digestive
cavity –

3 Animal consumes organic food burns oxygen - animal takes in O & gives out C - Plant C gives O - Plant consumes unorganized food & deoxidises.

4 ~~Grow~~ Animal consumes oxygen & gives off plants. Plant consumes Carbon gives off oxygen

5 Animal Originates from egg. Plant from seed Both have embryo - & have both lay upfood - Animal embryon stays longer in egg than plant -

6 Animals have voluntary motion & sensation (nerves)

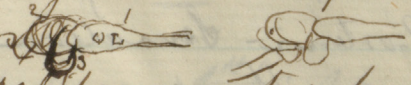
Plant has neither -

Nervous System & general sensation -

N. S. Brain & Chords that proceed from the brain -

Structure of N. S. - Brain divisible into several parts - lower & upper in man - lower animals different -

Brain of Bird. 1 Olfactory lobes



2 - cerebrum or true brain -

3 Optic lobes -

4 - Cerebellum - little brain

5 - Origin of Spinal column -

6 - Oratory lobe.

Optic lobes large or small as the vision is strong or weak -

Cerebrum & Cerebellum - latter is connected with sensation

Former regulates vol-motion
Cerebrum connected with higher
faculties —

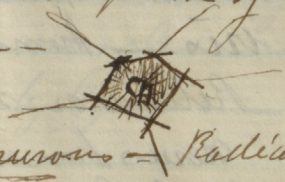
Structure of Chord which is
attached to brain —

Section of C — 

divided into 2
no seperate function —
diff however in anterior & posterior
Anterior - voluntary motion
Posterior - Sensation —
threads wear & waste
Articulates - nervous system diff.
Brain different - Skeleton outside
nervous chord & viscera in one
cavity in Articulates —
nervous system ring round
gullet —

chords leading down and
through body - knots & ganglia
at seperate points —

V - Myencephalous
A. Homoganglia -
Mollusc - very irregular nervous system nervous knots strung on branches - Heteroganglia
R. Last - nervous system of Star Fish -



Nematoneurous - Radiate

Special Senses. 1st Sight -

- eye inclosed in bony case - or socket - outer coat - called Sclerotic - transparent called Cornea -

1 three layers of cells - nucleus & nucleolus
2 Inner layer - showing nothing
3 - layer with double series of fibres -
4 Internally another layer of cells.

1 coat surrounds whole eye —
except at optic nerve —
Sclerotic lined by another thin
case — case full of blood vessels
Used to absorb the light —
does not extend in front eye —
— iris — human eye opening varies
Retina or nerve coat —
nerves branching out over
back part of eye — nerve cell
+ nerve fibres —

1 S —
2 C —
3 Retina

Certain humors — back part
of eye called vitreous humor —
crystalline lens ~~in~~ hung ~~in~~ eye —
by muscles — which contract —
~~Aqueous~~ Aqueous fluid —

Manner in which eye is slung -
~~fixe~~ muscles - attached to eye
& then to the back of orbit -
straight ones pull the eye
~~back &~~ from side to side -
~~in~~ The eye ~~rolls~~ in a bed of
fat - Oblique muscles -
Eye protected by Eyelids -
Moveable
within lids - glandular organ
to keep the eye moist with
oily fluid - another to pour
the lachrymal fluid down eye -

Simplification of Eye in Animals
lower than man -
Some animals have eyes
more complicated than man

Fishes. Eyes very different -
- no external safeguards -
eye lid - eye flat on fish -
no muscles - few small &
short - placed most prominent
in fishes body - lense very dense -
iris globular - elastic spring
behind eye -
Articulates & Molluscs -
very like man but simplified - Cuttle fish - very
like eye of fish, but the lense

resembles the figure -
As we descend some have no
eyes at all - sea snails eyes have
not internal parts - globular
sack transparent in front
filled with fluid -
light compelled to near
object - mounted on long horns -

In others mere dark specks —
Eyes of Articulates covered over —
— same material as ~~Body~~ —
Worms & Leeches — cup filled with
blood & covered by a sort of lid —
Radiates — highest ~~one~~ very
simple — some none at all —

Insects & Crustaceans differ
~~in it~~ from ~~the~~ other animal
in their eyes — by having
them covered by a horny coat —
& also (in a great many) the
eyes are made up of small
facets  — cannot be
moved — 1000 some 25000 —
some mounted on stalks —
jointed, so that in can be
moved about ~~— contracts~~ —
Principle same —

Hearing — Man — Hearing organs protected by part of skull — 1 Outer ear
2 ~~Middle~~ Middle ear
3 Inner ear.

Outer ear collects sound — tube allows these vibrations to pass to the drum of ear + closes up passage of tube — skin stretched tight across — protects ear inside chamber full of air ..... middle ear — Eustachian sound — inside again a series of small bones — (see text book) forming a chain from drum — Hammer placed next to tympanum — another membrane — 2 openings — oval + round openings.

means by which vibrations are ~~carried~~ conveyed - ~~tympanum~~ ear cavity filled with water - surround by bone - fluid has little branches of auditory nerve - Not known what the different parts of the ear are for - 1. Vestibule 2 S. 3 S.

Some animals appear to have a higher sense of hearing than man -

---

In Bird Cause Cochlea -
Reptile Cochlea & tabula portion dis-appear & drum appears outside -
Fish nothing remaining except inner ear - ear ossicles belong to inner ear & float in fluid -

As we get lower, hard to find organ of hearing - Labyrinth &c compared to that of fish.

Smell - Man - In nostrils - placed where the air enters the lungs. 1 series of bony plates nasal bones - twisted in various shapes - membrane spread over inside of nose - nerves spread over its surface - veins all over inside -

- Birds sense of smell very much reduced -

Fish organ of smell seperated from organs of respiration - small cavity in nose -

In Lobster organ of smell at the base of the antennae last segment has of each have a small slit leading into a cavity.

– Taste –

on surface of tongue & inner parts of mouth – this differs in respect to the nerves –

no lobes or any portion of brain – nerves spread over mouth to controlt the swallowing &c –

– papillae spread over tongue –

flavors not sense of taste but smell

Taste – bodies sapid or that have taste of their own – soluble in water –

Taste in lower animals

Birds diminution – bill – horny little taste –

Good many very little taste –

Touch

In skin over all body —
— nervous loops extend up through skin — Sense of touch does not reside in epidermis —
~~Puff~~ More especially hands — outer layer epidermis in young & 3 true skin —

— Voice —

Enables animals to communicate together.
Larynx — a ~~cal carcous~~ cartilaginous box.
2 muscles to alter size of opening.
Children smaller & therefore voice more shrill. Women also —
(1) — (see text book)
In some creatures greater number of cavities —
In bird double larynx —

Song produced altogether in l---. Fish destitute of voice - Insects produce sounds of all sorts - No proper voice.

- Voluntary Motion -

From will to brain & thence to muscles - Solid parts & supports - Skeleton - Human very complex - ~~bones~~

Points belonging to all V

1 Point - Spinal Column common to all Vertebrats -

Modifications - In the Fish ends of joints hollow & filled up with a pad -

fins serve for balancing

posterior part of Vertebra solid flesh

Serpent - Vertebra brought to highest degree of voluntary motion - fit into each other by ball & socket joints.

can move in various ways by its ribs - rib a kind of limb - by lateral & a vertical curves - Spring by uncoiling -

---

Anterior & Posterior Limbs.
anterior limbs - collar bone - man - Scapula Humerus Radius Ulna &c ——
Bat finger bones very long - Bird - wing radius ulna humerus hand finger bones diminished.

Fishes remnants of these bones Posterior - name of bones found in Text Book - pelvis is broadened out for the attachment of limbs - Thigh bone let into pelvis - knee hinge joint - knee pan - muscles to move foot - heel bones compressed for support to whole structure -

+ Dog Horse - toes are only placed on ground, heel in air - knee almost against trunk - Bird foot elongated heel good distance up leg

+ Dogs called digitigrades, (on the toes)
Man - plantigrade (whole foot down)

Motion in Invertebrates
Lobster - Paw, - All hard
& thum - No provision
for sensation - Not same
freedome allowed -
Joint inside & hinge
joints - All articulates
have hinge joints -
Muscles pull more
strongly being inside -

Molluscs - Skeleton gone
altogether - Bivalve shell -
2 valves, foot - great
number of muscles
in every direction - Motion
by foot -
Radiates - great variety
Star Fish - number of small
bones. arms can be used

as limbs & suckers -
~~this~~ in Jelly fish, desc
which it opens & expands
& thus ~~so~~ moves through
the water -

- Functions of Vegitable Life
1 Nutrition -
(a) Digestion -
Must be matter previously
acted upon by vegitable.
Organs for seizing & masticating
Jaws & teeth - Bear same
type of man, jaws work
on hinge joint, very
perfect in case of bear
muscular apparatus same
in ~~these~~ animals.
Frog head flat. mouth large
furnished with teeth in
on upper jaw.

Structure of teeth. Teeth consist of 3 distinct substances.

1 Bone (common)

2 Fine bone, with delicate tubes (Ivory)

3 Enamel.

Man. simple tooth compare with some of the lower animals.

Horse, more complex than man.

Diff kinds of teeth -

6 Incisors

Canines

Molars

Molars & False Molars

Man - teeth more similar

Repteles & Fishes teeth uniform
Bird, teeth abandoned & horny
bill in place. same in Turtles —
Insects, jaws work laterally —
1 Upper lip & Pair of Mandibles
3 Maxillae 4 Lower lip —
work laterally —

Mollusc's. tongue
furnished with rasp teeth
Radiates. jaws in higher
animals work from center
to circumference —

Organs of Digestion proper —
1 oesophagus a gullet
Sphincter man, narrow canal
leading from mouth —
merely tube in man —
serves as reservoir in some
animals — as crop bird —

2 Stomach

Lack more or less muscular
walls certain glandular
bodies containing fluids —
3 Intestine —
Elongated tube — & ejects food
from the body differs in
length in different animals —
large & small Intestine —
supplied with fluids.

F — Organs — action (mechanical)

1 Swallowing — tongue
roof of mouth — Food worked
down by contractions —
of the muscles —
movement of Stomach in digesting
food moves round walls of stomach
Some stomach furnished with
teeth —

Chemical Secretions -

1 Glucus - for lining & covering the inside of body -

Glandular bodies -

Salivary gland - constructed in roof of mouth - to make the food more Salivable -

In stomach - Gastric juice, glands placed in wall of stomach ~~stomach~~

Gastric juice constantly secreted Acid fluid - ~~2 acids~~ is composed of two acids -

Food resolved into fluid (Chyme) - Liver & gall bladder gives out bile - veins carry venous blood into liver - passed in canal to mix with food -

Bile - Kind of soap -
other acids - (See Text Book)

~~Bile~~ Food absorbed of Ries
small veins -

Absorbents - form a network
under skin. All parts of body -
form series of fine canals over
all body -

Spleen - organ filled with
blood vessels - reservoir of
blood - removes from
blood old blood globules -

---

large intestine, begin out-
surface certain transverse bands
to keep food from moving too
fast -

— Modification —

Lower Animals - (Digestion)

Molluscs - oesophagus - stomach simple sack - intestinal canal - liver ~~co~~ secreting Bile - dark colours - oyster liver green —

Insects - intestinal canal differs in young state —

Beetle - jaws masticates - ~~jaw~~ oesophagus, crop - muscular gizzard triturate, digestive stomach (gastric juice) liver, series of slender tubes —

Radiates - Sea urchin - ~~tot~~ mouth oesophagus, stomach, canal &c, time round animal - no distinct organs for liver - Bile obtained by same process as gastric juice in other animals —

Polyps - stomach simple sack -

mouth & tentacles —

simple sack —

The Blood – derived from the chyle –
float in the Serum of blood –
& Saline matters in it –
C. H. O. N. in blood –
Albumen – Fibrin hardens
when cooled – chemically identical –
Phosphate of Lime. for bone –
discs – multiply in blood –
Invertebrates – cell not so distinct.

Circulation & Respiration.
Blood circulated – consists of
clear liquor discs ~~that~~ Phenomena
while living – when taken
out form serum – blood
corpuscles – fibrine unites
all corpuscles at top –
Small quantities of fatty matter
Saline matter – Chlorine of
Sodium. Phosphates of Soda
Lime & Magnesia –

Sulphate of Soda Phosphate
of ox of iron -
Animal Materials -
Albumen & Fibrine -
Red corpuscles float in fluid
use - have power of determining
position other cells in tissues -
Fatty matter - Keeps up animal heat
for respiration -
Return of Blood - Organs -
2 series of vessels arteries & veins -
both tubular, arteries stronger
than veins - ~~out~~ a coats muscular
fibre - passes into net work -
Veins not muscular coat in
Mem as in arteries - feeble -
collect & carry back blood -
have apparatus of valves
circulation kept up by muscular
exercise

Heart – In the higher animals
4 chambers – 2 large & 2 small
& feeble, larger ones ventricals
smaller ones auricles – large ones
strong & muscular –
Heart contracts strongly –
Arterial & Venous blood –
Valves connected with
the chambers of to regulate
the flow of blood –
Valves open & close alternately
Function which lungs
perform in Circulation –
general & pulmonary
circulation – blood
must be impregnated by
oxygen – carbon given
out & oxygen taken in
known as respiration –

Fresh air needed for proper
circulation & Respiration
Lungs ex pand & air is drawn in
muscular action -
Lungs of other animals
Same structure but modified
Reptiles only 3 cavities - ~~Sam~~
much less perfect than the
human circulation -
Fishes 2 cavities. driven
to gills & then back to
heart - gills instead of
lungs - swimming bladder -

— Reproduction —

Ovum — always formed by union of sorts of different matter or cells — Known as male & female

Animals (lower) give up buds.

Some divide & so propogate —

Some of lowest form (plants) consists of union of cells —

Egg — development — vary in form & dimensions. Some oval others. ovard, flat &c — Vary. rounded ova enclosed in sacks — 1 outward membrane 2 granular material (yoke 3 nucleus 4 germinal dot

as now ready for laying, after union of male & female —

Some born alive ~~& bear~~ to parent —

growth of egg - laying - &
incubation or hatching —
Composition -
In some eggs as the egg
of bird, we have the white in
addition - next shell -
Spiral chord to support yoke -
attached to ends of shells -
date always floats to top -
Central portions - are essential -
germ & yoke — — date
Development - first appears in
dot - yoke at last divides into
a number of cells - ~~so~~ are all the
same until the first change in egg -
Vertebrates - (see text book for development
of egg) — differences as gon
as cond higher or lower
Worm - attached by back to
yoke -

Alternate reproduction -
Medusae - (~~See~~ text Book) -

Geographical Distribution—

animals - Fauna - grouping on surface of earth

Flowers - Flora - " " "

Man - not limited -

Some animals very narrow limit

Under the torrid Zone the

A. K. as well as the Vegetable

attain its highest development.

The tropical animals are not only

different, but present the greatest

variety among themselves, than

those of the temperate Zone.

Faunas are more or less distinctly

limited, according to the natural

features of the earth's surface.

The sea effects the most complete

limitation. The depths of the ocean

are quite as impassable for marine

species, as high mountains are,

for terrestrial animals.

Geological strata -

P
Permian — M
Carboniferous | Cretaceous
Devonian | Oolitic
Silurian | Triassic

modern

Tertiary
Post Pliocene
Pliocene
Miocene
Eocene

P - age. molluscs take the predominance. reign of fishes
M. age - have molluscs & radiates very abundant more articulates, not only fishes but also reptiles. also large reptiles which have now disappeared

T. age - More of Mammals
reptiles gone - huge do - -
huge Sloths - Mastodons
~~Dinos~~ ——

Ammonites & Belemnites, now,
completely wanting.
Fishes, now, covered with thin
scales, like those of the present
epoch, while in earlier ages
they were generally covered with
enamel. Among Radiata -
we see the family of the Crinoids
reduced to very few species.
& a great number of ~~the~~
New Star fishes & Urchins make
their appearance. Also innu-
merable remains of small
chambered shells, called
Nummulites - Form extensive
Layers of rocks —

Zoology Popper

Introductory Lecture -

Science of understanding Nature

2 great groups -

Organic or Inorganic

Mineralogy - Inorganic

Botany - Organic

Zoology - Sensation & Volunteer -

Geology - -

all these subjects connected -

25000 species of Animals

Made - essentially a science

of observation & investigation -

Science also of arrangement -

Zoology - Zoology - Zoology

Distinction between animal & plant

1 External Form -

Animal, separate organs

Plant - multiplication of organs -

2 - Chem - Composition

Plant - differs from animal

C. O. H. from atmosphere -

Animal - C. O. H + N -

Fibrine Albumen gelatine

Casein.

Plant - Cellulose, Lignine Gum

Starch & Sugar -

3 Nutrition -

Large cavities (internal)

Plant selects from water of the

soil what it requires.

Animals feed on organed

Plants or unorganized food -

Plant decomposes & cycle.

Plant gives out pure oxygen
takes in carbon
Plant & Animal the converse
4 Reproduction -
Plant - germ with seed
Animal - ovum or egg -
Animal produced entire -
Plant repetition of organs
5 - Sensation 6 VII - Motion -
Animal - Nervous system down
to smallest animal (Amoeba)
(see earlier part of this Book)

Structure - treated of in an
fo earlier part of this book -
2 ways in which cell are produced -
1 Epithelian Membrane
2 Epidermis -
free cells floating in fluid of body
4 Blood cell -

Rounded cells in man - Elongated cells in Fishes - As we descend lower we find colourless cells - The cells resemble the cells in the chyle, of the man -
Free cells circulate in all animals
Some animals consist of single cell.
Tissues - treated of in an earlier part of this book -

Shells - Shell of molluscs have cells, but these are filled up with ~~bony matter~~ carbonate of lime -

— H G V —

Myelencephalous Fools

Functions of the Animal Animals —
2 groups — those proper to Animal
animals & those two plants —
Sensation & Vol motion —
(see previous Notes on Immediately

Sensation — Hearing —
all the senses will be found
described in the first notes on
the subject of nourishment &c

⇐ Classification ⇒

Based on observation.

2 – 1 External Form
2 Internal Structure.

1 – 1. Forms – Study of forms very important

2 Structure – Also very important.
If the structure of one be known, others are easily recognized – important also as regard habits – & in Geology –
Regard there in twofold aspect
1 Relation to function & use
2 Type or Plan –
1 Relation to function & use –
you would notice things about the animal itself –
but to regard it in the other way – another species would have to be brought in

---

Natural objects –
when constructed on same plane
Homologous when for same purpose
Analogous

Some types are grand & general
Others ~~&~~ particular -
Is adaptation ever deviated from
~~or~~ for use -
fin of Whale - bones like man,
to carry out plan of all other animals
plan predominates ~~&~~.
rudimentary foot in Boa of no
use, serves perhaps for ~~some~~ economy
which
we are not aware of ~~-~~.

Some of lower animals have the
structure of plants -

Classification -

First based upon type Species -
unit of science - individual ~~&~~ can not
be taken as unit - ~~& sim~~
require a similarity in all essential
characters - Essential characters
Unity of form of structure
Unity of internal structure

1 Zoology

3 Unity of habit & instincts –
Domestication not taken into account –
Yet Domestication does not interfere
with internal character – &c –
Essential character – reproduction –
continuous reproduction from common
stock – Hum in habits whole of America.

Variation in species of Animals
certain animals confined to certain
~~animals~~ countries. species not
same matter, but same form –
species not confined to individual
but to a number – Domestic cat –
great variety, but same species –
If cat could not be changed, it could
not be domesticated – 1st species
then varieties – Cat brought into
Europe from east – other species –

Genus – Felis – Lion Tiger Lynx &c –
same structure – Dog & Wolves distinct
group – &c –

Species – ~~Genus~~ F. Gatus	
Genus	Felis
Family	Felidae
Order	Carnaria
Class	Mamalia
Sub Kingdom	Vertebrata

Species differs from other groups –

V. A – M – R –

Aristotle – divided Animals into
2 great groups – with &
without blood –
Linnaeus – – into 3 groups
according to blood. 1: Warm red
Blood, 2 cold red blood – then
left other animals in last group,
as having cold white blood –

— Zoology —

Hunter - according to the heart & its cavities - last group S & H proposing same (thing)

Cuvier - 1 Vertebrates - 2 Articulates - 3 Mollusces 4 Radiates. we now follow this method

Provinces or branches of Animal kingdom

Order - complexity of structure -
Class - adaptation
Province = Type

1 Vertebrates - brain & spinal cord internal bony skeleton - 5 senses - mouth & vertical jaws blood always red - heart complex strong muscular, 2 pairs of locomotive limbs (~~least~~).

2 Homogangliata, very round gullet external jointed skeleton, no proper red blood, vaseform heart - organs of respiration on sides of body - jaws lateral - diction

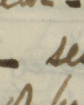
Heterogangliate - Molluscous
no external skeleton. blood
not red, heart compact & muscular
& organs of respiration lateral -
diecious -

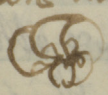
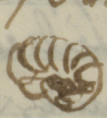
Radiates - Radiated members
of body — monecious -

Distribution - 20,000 Vertebrates
Molluscs less numerous -
Articulates - vast number 100,000
more numerous in species -
Radiates 10,000 species known
doubtless great many more

Total 145,000 S.

Animal Kingdom
(from lowest to highest)

Radiates - Typical & Aberrant R -
Typical 1 Class Protozoa
Absence of — - cell, sarcode
inclose in cell wall - very small.
1 order Rhizopoda - Simplest
animals - root like feet -
Amoeba - changes form - may be
globular - branch out root like
feet - seizes food & forces it through
wall of body - lowest form of Protoza
Actinophrys - spherical form retains
form -  2 kinds of tissues
seizes its food & forces it through
body - Calcareous chambered cells
Orbulina Universe - filaments
stretch through shell - ~~shell pelle~~

Zoology

Siliceous Polististecia –
Silica instead of Carbon & Lime –
Noctiluca – Inhabit sea –
very numerous – cause
brilliance of ocean –

inhabit seas of all climates
beds of limestones composed of
foraminifera –

~~Order 2 – Porifera~~ –
This order most important in
geological age – Foraminifera
most ~~genu~~ diffused over earth –
Orbulina Universa – circular cell –

2. Order Porifera –
Sponges. Animal, not plant
as has been supposed –
Some have siliceous & others
Corneous coverings – Spicula
of various forms –

Young free for a short time, but afterwards become fixed -
~~Picks stickout~~ - Fresh water sponges - Several genera - at first all called Spongia, but this is now confined to the tropical sponges - Siliceous sponges may be divided into several genera. - Spongilla Fresh water sponges -

---

3 order Infusoria - cell like form single & compound - covered with cilia - Cyestomi stomach excavated in body = Reproduction, Gemmation division, & ova -
epidermis covers body -
Vorticella - fixed individuals, cilia confined to mouth, stalk - stalk contraction - Spontaneous division = forms of young vary -

Great many plants very like these animals - Some say that the Infusoria are young of other animals -
(Since this lecture, however, I have heard from pretty good authority that they are ~~plants~~ the young of plants) -
2 Hydrozoa - body sack like & sarcode in material - large internal cavity - simple sack one opening - tentacles hollow thread cells - muscular fibres in wall round sack -
3 groups 1 Naked - no external covering - Hydra - small size soft sacode material of green colour cell structure in walls muscular fibres - attached by foot - tentacula hollow joints with small claws or darts

Zoology

Darts connected with some poison or material. Very simple great power of reparation - may be cut to peices, each part will become an animal, it can even be inverted - Reproduce rapidly by gemnation or budding

(a Tube cells

Tubularia - inhabit sea, in simple tubes always fixed to bottom bright flesh colour - fixed & at base of head little rings commence forming after a time head falls off; it attaches itself to bottom a stalk is produced, also another Head &c 2 or three diff modes of reproduction in diff species

3 Sessile Cells

Campanularia — branching stems. polype same as Hydra

Sertularia — Reproduction — young produces — horny capsule —

Sertularidae Sertularia — little stalks, cells approach one another — alternate opposite cells placed alternately. Other genus little branches & cells placed on them — some more side some on both — all of small size armed with minute dart cells — Ovicapsule produce little oval gemmules furnished with cilia. swim about for some time & then attach itself.

Henry —

Jan. 14th — 3 Acalephae —

Free swimming animals - gelatinous
tentacle armed with dart cells -
sharp threads - digestive cavities -
male & female forms - pass through
diff. stages, groups.

1 Siphonophera - bad floated
by air cells - Genus Physalia -
feed by tubes from lower part
of body -  - tubes filled with
thread cells with a power of lassoing
also shorter ones, open at ex hemity
sucking apparatus. little known
of habits - oceanic - specimens
rarely obtained - other forms


Porpita

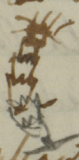

Velella

2 order - Dicrotophora - body .5
discoid - proppa jelly fishes -
mouth central - proboscis -
no organs of support - float -
sometimes very large - others microscopic
not easily preserved - 2 groups -
(1) Bare eyed & (2) Clothed eyed -
both by expansion & contraction -
some have long proboscis, eyes round
edge: spot of pigment - also organs
of hearing - tentacles for securing prey -
all very small - in great numbers
some ~~bud~~ reproduce by gemmation
~~2~~ (2) - Clothed eyed - more complex
Rhizostoma or root mouthed -
some very large - but very little
animal matter - 7 feet in
diameter will weigh when dried
3 grains - disc more curved edge -
permeated with a number of small

vessels - central cavity stomach - ~~radiating~~ stomach does not open into mouth - circulating system, & external senses ~~has~~ other another form

reproduction very curious.

true ova - from these a little oval object moving rapidly - settles after a while - upper part divides into 2 or four parts - next form exactly like polype - produces by gemmation, may exist in this way for some time - then it ~~to~~ divides into a series of joints.



They then drop off & move about - the last one sometimes remains goes on again reproducing, young invert themselves ~~man~~

Single ovum may reproduce a great number & become the prey of larger animals – ~~[illegible]~~ Phosphorescent
2 order Ctenophora. structures much the same – genus Beroe – globular or oval – not discoloured – structure however, same – tentacles can be extended to a great length – thread cells – can contract them very quickly. central stomach and through body – respiration performed by surface of body – eye spec at end of body – another form

same structure –
4 Class Anthozoa still radiated
1 fam Actineadae – tentacles round mouth & hollow – used as organs of prehension
soft flesh & muscular often of bright colouring.

foot of muscular character enables them to attatch themselves to substances — all this class are marine — walls chambered ovaries - respiratory organs  arms covered with thread cells - Habits - attatched to stones or shells sometimes at great depths — prey upon fish crustacea &c when alarmed contract their tentacles no eyes : they are however ~~to light~~ sensible to light some species fixed — walk on tentacles when they move from one place to another — Male & female in one ~~id.~~ individual young swim about & then settle very like Hydroid Polypes in young state — young differs from parent varied in colour sometimes 2 sets of tentacles — outer & inner

Xeniadae actiniae reproduce
by gemmation - branch out -
complex structures -
5 Alconiidae - polypes fixed
into compound masses partly
horny & partly mineral
like sponge - were at first
classified with sponges -
when alive covered with
an animal substance - little
cells - animals residing in these
very like actiniae - structure
same, except these creatures
have only 6 arms - live in all
seas - very abundant -
Pennatulidae - simple stem
& branches on this stem
& on each branch we have male
polypes in cells - structure
of actinea - stalk

live on muddy bottoms - grow, stalk, stretches down into mud no power of moving - very bright colouring phosphorescent
Tubiporidae or true corals -
red coral - Tubipora Musica -
number of cylindrical tubes -
in each tube, animal like Actinia
only smaller resides  compound
animal - animals develope at
the same time flat plate & all
connect & make flat form - animals
abandon bottom & moving upwards -

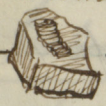
Missed lecture Jan 27

Actineadae
Fenidae
Madreporidae } - order - Zoantharia

Alcyonidae
Pennatulidae } order Alcyonaria
Tubiporidae
Corallidae

---

5 Class - Echinodermata - highest class - animals free - ~~organs of sense~~ Nervous system - & in some respiratory organs - order 1 Crinoidea - creatures attached by jointed stem - mouth vent - fam 1 Encrinidae
" 2 Comatulidae -
First extinct -  - arms organs of prehension - & also used for swimming organs - limbs break off when taken out of water, can reproduce arms - young state fixed, when older is free - (Comatula) - Encrinites remain fixed - strong jointed stem - P. of Medusae - resides in deepest seas - very rare - great abundance of fossil remains -

Some of our limestones entirely made up of them —  — 150,000 bony joints —

Some with only pair of arms, found fossil in canada —

2 order Asteroidea — Star fish

seven attached — calcareous spines —

Asterias Rubens — 5 fingered —

upper part of ray, composed of a series of plates — form arch — openings for tube feet  — organs of locomotion. fill tube feet with a fluid & stretch feet out — attach themselves & draw themselves along —

feet can destroy & eat the oysters — introduce their stomach & suck their juices —

vascular system strangely arranged —

a venous blood

b arterial blood

simple ring round gullet —

& branching out in each ray —

eyes in points of rays +
plate on top of body - for the entrance
of sea water ⊕ ⊕
reproductive organs near mouth -
young - like ancin alcals -
others like medusae, & others
again like polypes - some however
are like parent from first.
Stomach ex panded -

Genus - Ophiura - somewhat different
form - furrows short & do not
extend into rays - rays hard calcareous
joints placed end to end - section

- internal skeleton, then muscle
then a dermal skeleton - mouth
central stomach above mouth -
much the same as star fish -
suckers confined to disc, different
genera: Order Asteroidea

genus Euryale - Numerous fingers or rays - ~~extens~~

---

3 Order - Echinoidea - remove sate form - more or less rounded - hard shell - great number of plates - grow by addition to edges - mouth central stomach above mouth - plates 2 series - ambulacral & interambulacral - ambulacral have spines for protection of animal - interambulacral, have orifices for the protrusion of tube feet - stems of foot, firm & bony - [illegible] of general structure of shell - tubercles very large in some - not fixed - movable - shell not outside covered with a thin coat of fleshy matter - [illegible] - expire bent one way or another - mouth placed below - jaws with teeth - five teeth meeting in point - chisel shaped -

Intestinal canal winds round
bac shell from mouth - Ovaries along
sides - penicellarise - sharp pointed
organs & small pincer like organs -
organs for defence - & also for the
removement of any small object
on the body of animal - circulation
well understood - heart like organ
tracl - & also respiratory organs
have been supposed to have been
found - 5 plates on top of animal.
young of medusa like form -
4 order Holothuridae - sea
cucumber - vascular system -
respiration - peculiar & complex
different from an other animal.
5 - order Sipunculoidea -
worm like animals, live in
mud & sand - crown of
tentacles round mouth -

deviation from usual form of radiates
body elongated - & worm like -
~~#~~ used as article of food -

Aberrant Radiates -

1 Entozoa - Parasitic, live on other creatures - not a natural group - very numerous & diversified in their forms - no external organs - no distinct organs of respiration - low nervous system - full developement of reproductive ~~organs~~ few organs - ~~man~~ 13 species of ~~parasites~~ these attack man -

Divided into 2 group Nematelminthes & Platelminthes - 1st. Solid ~~worms~~
2nd Hollowed out ~~#~~.

Order Tænioidea - or tape worms - animals of lowest type -

genus. Cysticercus

(a) Cystic Entozoon - or bag like -
(b) Cestoid)
belt like

Tape worms - banded or belted Entozoon
not very different from Cystic Entozoon

Head of Tape worm - flat
joints -  male & female in
same individual - each joint is also
male & female - each of these ~~joints~~
joints may be considered a separate
animal - all joints may be taken
away, except the upper part, & may
be reproduced * may be regarded
as single animal with great
numbers of reproductive organs -
~~This~~ is not seen in Eastern Europe -
replaced by another species - joint
broader & shorter - double orifice in
each joint for the production of
ova - Cystic young of ~~the~~ Cestoid -
as far as is ~~known~~ yet known -

2 Order Trematoda - structures differs very little - Distoma -
Very like single joint of tape worm - distoma of sheep comes from the water they drink - live at first in body of snail, they there germinate -
3 Order Acanthocephala - peculiar spine apparatus - much higher in organization, distinct sexes -

- bores its way through the tissues - infests hog
II Coelelminthes
Ord - 4 Gordiacea
found in some insects - very long & slender - free moving active animals - young state passed in water - (Hair Worms) - Deposit eggs in water, these are hatched into a strange animalcule, not known -

Found in ponds & places where cattle drink - Genus T. Spiralis - microscopic - infests muscles of man - (5) - sometimes ~~a~~ animals muscles are filled with this species

5 Order Nematoidea - Placed by many Naturalists among the worms Dropper 2 - 1 Genus Filaria - ~~Gen~~ burrows under skin of animals in warmer climates - ~~complex~~ - 2. Genus Strongylus - infests kidneys - head obtuse, mouth circular surrounded with papillae. body surrounded by muscular bands - male & female - 3. Genus Ascaris Round Worms - tail acute, more so in male than female - male smaller than female - in sides of round worm, ~~two~~ 4 longitudinal bands -

The 2 down sides, circulating bands - abdominal & dorsal - nervous bands, - very different from articulates - no joints nor articulation - intestinal canal straight - mouth, a circular orifice - organs correspond to lymphatics - Ascaris Vermicularis - much smaller, & found in different part of ~~canal~~ intestinal canal, structure same - very reproductive.

Class - Rotifera - larger animalcules. found in standing waters - body oblong - tail - post. abdomen pointed - locomotion aided by the ~~wheel~~ circle of cilia at the head - can determine current to mouth, furnished with clospers - ~~digestive~~ canal - gullet, & crop pulsating sacs - apparatus for carrying water through body -

Sometimes ova produced, & at other times young pitched out alive — ~~no~~ no spontaneous division — Classification —

1 attached

2 attached moveable

3 Always free —

Genus — Stephanoceros ~~[illegible]~~ crown of tentacles round head — ciliated organs, attached by a stalk, containing 2 muscular bands — skin smooth. (some have all body covered with cilia) Muscular system — Muscles stretched longitudinally & others transversely — gullet — large crop — gizzard — with 2 hard teeth — work with grinding motion — proper digestive stomach & intestinal canal short — ganglia

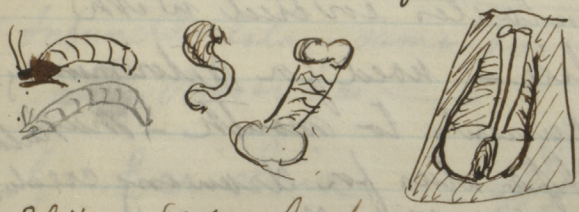
eye specs - sexes distinct
eggs few - large compared with animal
young can grow to full size in 12 hours -
produce 2 distinct kinds of eggs some
for summer others for winter -
Same thing occur in some crustaceans
Very tenacious of life - They have been
frozen into solid ice & recover -
Can be kept dry for a long time &
yet keep their life - Some have been
kept for 4 years in dry state -
Have been found to be able to
be revived 15 times - Some - 16th time
all were found dead - Appear to
prey upon smaller animal cells & some
called plants. Connect Radiats to
articulates -

- Byozoa -

(By Mr Carpenter)

— Mollusca on coasts of Mexico
Distribution & Variation
of Species —
Some have power of travelling to
great distances —
British Islands — Species here also
in Norway Greenland &c round
Polar region — ~~go~~ travels south —
West Indian Species come along
to New York & to Ma —
British Province — found in Medn
Sea — as far as Canary Islands —
~~Sp~~ do not always find
same species on one side
of atlantic as other —
~~on~~ all about the Pacific ocean
species same —
V — of species — Spondylus —
Gulf of California —

are often attacked by boring shell,
so their shells are very thick
sometimes 6 inches — also worm
eating cavity. when worm have died
out minute mollusces occupy
the cavity. (Cæcum.)
Serpula — Worm shells —
Vermetus
animal found on the Oyster



Slipper-shell — Crepidula —

(a) had been fastened on some murex
& had taken of shape of shell.
Spines of murex —
Limpets & Patellas —

Bryozoa - 3 classes of aberrant
Radiates - Small -
Genus Flustra - flat leaflike
ex Janacon -
Bowerbankii - body sack
like - interior oesophagus -
leading to stomach - mouth
opens in center of tentacles -
tentacles covered with
cilia - used for determining
currents to mouth - Muscular
apparatus for drawing creature
back into cell - round mouth
of cell opens - for the protection
of body - Nervous system -
~~no~~ little known -
Respiration - by means of
tentacles - Reproduced by
true ova - Male & female
in same animal -

Prehensile organs - very peculiar
resemble the head of bird - attached
about mouths & sides of cell.

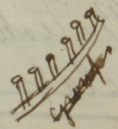
---

2 great Groups

Order 1 Infundibulata = marine
" 2 Heppocrepea - = freshwater -

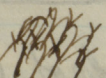
---

1 Infundibulata - Fam - Vesicularidae
Genus Bowerbanc —
Genus Lacrialaria



animal similar to Bowerbankia
Genus Tubulipora —

Fam Seriporidae -
Genus Membraneporida



" Lepralia -
very abundant in St Lawrence

Fam Oscarella contain ova

Fam. Escaridae
Genus Escara.
Genus Flustra - cells open
& horny

Fam. Alcyonidae - soft
gellatinous matter, spreading
over stones -

all interesting & rather
complex -
British naturalists call this
class - Polyzoa -

Bryozoa are nearly all small -
encrusting weeds, stones &c. -

Mode of collecting & preserving Bryozoa.
Rhizopods -

can only be kept as living specimens

evaporate the water very quick &
the animals will be left dry —
Order Foraminifera — live in fresh & salt —
merely dried —.
Sea Sponge — dried — if washed
much they bleach —

Foraminifera — found in sand of sea
shore — one also find in sponges —
& attached to Oyster —
dry — throw in water, & their tests
& shells will float —
can be mounted either with Canada
Balsam or
or as Opaque objects — Asphalt —
let shell ~~sing~~ sink in —

Hydroid Polyps — Fresh water polyps
can ~~only~~ not be preserved —

Marine have nearly all died ~~this time~~
can be dried, animals are

looked at alive - may be preserved - - let them die in salt water - & then they are nearly all half out of cells - can be mounted in Glycerine -

---

Best preserved in this —

Salt 1/2 lb (for strong animals)

Arsenic 20 grs

Corrosive sub - 2 grs

Boiling water - 1 quart -

But for small animals this is the best -

Spirit 30 under Pg -

Creosote 40 drops -

---

this does not change colour -

Ctenophorae - found floating -
Tow net - 
made of Bunting -

P - very difficult - may be preserved
in last Solution -

Anthozoa - Sea Anemonies
not easily preserved - best,
method is to let them die
& put them in vessel & pour
in Glycerine - May then be
put in Glycerine -

E. Echinodermata -
Sea Urchin make opening & draw out
animal - Starfish - animal
drawn out of sacs -
Comatula - Drop into fresh water
at once - dried - & placed on
card -

Holothuria – preserved in spirit –

– Mollusca –

absence of true skeleton –
Mantle – ~~&~~ in many ~~one~~ species
The mantle has the power of depositing calcareous matter in shell –
Intestinal canal – bilateral symetry – locomotive organs, very slightly developed, organs of nutrition largely provided for –
Sub-division 2 Groups –
(1) Acephala – headless
(2) Encephala – with heads –

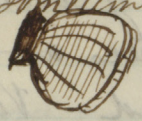
~~(1) – Class Tunicata~~ –

(1) – (a) Class Tunicata –
Sack – ~~walls~~ .

(b) Class Brachiopoda –

bivalve shell – 2 spiral arms –

(c) Class Lamellibranchiata –
body defended by bivalve shell
placed laterally – sometimes attached
sometimes not –



(2) Gastropoda –
(a) Pteropoda – wing like expansion
of body

Pteropod –

(b) Gasteropoda –

(c) Cephalopoda

– Tunicates – external tunic
or coat – coat tough – muscular
coat – ~~sometimes~~ Order Ascidea
Fam. Ascidians –

2 openings one serving for mouth
other for anal orifice –

mouth at ~~bottom~~ end of animal
large & well developed stomach
Organs of circulation
eye specs ~~not the~~ have also been
found — Vital actions very
simple — contraction &
expansion — "
Fam. 2 Botryllidae —

Star form —
" 3 — Clavellinae.
resemble ~~one~~ Bryozoa —

" 4 — Pyrosomidae —
cylinder — closed at one end —
from surface of cylinder the
orifices with a leaf like process
are situated — one general orifice
for the e[illegible] of water

very luminous, seas of warm climates - (4 families in this order)

2 order Siphone -
~~animals~~ Fam Salpidae
Found floating in bands -
united side by side -
respiratory organ a sort of gill -
Stomach - globular - heart -
alternate pulsation -
2 forms - band like - each individual produces an egg -
& young again produces a cluster -
alternate generations -

Young of Ascidians quite different from parent.

Reproduction by ova - which are hatched into tadpole like animals -

2 Class Brachiopoda - Bivalve Shell.
valves placed dorsally & ventrally.
Called by older Naturalists Lamp Shell.
Attached - muscular & tunic
divided into two leaves (In the
Ascidians there was one tunic)
Valves of Brachiopods always
equilateral - always have
opening at apex - to allow of
the protrusion of peduncle -
Ventral valve down in the
right position - peduncle is
soft & membraneous permanent
stalk - Shell - valves attached
by teeth, shell can not open
far - viscera near hinge - Mouth
leads to stomach short
intestinal canal - 2 long fringed
tubular arms - they are muscular
fringes with cilia -

B. keeps its valves open - & cilia on arms determine currents of water. loops to which the arms are attatched =

General arrangements very like tunicates. Differ in respect to arms. two distinct sets of muscles, one for opening & the other for shutting - very powerful - 7 sets of muscle.

Circulating system - heart double ventricle & oracle. (Tunicates had single).

Nervous system - two ganglia near gullet -

Respiration also provided for - not presumed of arms - but by the inner surface of mantle. blood vessels spread out over it largely - currents bathe walls continually.

(Brachiopoda) continued.

Reproduction - by ova - found on inner surface of mantle.

All inhabit deeper parts of sea - 200 fathoms deep sometimes anchored to rocks - no locomotion young state not known. but most likely have power of some locomotion -
Need strong muscles to open & shut under such a pressure of water -
Very few in modern seas - Only two species in our seas - From Greenland to Florida - or the whole of North Atlantic Ocean - The older rocks are full of Terebratulas & Brachiopods as we get to the newer rocks they disappear almost altogether -

8 Families in this Class —

1 Terebratulidae — beak perforated — internally a looped apparatus — serves for attachment of arms — shell of tubular structure supposed to be a provision for breathing while shell is shut —

2 Spiriferidae — spiral apparatus instead of loop for attachment of arms — all extinct — arms were intented to be always kept coiled instead of being thrown out — notch for peduncle — (Spirifer Syrx) common in Canada —

3 Rhynchonellidae — ventral valve prominent, notched valve for peduncle — short process for the arms — occur in our seas —

Atrypa — Plena & Increbescens

4 - Orthidae - valve nearly equal - notch for stalk - flat shells - abundant as fossils -

5 - Productidae - great convexity of ventral & concavity of dorsal - hardly any notch for peduncle spine of on dorsal valve - spine for attaching shell to bottom - lived in muddy bottom -

6 Craniadae - attached to rock of valves - modern

7 - ——— - hole in valve nearly in the center - for peduncle. Modern -

8 Lingulaide valves not attached - mantle has bristly edge - Lingulas occurs in oldest rock we have, not-

Same species - but of genus
lingula - Phosphate of lime -
70 recent species of B
1,000 fossil species. —

---

3 Class Lamellibranchiata -
body clothed with pair of shells
Shells differ of those of Brachiopods
inequilateral - Mantle closed
in most open all round in some -
want oral arms of Brachiopods -
have 4 tentacles - & also distinct
gills - 4 branchiae -
Mytilus Edulis. no distinct head
mouth with 4 long tentacles. ~~no~~
stomach muscular - long bodies in
interior for mastication, ~~liver~~ ~~[illegible]~~
stomach - intestine extends along to
posterior part of body - gills along
front of body - foot used ~~for~~ as a
tool in fastening itself

& also as organ of locomotion
ovum. find their way into gill.
& are then hatched & passed out
of ~~moth~~ mouth. Cilia round
inner part of mantle for circulation of water —
nervous system. ganglia round
~~moth~~ mouth &c — Adductor
muscle — used for closing shell —
Hinge — internal & external
ligament. pad in some for
opening shell. & consequently
open when animal is dead
double heart. sometimes 3 cavities.
2 sexes. different animals —
Oyster. labial tentacles open
into mouth — lead to stomach
round which is the liver —
largest part of animal — intestine
short — only one muscle can be
detected — very strong — heart

elongated vesicle 2 cavities
gills round whole length of
animal – Mantle open
round edge – edge of mantle
is fringe – shell secreted
by mantle – foot not apparent
settles for life – & attaches
its lower valve – Gills – bars
connected by other bars –
covered with cilia –
Tellina – marked difference – it is
a locomotive animal & burrows –
broader than long – 2 muscles
anterior & posterior – 2 labial processes
gills placed across shell – foot
largely developed – ~~Siphons~~ two
siphons – for breathing when under
ground – cilia or bristles round
end of siphon – to keep out matter
that would injure animal –

Some can even leap a great distance by means of foot.
Mya F — can bury itself a good distance. as it has a long siphon.
Epidermis. external covering - protects shells from dissolving by water - outer layer of shell prismatic. carbonate of lime. very brittle - inner surface lined with laminated shell - proportions differ. in different shell. inner surface produces pearl.
Pearl oyster laminae runs in waves.
Shells grows by addition to edges.
Form of shell.

Teeth of shell of great importance in determining shell (species)
marks of muscles - & labial ~~marks~~ impressions.

(2)

(1) Monomiaria & Dimiaria –
not natural divisions –

(1) Ostreadae (Jam) – common Oyster
genus Anomia – hole through
which the muscles grasper & fasten
below –

Pectens – most active & highly
organised – large adductor
muscles – eye spot round
edge of mantle –

(2) Pearly Oyster Shells –
genus Pinna – spin long
beard or byssus – silk used
a little in commerce
Mytilus – beard or byssus
Arcadae – rows of teeth round
edge of shell – wind Nuiguna –
live in mud –
Solenelidae – Sedos –

Trigonidae - Trigonia
Unionidae Fresh water mussel -
Elasmodon -

Hippuritidae lower valve
of great thickness -
Tridacnidae - bears claw -
Cardiadae - cockles -
well developed foot -
does not burrow much -
Cyclads. Cyclas -
Veneridae - Venus -
Mactridae - Mactra -
very large - largest bivalve -
Solenidae Solen
Myacidae - Mya -
Pholadidae - great burrowers -
Teredo or Ship worm -
bores into timber -

Pholads - possess the power of boring - The means by which they burrow has long been a disputed point - Some suppose by the rasping action of edges of shell -
Another view is that the action is a chemical one - is ~~most~~ very likely by both of these means, that the boring is accomplished

---

Unio Gibbosus very plentiful in St Lawrence - Also U Rectus U. Radiatus -

---

Pteropoda - winged Mollusks distinct heads - Swim near surface of sea - organs of locomotion on sides of body in shape of wings - small animals -

2 Groups - 1 Shelly coverings &
2 No shell.
Animal fleshy coloured wings
of a rich colour - structure -
digestive organs - leads thru crop.
stomach long & narrow - intestine
heart - oracle & vertical
Conularias - are of this Order
but extinct -
1 fam Hyaliadae -
2 Limacinidae ex Limacina
Spiral Shell - like snail shell
turned opposite way -
internal structures like last
family - by these fins it
moves through water -
2 group No shells.
Clio - borealis - pinkish
small - organs of reproduction -
both sexes in same individual.

cephalic lobes - furnished with
a number of little suckers -
vastly numerous - prehensile
organs - eyes at base - simple
in structure - globular sack
with fluid - retina at back -
optic nerve passing through it -
an organ which corresponds with
foot of often some molluscs
rudimentary - wings expansion
of mantle -
tentacles - tubular processes -
organs of touch -
Clio lives above generally organization
of Scam - . exists in great
numbers in Artic Seas -
Whale feeds upon ~~the~~ them -
habits of the Clio dense -
apparatus for prehension very complex -
inhabit wide ocean possibly former

Some naturalists place them along with the Gasteropoda as an order -

---

Clio Borealis - The body is about an inch in length of an oblong shape & terminating posteriorly in a point; while at the opposite extremity there is a little head supported upon a short neck, & furnished with ~~short~~ delicate retractile tentacles, apparently instruments of touch.

The locomotive organs, as the name of the class imports, consist of two delicate wing like appendages attached to the two sides of neck; by means of which, as by a pair of broad fins, the Pteropod rows itself about with facility -

a a wing like appendages -
S 3 conical appendages
K 2 slender filiform tentacula -

Gasteropoda - Head developed - muscular foot, along lower part of body + hence their name - tentacles organs of hearing &c. - move by undulation of foot. muscles contract & stretch out again - Gills comb like - covered by mantle - Univalve shells - Not always shells -

Order 1 Nucleobranchiata - called from shape of gills - gills in mass - In one species. heart gills & liver in shell distinct from body -

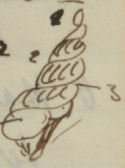
Gymnarium - oceanic creatures -
swim rapidly - rasp like tongue -
little shell on back - contain gills &c -
Atlantidae, have a shell (spiral)
large & into which the animal
may retire -
2 - Order - Opisthobranchiata -
Sea slugs - gills at back part
of body - & in tufts outside
body - (a) Naked gills.
gills along body -
all small snail like creatures.
some very finely coloured -
(b) Gills Protected - by mantle -
some sea slugs among them -
Bursatella. In some of these
there are shells - Genus Bulla -
3 - order Pulmonifera - breath air -
fresh water molluscs - live in moist
places - some have shells -

Common Snails - organs of sensation -
nervous system, higher than any
of our former orders - Sense
touch & vision - 2 pairs of
tentacles - small & large - organs
of touch anteriorly - ~~in~~ larger
tentacles - organs of sight - eyes spot
near extremity - can invert tentacle
& draw eye back into body -
2 great masses of muscles, by which
the animal is drawn back into
shell - Pulmonary sack, organ
of respiration - not like lung
of Vertebrate - placed along back,
seperated from viscera by a muscular
diaphragm - circulation performed by
a simple heart - come up to
surface & fill this sack with
air, & can then descend & stay
a considerable time under water -

mucus secretion over surface
of bodies - tongue rasp like -
tongue covered with little siliceous
teeth (a) Operculate & (b) Inoperculate
~~Operculate~~ - Helix Alorlubris -
genus Pupa - Lymnea - Auricula - toothed
Physa - Planorbis - genus Limax
no shell at all -
4 Order - Prosobranchiata -
great number of marine univalve
shellfish - foot under belly - & all
the senses - gills in front of
heart - systemic circulation -
into gills & then back to heart -
digestive same as in Aspkala -
but more complicated - ovi sack
or egg cases — all marine well
developed head -

ovi sacs -

Univalve shell - spiral ~~of~~
peculiar shapes - in different species
- blunt or sharp & again in rudimentary
Vermetus irregular - some tubular -
others shield shape - Crepidula -
Limpet - Multivalve shells -
Chitons - very like limpet -
series of shelly plates -
Spire - in one particular direction
dextral but sometimes
we have them sinistral
as Physa - 1 apex - 2 spire
3 suture - 4 aperture - columella
& outer lips - notch or if long
canal - may have complet
operculum - att ached to foot -
& range during life of animal -



Paludina is provided with gills
& can only live in water - siphon
placed near head - ovary occupies
a large part of upper part of shell -
Some vegitable others animal feeders -
long rasp tongue -
Fam Chiton - can be rolled up into ball -
2 Dentalium - tubular shells -
3 Patellidae - creep along surface of rocks -
attach themselves to rocks -
4 Fam Crepidulia - slipper shell -
5 Fissurellidae - key hole limpets -
respires without raising shell -
6 Haliotidae - series of holes - large
size - Lanthina also placed
in this family - swims on surface
gills used side of Haliotis &
Lanthina appear to represent
the oldest univ alves we have
swam on surface -

7 Turbinidae. Turbo —
8 Turritellidae — T ——
9 Paludinidae. P —— fresh water
10 Neritidae — N —— .
11 Littorinidae. L —
12 Melaniidae. M.. — fresh water —
13 - Erythreidae. E — .
14 Naticidae — N — Natica —
(all without siphons)
15 (with siphons). Cypraeidae — Cowry —
16 Volutidae — Voluta —
17 Conidae — Cones —
18 Buccinidae — B — —
19 Muricidae — Murex —
(4 genera of mantles —
20 — Strombidae — Strombus —

VI - Cephalopoda - distinct head - structures equivalent to brain ~~[illegible]~~ rudimentary shell - prehensile organs attached to head - sexes distinct - some enclosed in shells - others not as Cuttle Fish & Squid -

Order I - Tetrabranchiata - 4 gills - lowest - shells external & chambered - body is only in anterior whorl - other divisions filled with air - N - Pompilius - animal body unknown - analogous to cuttle fishes = large number of tentacula - 90 or more - armed with suckers eye placed in front - funnel filled with sea water, bathes gills - mouth - armed with a pair of jaws - liver - gall bladder -

N. system ring round gullet –
Circulatory – heart 2 ventricles –
Mantle found in the molluscs –
Swim head downwards – & preys
upon animals below it –
force water through siphon & sink –
Very rare now – great number
fossil & extinct – Ammonites –
Orthoceras – straight ~~outer~~
chambered shells –
Order 2 – Dibranchiata – 2 gills –
either no shell or internal shell –
in/2 bladder – very black fluid –
They can force this out & darken
the ~~outer~~ water all round them
& escape – highest – 2 divisions
1 Decapoda 2 Octopoda
(1) Common Squid – elongated
body – fin at back of body –
quicker in swimming –

Internal skeleton - 8 short
arms - claw like darts -
horny jaws - rapid movements -
representatives in arch[illegible]
rocks - Belemnites -

Large eyes - movements
very quick - always backwards
used for bait.
Spirula - internal shell -
Pacific - Atlantic - very plentiful
in Tropics - shell altogether
internal - ~~animal~~ used for a
float - have ink bags - in fossil
open chamber of shell -
Decapods - Loligo Sepia Spirula
Octopoda - 8 arms all of
same length - Octopus -
very fine species - ~~Arms~~ body small
arms largely developed - & all
of one size - large suckers -

Argonaut - Paper Nautilus -
no chambers - animal not
attatched in any way to shell -
arms enclose shell - suckers -
Shell moves by the ejection of
water through canal - only female
known found, male has no shell
& is small - chief use for shell
in female is for the spawn -

Nervous system in the Cephalopods
brain in a kind of bony case -
cavities for eyes & ears -
nervous mass round gullet -
heart shaped mass - lies over
the oesophagus - branches
anteriorly & laterally -
series of nerve fibres to arms -
1 pair to mouth ganglia -
spinal chord into 3 nerve chord
ramify the surface of mantle -

central branch which supplies
the viscera & lungs with nerves.
Sensation - Eye same principles
as Vertebrates - crystalline lense
globular - groove round middle
Hearing - like fishes - ear chamber
sac c/c enclosing ear stones in
fluid -
Smell - small cavities near
eyes -
Mastication - horny beak -
proper tongue -
Respiration & Circulation - as
in lower Vertebrates.
blood a yellow colour -
valves in veins -
Generation - Sexes or sometimes
taken care of by ancestral -
right generally left attached in
females - or some body stone -

Called Sea Grapes — no
metamorphosis - animal
when young same as parent -
In Octopus male attached
to female like parasite

— Preservation & Collection —
Dredging - Low net - & from stomach
of fishes - & also along shores —
glass - shells glued to glass —
see both sides - Laid
out on black grounds —
Animals preserved in spirit.
weak spirit - Gattle fish
& squid will darken spirit
when first put in —

III Articulata - horny case —
jointed & external to
muscles - nervous chord double
ring round gullet —

one ganglia corresponds to
each articulation of body
100,000 species –
Classification –
Class 1 Annulata – Worms –
2 Pisces – Fish parasites –
something like entozoon
3 Cirripedia – Acorn Shell –
4 Crustacea Soft Shell fish –
5 Myriapoda – Centipedes
6 Insecta – Insects –
7 Arachnida. Mites Spiders –
Scorpions –

Class 1 – Annulata – Worms –
Mostly aquatic – rings
organs of locomotion but
bristles or suckers –
Red blood –

Order 1 - Suctoria - Leeches
Medicinal Leech - absence
of bristles, suckers at each
extremity - body composed
of rings - ~~[illegible]~~ integument
divided into an outer epidermis
& the skin — organs of
mastication - 3 teeth - saw
like form - stomach of great
size, great number of sacks
out from it on both sides —
can absorb a great quantity
of blood - mucus glands -
~~[illegible]~~.
Circulation - dorsal & ventral
vessels - two lateral ones —
Nervous - ring round gullet -
Sensation - eyes - 10 eyes - round
margin - dimple - food - to
blood of higher animals -

feed on a great number of animals.
Great number of species -
Tortoise Leech - ~~in east~~
found in our streams -
Young attach themselves
to parent - fish & birds do
feed on them -
2. Order 2 Terricola - Earth Worm
form of body like leech
no suckers - body covered
with bristles - Mouth
placed laterally in first
joint - Food - fine particles
of vegetable & animal matter
Respiration - breathing
pores at sides - very abundant
in rich soils - Become food
of birds - Prepare soil for
cultivation - Nocturnal
in its habits -

Order Gravitia - Sea worms
move freely over sea -
organs of locomotion
pair to each joint -
also they are organs of
respiration - & also for swimming
feet very complex - differ
very much in different species -
2 strong lateral jaws -
destitute of eyes - may be
very minute - of circulation
differs in different species -
gill along back - in lift -
heart - muscular -
habitat mud & sand -
under stones - ~~to~~ can repair
injuries - head can be
reproduced, & all joints -
very tenacious of life -
more so than common earth worm -

very complex reproductive organs — also they produce sometimes by division —
Order 4 - Tubicolae —
Inhabit tubes — slipper to tube — & branch like organs on each side head — also a foot like organs to pull the body out of shell & to two others to pull it in again — adhere to shells — Spirorbis very like these creatures —
Some make cases of sand — Sabella —

Class III Epizoa — live on surface of other animals —
~~— in fish~~ body divided in to zoonites —
Order 1 - Cephalura — Pediculus — lower into eye — long & narrow — sucker mouth — rudimentary limbs.

long intestinal tube – nervous chord
large & complex sexual apparatus –
quantities of ova – held in sacks
ovi sacks + common in Crustacea –
Lernea – curious forms – rudiment
of limbs
order II Brachiura – Achthres –
insects perch – long antennae –
2 large feet united by sucker
mandibles – stomach & canal
not operated – nervous system
& also muscular system –
ovi sack – when empty hardly
perceptible – Male small
& general structure rudimentary
in comparison with female –
Pass through a kind of metamorphosis
brings them from moving to
fixed animals – 1 pair antenna
& pair of hooked feet –

moves by jerks — attaches closely to feet —

3 Class Cirripedia —
Order 1 Thoracica —
Fam 1 Balanidae — acorn shell —
Balanus — conical shell —
consists of base, attached to some body — 6 permanent & 6 depressed areas — shell divides into 4 or 8 pieces — back piece often larger — (carina) front (rostrum) 4 valves — opercular valves (scuta & terga)
animal — semi articulated body — number of ciliated feet —
Fam 2 — Verucidae — acorn shells — some peculiarity of valves —
(coronula) found on whales
(helms to Fam 1)

Fam 3 Lepadidæ - Lepas goose barnacle
~~so~~ series of loose plates - 5 valves
2 large - (scuta) 2 small (terga)
one along the back (carina)
animal inverted in shell -
6 palpi - & 3 pairs of horny jaws
cirri or bristles on ~~the~~ feet - stalked
fixed on to wood or stones -
generally some floating material -
nervous system - eyes rudimentary -
ear sacks, & pouches supposed
to be organs of smell -
~~true~~ reproduction very curious -
hermaphrodite - young very
different from parent - distinct
eye specks - 2 stage - eye
spec become double - 3 stage
8 more pair of legs - bivalve
shell - then attaches itself
by antennae - by a kind of glue.

which comes out from end of antennae —

order 2 - (Abdominalia)

" 3 (Apoda)

Class 4 Crustacea - distinct sexes -

sub class 1 (Entomostraca)

~~Order 1 Trilobites~~ - eyes always sessile - segments generally 14 - Limulus order 1 Ephosura mouth center of limbs - eyes - 2 principle one - 2 smaller ones - each of pairs compound eyes - at base of spines - 1st joint of each limb, modified into a sort of jaw - stomach lands round & comes in front of mouth - some a foot in length -

Phyllopoda Branchipus

Cladocera - Daphnia -

antennae form organs of
locomotion - water fleas -
ovi sack very often - ~~all~~
~~more or~~ lamly more or less modified
for swimming or breathing -
Ostrapoda - Cypris -
bivalve shell - crustacean -

Trilobites - very abundant as fossils -

Sub-class 2 - (malacostraca)
(a) Sessile eyes -
Order 1 - Laemodipoda ex Caprella -
small rudimentary abdomen - some of
the limbs modified by for sacks -
2 Isopoda - Oniscus - segments of
body equally developed -
3 - Amphipoda - Gammarus -
feet serve for respiration & locomotion.
attack marine worms - 1 segments
of legs turned into respiratory sacs -
sessile eyes - (stalk eyes

(stalked eyes)

Order 4 - Stomopoda - Squilla - very curious animals -

" 5 - Decapoda - highest crustacea

(a) Macura - long tailed - Decapoda

(b) Anomoura - soft tail - D -

(c) Brachyoura - short tailed D

(a) Macura - lobster - Homarus

Carapace - series of segments below - 14 segments - 4 antennae 2 long & 2 short - 2 root ends 2 branches - rostrum protection to eyes - eyes mounted on stalks - compound eyes - Jaw - organs of mastication - very complex - 1st upper lip & tongue - then mandibles furnished with jointed palps ~~& pal~~ - 1st pair of maxillae - 2nd pair of maxillae 3 pairs of foot jaws -

2 large claws — of different form
one for holding strongly &
the other for ripping —
can reproduce claw — other feet
feeble — for walking — have pair of
fingers for holding on ~~to~~ any thing —
gills att atched to feet —
Swimming feet — rudimentary feet —
hatch ~~to~~ eggs — viscera — heart
2 chambers — stomach has calcareous
pieces to strengthen it — has also teeth
for further mastication of food —
nervous system at base — change
of shell — grows by casting its
shell — new shell soft — but tough —
Cray fish —
Hot Anomoura — Hermit crab —
abdominal segments perfectly naked
have little shelly hooks on tail —
creep into other shells —

all marine here - in tropics
live for a great time on land -
some species feed on cocoa nuts -
one large & one small - first large
shell out at door.
(C) Brachyura - Crabs -
carapace broader than lobster -
tail constantly kept curved
up under the body - stronger
& longer than lobster -
stomach heart shaped - heart
compact organ - not tubular
as ~~too~~ in lower animals - gills
at sides - grouped close together
gills & heart placed close together
nervous system below -
antennae less developed than those
of lobster - some crabs also
terrestrial - live on mountains -
come down to sea annually -

Some Herbiverous - ~~some~~ & eat
rice - not metamorphosis - in first
two - but in Brachyura they
have very strange one - ~~larvae~~
Young larvae like form -
Crabs placed higher than Lobster -
highest of Crustaceans -
acute vision - organs of touch
antennae - organs of hearing -
at first joint of antennae -
sack, organ of hearing -
olfactory nerves - at base of small
antennae - Crunching -
not tameable - very pugnacious -

Class V - Myriapoda -
Centipedes - something like sea worms
well developed limbs - limbs increase
with age - respiration & trachea -
approach closely to insects -
Some place them as apterous insects -

Order Chilognatha - Julus
proper jaws - gally worms
2 pairs of feet on each segment -
slow moving - under stones
2 Chilopoda - smaller number
segments & only one pair of
feet on each segment -
flat -

Class VI Insecta - distinct head
thorax & abdomen - 6 legs
coat of Chitine - eyes - well
developed - compound -
1000 in house fly - 17-000
Butterfly - Dragon Fly - 28-000
Antennae - organs of touch
only one pair - very sensitive -
organ of hearing not known in
insect & also organ of smell -
although we know they exist -

Mouth complex - labrum upper lip -
pair of mandibles - pair of maxillae
with palpi - lower lip labrum
with pali or feelers - Haustellate
or sucking insects mandibles
remain & upper lip maxillae
developed out into sheath for
a long tongue - ~~Thorax~~
organs of locomotion on Thorax -
Abdomen contains viscera -
front pair of wings sometimes
converted into elytra & aerae as
covers for other wings - Joints -
hinge joints - Wings - flattened
vessels with tubes passing
through - Heart dorsal vessel -
Respiration - trachea -

Eggs larva - Pupa Imago or
perfect insects -

— Division into orders —

Order 1 Aptera wingless

" 2 Aphaniptera rudimentary

" 3 Diptera 2 wings

4 Lepidoptera 4 scaly "

5 Hymenoptera

6 Hemiptera —

Hard Order

Ord. 1 Aptera — Lice — Louse —

" 2 Aphaniptera — Common flea —

wings rudimentary —

" 3 Diptera Flies Gnats 2 winged

" 4 Lepidoptera — Moths Butterflies —

Diurnal — L —

~~Hetero~~ Crepuscular S Moths

Nocturnal — Moths —

~~wh~~ wings Horizontal —

" 5 Hymenoptera — 2 pair membranous

wings — Bees Wasps — Ants —

" 6 Hemiptera Plant Lice — frog spittle

Insect — Bugs —

Order 7 - Strepsipteren - twisted wings
" 8 - Neuropteren - nerve winged
" 9 Orthopteren straight winged
" 10 Coleopteren - elytron -
(all these Mandibulate).

Lecture on the Preserving & Collection
of Insects

Class - Arachnoidea -
Head united to thorax
thus differ from Insects - no wings
4 pairs of legs - pulmonary
sacks for respiration
in some others as in insects -
no metamorphoses -
Order 1 - Dermophysa - no
distinct respiratory organs -
parasites most of them -
Demodex - parasite on
hair ~~in Mammals~~ -
lowest type of class -

Whale louse - in this order -
order 2 (Trachearia
Trachea like insects -
Mites - not parasitic
pec moving - Sarcoptes -
4 limbs, cephal & thorax
small - suckers on anterior
limbs - vast group of creatures -
feed on every thing - great
number of species -
Ticks - habit woods - ~~African~~ -
long legged spiders Phalangium -
Chelifer - Scorpion crab -
book mite - found in old
books -

Order 3 - (Pulmo-tracheaeae)
Spiders proper, both trachea &
pulmonary sacs -

~~Fam: Mygalidae - ex Myggle~~

8 legs - 2 distinct jaws -
2 claws at end of foot -
2 strong palpi - mandibles -
punctured to admit of poisonous
fluid - internal sack -
Palpi in femal spider
are used as organs of preservation -
Heart elongated vessle -
Stomach small - intestinal tube
simple - sucks juices of
animals - ~~ex~~ pended beno-pouches
in those spiders which have
to wait for prey - to hold
food - nervous system much
condensed & shortened -
like ~~other~~ insects only much
shortened -
Organs of sensation - eyes
often of great beauty - simple

8 in number — but differently
grouped in different species.
Web-organs. glandular
organs — connected with
spinerets — 2 kind do produce
some dry silk, other glutinous
by some species — use
webs in different ways —
Hunting spiders —
Mygale — ~~[illegible]~~
some a trap door nest —
8 pairs — ~~web~~ webs flat —
Natantes or water spiders —
Wandering Spiders — smaller
size — catch prey by approaching
it slowly — female carry
about young in sacks —
Order 4. (Pulmonata)
Scorpions — internal sacks
Whip-arms — & poison fangs in

tail – in pulmonary sacs
Camellae on surface of sacks
- Tam Phrynidae & Phryno-
1. 2 Scorpionida – Scorpio –
active creatures – simple
eyes – 6 to 8 in number
female has great attachment
to young – frozen of Spider
& Scorpio thought to be the
same –

Province III = Vertebrata
~~Class Pisces – Fishes~~ –
Brain & spinal marrow separate
from viscera – vertebral column
4 – great Classes
1 Pisces Fish
2 Reptilia Reptiles
3 Aves Birds
4 Mammalia – Mammals

Class Pisces - Fishes -
lowest form of Vertebrates -
aquatic - simple form
of brain & column -
limbs very little developed -
lowest condition of brain
& nervous system -
& Touch very feebly developed -
tentacles in some - hearing
organ internal - perfect
~~hear~~ ear - air bladder
of fishes corresponds to lung
of higher animals -
eyes large & well developed -
Smell - small pits in front
part of head, double nipple -
alimentary canal short & simple -
circulation & respiration -
somewhat peculiar -
Heart - single cradle & ventricle

Heart at base of head – (Cuvier)

~~Order (Dermopteri) ex – Amphioxus~~ Cartilaginous Fishes

Cuvier's Classification –

a Cartillaginous & Bony

The Bony he divided into Orders –

We will not give the classification here –

Moulen is the one given in the synopsis –

Order 1 – Dermopteri –

~~Lamprey~~ – Lancelet

" 2 Malacopteri – sea eels –

Carp Pikes –

" 3 (Pharyngognathi)

" 4 (Acanthini)

{Cod – Fish / Haddock} {Turbot / Flounder}

" 5 (Acanthopteri) Perches

Mackerel –

No 6 ~~order~~ (Plectognathi - Spine
Fish - Box fish -
" 7 " (Lophobranchii)
Sea Horse
" 8 (Ganoidei) Bony plates
Bony Pike of St Lawrence -
Sturgeon -

Extinct genera of Ganoids.
" 9 (~~Prot~~ Protopteri?)
Lepidosiren found
in Africa -
" 10 (Holocephali)
Chimaroida
" 11 (Plagiostomi) true Sharks
Ray Fish -

G. II Reptilia - circulating system differs from fishes - eyes better protected, eyelids - middle & external ear - nostrils back part of mouth - lachrymal tube oviparous reproduction.

Order 1 - Batrachia -

(a) Apoda - (Blind worms)

(b) Amphisphenista -

Menobranchus common in our rivers - gills outside

Proteus anguinus -

(c) Urodela - ~~not gills~~ outside - long tailed - gills temporary - only in young state -

(d) Anura - Rana - common frog

frogs & toads -

respiration gills at side of neck -

Order 2 (Chelonia) -
Chelonidae - Chelonis -
Jaws ~~& Teeth~~ - vertebral
column modified to form
sheath or covering - internal &
external - Jaws proper -
Trionycidae - Trionyx -
Emydae ex. Emys } tortoises
Testudinidae - Testudo
terrestrial, feet furnished
for walking.
Order 3 (Ophidia) Serpents -
vertebrae greatly increased -
ribs organs of locomotion -
4 families -
Crotalidae - Poisonous -
always poison fangs - Rattle.
can lay flat along roof of
mouth & be erected at any
minute -

Colubridae - not poisonous
small teeth - swallow prey
whole -
(Boridae & Typhlolidae)
Order 4 (Sauria) Lizzards
typical Reptilia - scaly
bodies - confined to warmer
regions of earth -
Chamaeleonidae ex Chamaeleon -
Iguanidae ex Iguana -
arboreal in habits -
Extinct families -
Palaeosuridae
Dinosauridae
Pleodactyli - br

Order 5 (Loricata) - ex gavialis -
heart begining to show a division
at into 4 parts -

Class III Aves –

Vertebrate skeleton modified very strangely – respiration very well developed – skeleton very light – Pelican only a few ounces – bones hollow –

Sternum projects into great keel – for pectoral muscles

Brain very much larger & more complex than in Reptiles

Eyes very perfect –

Smell not acute –

Touch very little developed –

Order 1 (Natatores) –

swimming feet – webbed or palmated feet – Mergus

" 2 (Grallatores) Waders

Bitters & Sand pipers.

" 3 (Cursores) Ostrich

(can run but cannot fly)

Order 4 (Raptores) - Petrina
~~Ra~~ Scraping birds -
Ptaromigans -
" 5 (Insessores) Perching
typical birds - Swallows
Woodpeckers - &c -
some vegetable & other animal
feeders -
(a) Conirostres - Sparrows
(b) Dentirostres - Fly catchers
(c) Fissirostres - Swallows -
(d) Scansores - Woodpeckers
(e) Tenuirostres - Humming Birds -
Order 6 (Raptores - Birds of
Prey - Vulturidae Strigidae
Falconidae - Owls
Hawks -
Owls nocturnal Falcons -

~~Mammalia~~ — Mammalia —
~~Classification~~ — organs of locomotion
not so well developed as those
in birds — Nervous system ~~much~~
higher in mammals —
Hair different character than that
of feather — Classification
of teeth — based on dentition
& organs of locomotion —
Sub Class 1 — Oviparia —
" " 2 — Viviparia

Owens Classification
& ~~Cuvier~~ 1 — Hyancephala

lowest of mammals — Marsupial
in reproduction —
2 orders 1 (monotremata
2 (marsupialia)
(1) — lowest of mammals —
reptilian forms — Ornithorhynchus

very like birds – ~~young very~~

(3) New Holland –

(2) – using a little – particular in dentition – pouch for young which remain attached to nipple of parent, till old enough to take care of themselves – nearly all nocturnal – nearly all confined to Australian Island –

~~Great~~ R – Lepen gephala –

2 halves of brain connected –

Rom 1 – Edentata or Bruta –

Molars – some very large, some arboreal, other vegetable eaters, & other insect eaters – Sloths armadillos & Ant eaters, may be taken for examples –

– good many extinct species –

order 2 (Rodentia) gnawing —
~~teeth~~ nearly all small animals
Rat Beaver &c — low
order of intelligence —
order 3 — Chiroptera —
Bats & allies — breast bone
like birds — dentition suited
for insectivorous feeding —
order 4 — Insectivora — insect
feeders — Shrew mice — Moles
Hedge-hogs — nocturnal —
Sub-group 3 — Gymnencephala —
all higher mammals except
man —
Order 1 — (Cetacea) Whales —
Porpoise — true mammals —
Order 2 — Pachyderms —
Elephants & Rhinoceros &c —
great numbers for many
fossil remains —

Order 3 Ruminants —
peculiar form of limbs —
Order 4 Carnivora —
feet divided into 5 toes
with claws —
Order 5 — Quadrumana
Monkeys — Proteiniae & families
pertaining to man & with
Marsh —
New species lately discovered in Africa
very formidable —

Group 4 — Anthropocephala

Order 1 Bimana —
Different species have been
tried to be made out, but this
has failed —

— End of Course of Zoology —

Trilobites

a very extraordinary tribe of extinct animals - body composed of three distinct parts - & divided longitudinally by two deep impressions, forming 3 elevated lobes - The anterior part of body always more or less semicircular or lunate, having on the upper side two large & generally reticulated eyes - shaped like kidneys. The part is succeeded by numerous (from 6 to 24) transverse segments & the body is terminated by a large semicircular plate less distinctly articulated than the preceding part - no organs of ~~that~~ locomotion or antennae have been found & it appears to have been

a habit of these animals to roll themselves up into a ball, by bending the extremities of the body, beneath the breast, & bringing it into contact with the head —

as appears expanded —

These creatures are most analogous to the Limulei & other entomostracous crustacea, provided with a great number of legs, of a more less membranous construction, & which, it may be easily conceived, would have been entirely destroyed during the great overthrow which has reduced these creatures to their present state.

They appear to have been marine animals — their constant association in the same rocks with shells & other marine productions leaving no doubt upon this point — They must have had the power of multiplying prodigiously. Certain formations being crowded with them, as to give the appearance of their being entirely formed of their remains — 5 genera each of which contains several species — &c &c —

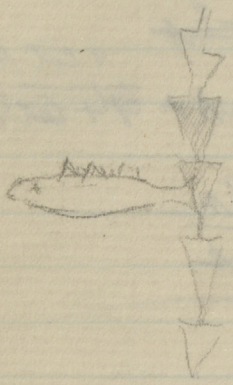
— HSV —

$$\tan 3A = \tan(2A + A) - \tan 2A \tan A + \cot 2A \cot A$$

$$= \cancel{2\tan^2 A + 2\cot^2 A}$$

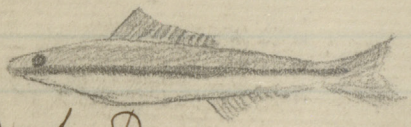
$$= \frac{2\tan A}{1 - \tan^2 A} \tan A + \frac{2\cot A}{\cancel{4} + \cot^2 A} \cot A$$

$$= 2\tan A = \frac{\cancel{1 - \tan^2 A}}{\tan^2 A}$$

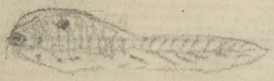


Hyalinea

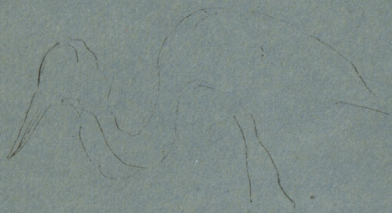
Foraminifera



New York Dace



Nemalonelous



43