

STUDY MATERIAL FOR M.Sc ZOOLOGY

Semester – I

PAPER - I

STRUCTURE AND FUNCTION IN INVERTEBRATES

Time : 3 hrs.

Max. Marks – 80

Min. Marks – 29

Classification of invertebrates upto the orders.

<https://www.kullabs.com/classes/subjects/units/lessons/notes/note-detail/758>

Locomotion :

Types of Pseudopodia and Theories of Amoeboid locomotion, Flagella and ciliary movement in Protozoa

<http://www.biologydiscussion.com/invertebrate-zoology/protozoa/top-10-theories-to-explain-the-locomotion-in-amoeba/28189>

https://en.wikipedia.org/wiki/Amoeboid_movement

<http://www.biologydiscussion.com/animals-2/phylum-protozoa/locomotion-exhibited-by-protozoans/32569>

Hydrostatic movement in Coelentrata and Echinodermata

https://en.wikipedia.org/wiki/Hydrostatic_skeleton

Canal system in Porifera : Ascanoid, Syconoid, Leucanoid

<https://www.studyandscore.com/studymaterial-detail/phylum-porifera-canal-system-in-sponges-types-of-canal-systems-in-sponges-functions-of-water-current>

Polymorphism in Coelentrata

<http://www.biozooomer.com/2014/06/polymorphism-in-coelenterates.html>

Corals

<https://en.wikipedia.org/wiki/Coral>

https://en.wikipedia.org/wiki/Coral_reef

Nutrition and digestion :

Patterns of feeding in lower metazoan

<http://www.biologydiscussion.com/invertebrate-zoology/multicellular-animal/detailed-account-of-metazoa/28553>

<http://www.notesonzooology.com/invertebrates/feeding-and-digestion-in-invertebrates-zoology/1981>

Filter feeding in Polychaeta

<https://www.slideshare.net/vikasjangir796/filter-feeding-in-higher-metazoa>

<https://studyres.com/doc/4859726/filter-feeding-in-polychaetes>

Respiration :Organs of Respiration : Gills, Lungs, Trachea

<https://www.britannica.com/science/respiratory-system/The-lung>

Excretion :

Organ of excretion, Protonephridia, Nephridia

<https://www.britannica.com/science/excretion/The-malpighian-tubules-of-insects>

Coelomoducts, & Nephridia.

<http://www.biozooomer.com/2014/10/coelom-and-coelomoducts-of-annelida.html>

Malpighian tubules

https://en.wikipedia.org/wiki/Malpighian_tubule_system

Water vascular canal in Echinodermata

<http://www.biologydiscussion.com/invertebrate-zoology/phylum-echinodermata/water-vascular-system-of-echinoderms/33754>

Nervous systems :**Primary Nervous system : Coelentrata and Echinodermata**

<https://www.britannica.com/science/nervous-system/Diffuse-nervous-systems>

Advanced Nervous system : Mollusca

<https://nervousphylums.weebly.com/echinodermata.html>

Major Larval form of invertebrates :

<http://www.biologydiscussion.com/invertebrate-zoology/arthropoda/larval-forms-found-in-crustacea-invertebrate-zoology/27738>

<http://www.biologydiscussion.com/invertebrate-zoology/phylum-echinodermata/larva-found-in-phylum-echinodermata/33758>

Structure and development of Trochophore and its phylogenetic significance.

<http://www.biologydiscussion.com/invertebrate-zoology/phylum-annelida/trochophore-larva-historical-retrospect-structure-and-affinities/33173>

Semester – I
PAPER - II
BIOSYSTEMATICS & TAXONOMY

Time : 3 hrs.

Max. Marks – 80

Min. Marks – 29

- **Definition and concepts of Biosystematics and Taxonomy -**
 - **Historical resume of biosystematics in biology**
 - **Importance and applications of biosystematics in biology**
<https://ipmworld.umn.edu/pinto>
<https://sites.google.com/site/lutfurrahmansaikia/a-note-on-iczn/home/animal-taxonomy>
- **Trends in biosystematics - Concepts of different conventional and newer aspects -**
 - **Chemotaxonomy**
<https://en.wikipedia.org/wiki/Chemotaxonomy>
<http://www.biologydiscussion.com/plant-taxonomy/chemotaxonomy-meaning-stages-and-significance/30483>
 - **Cytotaxonomy**
<https://en.wikipedia.org/wiki/Cytotaxonomy>
- **Dimensions of speciation and taxonomic characters -**
 - **Species category, Different species concepts, sub-species and other infra-specific categories.**
<http://www.ufscar.br/~evolucao/TGE/Lect01.pdf>
https://en.wikipedia.org/wiki/Species_concept
 - **Theories of Zoological classification, Hierarchy of categories.**
<https://byjus.com/biology/taxonomic-hierarchy/>
http://ashvital.freesservers.com/biological_classification.htm
https://ore.exeter.ac.uk/repository/bitstream/handle/10036/3825/BTLeo_nelliSubmissionFinal.pdf?sequence=11
 - **Taxonomic characters :- Different kinds, origin of reproductive isolation.**
<http://www.biologydiscussion.com/angiosperm/taxonomy-angiosperm/species-concept-history-types-and-categories-taxonomy/34704>
https://www.jstor.org/stable/2418754?seq=1#page_scan_tab_contents
<https://www.askiitians.com/biology/diversity-in-the-living-world/taxonomic-categories.html>
<http://bio.slu.edu/mayden/systematics/bsc420520lect7.html>
- **Procedure Keys in Taxonomy -**

- **Taxonomic collections, preservation, curation process of identification.**
<https://pdfs.semanticscholar.org/03d0/b788148e200c67b216f7de4ff03848b07843.pdf>
[http://hydrodictyon.eeb.uconn.edu/eebedia/images/9/94/Lecture_1_'07-Insects, Taxonomy, and Classification.pdf](http://hydrodictyon.eeb.uconn.edu/eebedia/images/9/94/Lecture_1_'07-Insects,_Taxonomy,_and_Classification.pdf)
<https://www.slideshare.net/badshah77/taxonomic-collection-and-identification>
<http://webcache.googleusercontent.com/search?q=cache:http://darwin.wcupa.edu/faculty/boettger/uploads/main/preservation.pdf>
- **Process of typification and different Zoological types.**
[https://en.wikipedia.org/wiki/Type_\(biology\)](https://en.wikipedia.org/wiki/Type_(biology))
https://www.google.com/search?rlz=1C1SQJL_enIN848IN848&q=process+of+typification+in+zoology&sa=X&ved=2ahUKEwj4_oCSjNLjAhWK6nMBHSYxCQEQ1QIoAHoECAoQAQ&biw=1536&bih=754
https://en.wikipedia.org/wiki/Principle_of_Typification
- **Outline idea of International Code of Zoological Nomenclature**
<http://www.biologydiscussion.com/animals-2/international-code-of-zoological-nomenclature/32399>
<http://www.vliz.be/imisdocs/publications/271138.pdf>
<https://www.biotaxa.org/Bionomina/article/download/163/254>
- **(ICZN) - its operative principles, interpretation and application.**

Semester – I

PAPER - III

GENERAL AND COMPARATIVE ENDOCRINOLOGY

Time : 3 hrs.

Max. Marks – 80

Min. Marks – 29

Aims and scope of endocrinology :

Hormones as messengers

<http://www.ikonet.com/en/visualdictionary/static/us/hormones>

<http://www.biologydiscussion.com/chemical-coordination/hormone-hormone-as-messenger-and-regulator/5067>

<http://www.umich.edu/~kcourses/w99/mvs442/chapter1.pdf>

Classification of Hormones

<http://www.biologydiscussion.com/hormones/classification-hormones/classification-of-hormones-5-categories/18429>

<https://www.slideshare.net/hephz/classification-of-35705749>

<https://www.thoughtco.com/hormones-373559>

Discovery of Hormones

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1369102/>

Experimental methods of Hormone research

Phylogeny of Endocrine glands (Pituitary, Pancreas, Adrenal, Thyroid)

https://embryology.med.unsw.edu.au/embryology/index.php/Endocrine_System_Development

Neuroendocrine system and Neurosecretion.

<https://www.encyclopedia.com/medicine/anatomy-and-physiology/anatomy-and-physiology/neuroendocrine-system>

General principles of Hormone action –

https://www.utsouthwestern.edu/edumedia/edufiles/education_training/programs/stars/li-endocrine-glands.pdf

Nature of Hormone action

<https://www.toppr.com/guides/biology/chemical-coordination-and-integration/mechanism-of-hormone-action/>

Hormone receptor

https://en.wikipedia.org/wiki/Hormone_receptor

Signal transduction mechanisms

<https://www.mun.ca/biology/desmid/brian/BIOL2060/BIOL2060-14/CB14.html>

<https://www.khanacademy.org/science/biology/cell-signaling/mechanisms-of-cell-signaling/a/intracellular-signal-transduction>

Hormones and Homeostasis

<https://www.bbc.com/bitesize/guides/zgqcmmsg/revision/1>

Hormonal regulation of carbohydrate, nitrogen and lipid metabolism

<http://watcut.uwaterloo.ca/webnotes/Metabolism/Hormones.html>

Biosynthesis and secretion of Hormones -

Biosynthesis of steroid hormone

<https://www.rose-hulman.edu/~brandt/Chem430/Steroids.pdf>

Biosynthesis of amino acid derived small size hormone

(T₄, Epinephrine)

<https://www.ncbi.nlm.nih.gov/books/NBK285550/>

<https://www.cvpharmacology.com/norepinephrine>

Hormone and Behaviour

<https://nobaproject.com/modules/hormones-behavior>

Hormones and Reproduction

Seasonal breeder & Continuous breeder

<http://people.upei.ca/bate/html/endocrinologyofreproduction.html>

Hormones and Growth

<https://www.britannica.com/science/human-development/Hormones-and-growth>

Semester – I

PAPER - IV

MOLECULAR CELL BIOLOGY

Time : 3 hrs.

Max. Marks – 80

Min. Marks – 29

- **Biomembranes : Structure, Molecular composition and function, of Plasma Membrane, Specialisation of Plasma Membrane, Transport across cell membrane, Diffusion, Facilitated Diffusion, Ion channel, Active transport and pumps, Uniports, Symports and Antiports.**

https://www.pmf.unizg.hr/download/repository/5_Biomembranes.pdf

<https://www.ncbi.nlm.nih.gov/books/NBK21583/>
<https://www.khanacademy.org/science/high-school-biology/hs-cells/hs-the-cell-membrane/a/structure-of-the-plasma-membrane>

- **Cytoskeleton**
 - **Microfilaments and microtubules -structure and dynamics**
 - **Cell movements - intracellular transport**
<https://www.khanacademy.org/science/biology/structure-of-a-cell/tour-of-organelles/a/the-cytoskeleton>
<https://biologydictionary.net/cytoskeleton/>
- **Cilia and flagella**
<https://www.ncbi.nlm.nih.gov/books/NBK21698/>
<http://www.biologydiscussion.com/cell/flagella-and-cilia-structure-and-functions-with-diagram/70522>
- **Cell-Cell adhesion and communication -**
 - **Ca⁺⁺ dependent homophilic cell-cell adhesion**
 - **Ca⁺⁺ independent homophilic cell-cell adhesion**
<https://www.slideshare.net/AllergyChula/cellular-adhesion-molecules>
- **Cell Organelles :**
 - **Mitochondria, Ribosome, Golgi bodies, Endoplasmic Reticulum**
<https://biologydictionary.net/mitochondria/>
<https://www.britannica.com/science/mitochondrion>
<https://www.microscopemaster.com/ribosomes.html>
<https://www.britannica.com/science/Golgi-apparatus>
<https://www.thoughtco.com/endoplasmic-reticulum-373365>
- **Morphological and functional elements of Eukaryotic chromosome**
 - **Morphology of Giant chromosome**
 - **DNA – Structure, Replication & Genetic Code, Repetitive DNA**
 - **RNA – Structure, Transcription, Transposon**
<https://courses.lumenlearning.com/suny-microbiology/chapter/structure-and-function-of-dna/>
<http://eagri.org/eagri50/GBPR111/lec16.pdf>
<https://www.ccruc.uga.edu/~rcarlson/bcmb3100/Chap39.pdf>
http://genetik.wzw.tum.de/fileadmin/scripts/Chapter_13.pdf
- **Intracellular Protein traffic**
 - **Protein synthesis on free and bound polysomes**
 - **Uptake into E.R.**
 - **Uptake into Mitochondria**
<https://www.slideshare.net/cheluvarya20/protein-sorting-and-targeting>
- **Biology of Cancer**
http://sphweb.bumc.bu.edu/otlt/MPH-Modules/PH/PH709_Cancer/A10-Cancer.pdf
- **Biology of ageing**
[https://www.cell.com/fulltext/S0092-8674\(00\)80567-X](https://www.cell.com/fulltext/S0092-8674(00)80567-X)
- **Apoptosis-Definition, mechanism and significance**
<https://www.ncbi.nlm.nih.gov/books/NBK26873/>

Semester - III
PAPER - I
COMPARATIVE ANATOMY OF VERTEBRATES

Time : 3 hrs.

Max. Marks – 80
Min. Marks – 29

Classification of vertebrates up to orders with examples.

<https://www.britannica.com/animal/vertebrate>

<https://en.wikipedia.org/wiki/Vertebrate>

Vertebrate integument and its derivatives.

https://www.zoology.ubc.ca/~millen/vertebrate/Bio204_Labs/Lab_2_Integument..html

Development and general structure and function of skin and its derivatives. Glands, Scales, Horns, Claws, Nails, Hoofs, Feathers and Hairs.

http://wikieducator.org/The_Anatomy_and_Physiology_of_Animals/Learning_Design/Sample-Skin

Evolution of Heart

<https://inside.ucumberlands.edu/academics/biology/faculty/kuss/courses/CirculatorySystem/ComparativeHearts.htm>

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5744704/>

Evolution of aortic arches.

https://www.researchgate.net/publication/265689748_Evolutionary_and_Developmental_Origins_of_the_Cardiac_Neural_Crest_Building_a_Divided_Outflow_Tract/figures?lo=1

https://en.wikipedia.org/wiki/Aortic_arches

Respiratory system : Comparative account of respiratory organs.

<https://inside.ucumberlands.edu/academics/biology/faculty/kuss/courses/Respiratory%20system/Gills.htm>

https://en.wikipedia.org/wiki/Respiratory_system

<http://people.eku.edu/ritchisong/342notes8.html>

https://en.wikipedia.org/wiki/Swim_bladder

Skeletal system : Comparative account of Jaw Suspensorium

<http://people.eku.edu/ritchisong/342notes4.htm>

Vertebral column

<https://skeletalsystemdev.weebly.com/vertebral-column.html>

Limbs and Girdles.

<http://people.eku.edu/ritchisong/342notes5.htm>

<http://www.notesonzoology.com/vertebrates/comparison-of-pectoral-girdles-in-various-vertebrates/3238>

<https://www.bioscience.com.pk/topics/zoology/item/765-comparative-anatomy-pelvic-girdle-of-bird-reptile-and-mammal>

Comparative account of Urinogenital system in vertebrate series.

<http://www.egyankosh.ac.in/bitstream/123456789/16528/1/Unit-9.pdf>

<https://en.wikipedia.org/wiki/Kidney>

Comparative account of Brain and Spinal cord in vertebrate series.

<https://en.wikipedia.org/wiki/Brain>

Semester - III

PAPER - II

PHYSIOLOGY OF VERTEBRATES

Time : 3 hrs.

Max. Marks – 80

Min. Marks – 29

- **Water as solvent.**
<https://www.suezwaterhandbook.com/water-and-generalities/water-a-fundamental-element/water-s-chemistry/water-as-a-solvent>
- **Thermodynamics, Free energy, Entropy, High energy bond & ATP synthesis**
https://saylordotorg.github.io/text_general-chemistry-principles-patterns-and-applications-v1.0/s22-08-thermodynamics-and-life.html
<http://biochem4.okstate.edu/~firefly/Bioch205/Bioch205clmfolder/b205clm3/Biochem2module3.ppt>
- **Muscle contraction : Types of muscles, Light and Electron microscopic structure of skeletal muscle, Molecular basis of muscle contraction – Proteins of myofilaments, Sliding filament hypothesis, Role of calcium in contraction, Energetics and thermal aspects of muscle contraction, Twitch, Summation, Tetanus & Fatigue.**
https://en.wikipedia.org/wiki/Muscle_contraction
<https://www.nature.com/scitable/topicpage/the-sliding-filament-theory-of-muscle-contraction-14567666>
- **Physiology of Nerve and impulse transmission : Structure of Neuron, Excitability, Conductivity, Resting membrane & action potential, Refractory period, Summation, Chronoxie, Rheobase, All or None principle, Propagation of nerve impulse transmission, Synaptic transmission, Neurotransmitters.**
<https://www.onlinebiologynotes.com/nerve-impulse-conduction/>
https://byjus.com/biology/conduction-of-nerve-impulse/?utm_source=Google&utm_medium=cpc&utm_campaign=K12-Traffic-DynamicSearch-India&mx_utm_Term&gclid=EAIaIQobChMIpPTwxNn84gIVAQ4rCh0bewCFEAAAYASAAEgLMYPD_BwE
- **Blood : Structure & composition of blood, Blood cells and their origin, Haemopoises, Haemoglobin, Function of erythrocytes & leucocytes, Blood coagulation – theories and factors affecting blood coagulation.**

<https://www.britannica.com/science/blood-biochemistry/Laboratory-examination-of-blood>

<https://en.wikipedia.org/wiki/Coagulation>

- **Defence Mechanism : Reticulo-endothelial system - Macrophages, Lymphocytes, Immuno-globulines - origin, properties and functions. Humoral immunity and cell mediated immunity, Blood groups and tissue antigens.**

<https://www.goodtherapy.org/blog/psychpedia/defense-mechanisms>

<https://medical-dictionary.thefreedictionary.com/reticuloendothelial+system>

<https://www.microbiologybook.org/mayer/IgStruct2000.htm>

- **Physiology of Excretion : Structure of Mammalian Kidney, Nephron, Urine production, Counter Current multiplication, Regulation of pH by kidney.**

https://en.wikibooks.org/wiki/Human_Physiology/The_Urinary_System

<https://courses.lumenlearning.com/boundless-ap/chapter/acid-base-balance/>

<https://opentextbc.ca/anatomyandphysiology/chapter/26-4-acid-base-balance/>

- **Sense organs : Classification of sense organs, Photoreception, Auditory perception, Ecolocation,**

<https://www.scientificpsychic.com/workbook/chapter2.htm>

<https://www.coralspringscharter.org/ourpages/auto/2014/9/2/46022174/Senses%20and%20Sense%20Organs.pdf>

https://en.wikipedia.org/wiki/Animal_echolocation

- **Bioluminescence**

<https://ocean.si.edu/ocean-life/fish/bioluminescence>

<https://www.nationalgeographic.com/animals/reference/bioluminescence-animals-ocean-glowing/>

- **Digestion : Physiology of digestion & absorption, Digestive glands, Gastro-intestinal hormones.**

<https://en.wikipedia.org/wiki/Digestion>

https://en.wikipedia.org/wiki/Human_digestive_system

<https://www.drbeen.com/blog/hormones-of-the-gastrointestinal-tract/>

[https://byjus.com/biology/human-digestive-](https://byjus.com/biology/human-digestive-system/?utm_source=Google&utm_medium=cpc&utm_campaign=K12-Traffic-DynamicSearch-India&mx_utm_Term&gclid=CjwKCAjwmNzoBRBOEiwAr2V27TbZwL84EqB1GVZ_7pbChQsUJ9VyTp8But50W0O1FJ_N7VJVpFolDxoCJroQAvD_BwE)

[system/?utm_source=Google&utm_medium=cpc&utm_campaign=K12-Traffic-DynamicSearch-](https://byjus.com/biology/human-digestive-system/?utm_source=Google&utm_medium=cpc&utm_campaign=K12-Traffic-DynamicSearch-India&mx_utm_Term&gclid=CjwKCAjwmNzoBRBOEiwAr2V27TbZwL84EqB1GVZ_7pbChQsUJ9VyTp8But50W0O1FJ_N7VJVpFolDxoCJroQAvD_BwE)

[India&mx_utm_Term&gclid=CjwKCAjwmNzoBRBOEiwAr2V27TbZwL84EqB1GVZ_7pbChQsUJ9VyTp8But50W0O1FJ_N7VJVpFolDxoCJroQAvD_BwE](https://byjus.com/biology/human-digestive-system/?utm_source=Google&utm_medium=cpc&utm_campaign=K12-Traffic-DynamicSearch-India&mx_utm_Term&gclid=CjwKCAjwmNzoBRBOEiwAr2V27TbZwL84EqB1GVZ_7pbChQsUJ9VyTp8But50W0O1FJ_N7VJVpFolDxoCJroQAvD_BwE)

- **Physiology of Respiration : Respiratory pigments, Oxygen transport in blood, Carbon dioxide transport in blood, Regulation of body pH.**

<http://people.eku.edu/ritchisong/301notes6.htm>

<https://www.rsc.org/Education/Teachers/Resources/cfb/transport.htm>

<https://www.britannica.com/science/circulatory-system#ref321177>

<https://www.news-medical.net/health/pH-in-the-Human-Body.aspx>

<http://www.chemistry.wustl.edu/~edudev/LabTutorials/Buffer/Buffer.html>

Semester - III
PAPER - III
QUANTITATIVE BIOLOGY

Time : 3 hrs.

Max. Marks – 80
Min. Marks – 29

- **Introduction to Biostatistics :**
 - **Statistical application in some specific areas in Biology**
<https://www.slideshare.net/jippyjack5/application-of-biostatistics>
<http://www.model.u-szeged.hu/etc/edoc/imp/KBoda/KBoda.pdf>
<http://www.biostathandbook.com/HandbookBioStatThird.pdf>
- **Measures of Central Tendencies –**
 - **Mean (Arithmetic, Geometric, Harmonic mean).**
 - **Median.**
 - **Mode.**
 - **Relation between mean, median and mode.**
<https://statistics.laerd.com/statistical-guides/measures-central-tendency-mean-mode-median.php>
https://en.wikipedia.org/wiki/Central_tendency
<https://corporatefinanceinstitute.com/resources/knowledge/other/central-tendency/>
- **Measures of Dispersion –**
 - **Range**
 - **Mean deviation**
 - **Variance, coefficient of variance**
 - **Standard deviation**
<http://www.economicsdiscussion.net/dispersion/measures-of-dispersion-a-close-view/12173>
<https://sol.du.ac.in/mod/book/view.php?id=1317&chapterid=1066>
- **Frequency distribution :**
 - **General idea about Normal, Binomial and Poisson distribution.**
- **Analysis of Variance.**
<https://www.investopedia.com/terms/a/anova.asp>
<https://www.statisticshowto.datasciencecentral.com/probability-and-statistics/hypothesis-testing/anova/>
- **Correlation**
http://sphweb.bumc.bu.edu/otlt/mph/modules/bs/bs704_multivariable/bs704_multivariable5.html
- **Regression.**
<https://www.statisticshowto.datasciencecentral.com/probability-and-statistics/regression-analysis/>
https://en.wikipedia.org/wiki/Regression_analysis
- **Hypothesis testing :**
 - **Chi square**
 - **f test**
 - **t test**
<https://www.spss-tutorials.com/chi-square-independence-test/>
<https://www.mathsisfun.com/data/chi-square-test.html>
<https://www.statisticshowto.datasciencecentral.com/probability-and-statistics/hypothesis-testing/f-test/>
<https://www.investopedia.com/terms/t/t-test.asp>
- **Probability theory**
<https://www.britannica.com/science/probability-theory/The-principle-of-additivity>

<https://towardsdatascience.com/basic-probability-theory-and-statistics-3105ab637213>

- **Presentation of data :**

- **Diagrammatic presentation**
- **Graphic presentation**

<https://www.slideshare.net/rubyocenar/presentation-of-data-37973327>

<https://www.rajgunesh.com/resources/downloads/statistics/presentationofdata.pdf>

Semester - III
PAPER - IV
ICHTHYOLOGY

Time : 3 hrs.

Max. Marks – 80

Min. Marks – 29

- **Introduction and general organisation of fishes :**

- **General organization of bony fishes**
- **General organization of cartilaginous fishes.**

<https://en.wikipedia.org/wiki/Osteichthyes>

<https://seaworld.org/animals/all-about/bony-fish/anatomy-and-physiology/>

http://www.csun.edu/~msteele/classes/Ich530/handouts/1_external%20anatomy%20and%20taxonomy.pdf

<http://www.biologyreference.com/BI-Ce/Cartilaginous-Fish.html>

<https://en.wikipedia.org/wiki/Chondrichthyes>

- **Origin and evolution of paired fins.**

https://en.wikipedia.org/wiki/Fish_fin

<http://www.fishfarmingtechniques.com/fish-structure/fins/origin-of-paired-fins-in-fishes-3-theories-fisheries/13432>

- **Skin and scales.**

https://en.wikipedia.org/wiki/Fish_scale

<https://www.britannica.com/animal/fish/The-skin>

- **Respiratory system –**

- **Gills**
- **Accessory respiratory organs.**
- **Air bladder, weberian ossicles.**

https://en.wikipedia.org/wiki/Fish_gill

<https://basicbiology.net/animal/fish/gills>

<http://biolearnspace.blogspot.com/2016/03/accessory-respiratory-extrabranhial.html>

<http://www.biologydiscussion.com/fisheries/fish/accessory-respiratory-organs-in-fishes-phylum-chordata/40801>

https://en.wikipedia.org/wiki/Swim_bladder

<http://www.biologydiscussion.com/fisheries/fish/swim-bladder-development-structure-and-types-fishes/40812>

https://en.wikipedia.org/wiki/Weberian_apparatus

<http://www.notesonzoology.com/fish/weberian-ossicles-meaning-mode-of-action-and-functions-zoology/4090>

- **Digestive system.**
<http://web.utk.edu/~rstrange/wfs550/html-con-pages/v-digest-sys.html>
<https://www.necropsymanual.net/en/teleosts-anatomy/digestive-system/>
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