********** Classical Evolution Fall 1957 **********

[Transcript & comments on class notes compiled by Byrd Curtis in 1957-58 (58 years ago). My comments in brackets, all **bolds** added by me. Text not in brackets is from Byrd's class notes. Transcribed, September and October, 2015. Note: these pages are not numbered as the ones in Mechanics of Evolution were, but there are some dates. I numbered the pages lightly in pencil in the lower corners of the pages and added day of the week to dates. HVH2]

[At the beginning are several pages of typewritten handouts. The First set was a three page outline of:]

History of Evolutionary Thought.

I. Man Learns to See Himself: (See Genesis 3:1-24)
II. Early Evidences of Interest in Nature:
Etc.

[The second handout was 5 pages stapled together called:] "An Outline of Historical Geology" [These were attached by Byrd to the front but must have been handed out as the various topics came up. The Third were a number of pages containing the Taxonomic System first for animals (10 pages +4 pages of diagrams) then the Taxonomic System of plants (7 pages + 2 pages with diagrams & written descriptions). I did not try to transcribe these, but they should be among the pdf scanned documents.

Finally the hand-written notes by Byrd Curtis:]

16 Sept. '57 [Monday, Day 1]

Classical Evolution

Sat. Greek civilization & character

Greek attitudes toward:

Industry

Slavery

Internal & External Politics

Education

Religion

Get ideas of what Greeks thought to be important.

Read Pages 33-112 in Greek Science

Paleolithic (old stone age) Culture

Man on earth 1,000,000 years

Early man spent most time getting food to live.[1]

Used tools, stone wood – fire prob. First tool

Cultures of old stone age

(1) Australian aboriginals

Every working hour finding food. … Read Brown men & Red Sand [By Charles P. Mountford, 1948, and see footnote 1, below.]

Neolithic (New stone age)

Not too well defined

Stone working expert – ground stone – arrow point weaving & basket making – weaving tight enough to hold water.

Pottery – highly specialized

Late Neolithic – growing food plants, greatest development of man – 80% of people producing food, other 20% doing something else. Possible to develop armies & set up civilizations, empires, etc.

Knotted cords kept by priests (Mesopotamia) was first writing. (Much literature went unwritten – passed down)

[In margin with an arrow coming from "growing food plants" he has a list of foods and crops (21 in all, which I did not copy – see scanned version) and at the bottom of the page, below a note on:] "Maya Indians in Central Amer. & Incas in Peru, etc. [he has a note:] Not a single staple food crop domesticated since Neolithic age.

[page 2] [at top margin:] Greek Science – Ben Farrington

Domestication of animals – dog in Paleolithic – took place in stone age. Not known when, where, or what began with not known [here Byrd inserted a list of animals:] Horse, oxen, goat, buffalo, sheep donkey, camel – old world

[1] This was the prevailing view in 1957. A few years later an idea was put forth: The Original Affluent Society, which changed our view of "primitive man". Harlan will revise his thinking accordingly. However, the original affluent society refers to contemporary hunter-gathers, which are advanced beyond the Paleolithic, so his point may be fine. HVH2

Agri. Grew out of gardening – Cassava, sugar cane, bananas, plantain. Moved roots, to dooryard – do work. Harvested fruit still in existence in some tropics. [then another list:] Turkey, dog, lamas, ??, Guine logs? – New World (America)

Both cereal and gardening culture thought to be late. Very little info to go on. Being sure of food supply greatly affects what one can do. Big cities sprang up overnight apparently (few generations) came about because of abundance of food.

Agricultural Revolution – near east – of Neolithic – because of food plants and domestication (evidence available). In Near East archaeological evidence gives story of ages.[2]

Recording

Greeks – not aborigines – came along late (Pyramids of Egypt 2000 year old when Greeks came along.)

Greeks are progenitors of western man & western science. Began as great merchants – sea faring. Common language – 10 scripts, but could understand. Would unite during great crises. Contact w/Egypt & Babylonians greatly influenced their thinking.

Thales learned early math from Egypt.

[page 3]

Things were well started before w got out of stone age. Why no new crops developed? Reason – stone age man picked easily domesticated plants[3]. Need prepared land. Plants must be highly variable – not many plants that are easily domesticated.

Compilation of Emperor Shew-nung

Described 347 medicines odes of pin

Ants used in biological warfare

5 Cardinal Chinese cereals 7 fruits

Rice, wheat, sorghum, millet & soybeans

Plum, apricots, peach chestnut, jujube – Emperor didn't like pears.

Chinese had very little influence on other parts of world.

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[2] [Note, this kind of thinking is getting him ready to go to an archaeological dig with Braidwood, in just 3 years – 1960 & again in 1964]

[3] 20 years later, Harlan will begin to study the domestication of maize, which turned out to NOT be an easy crop to domesticate. We still do not know quite how they did it, although there are competing theories.

Isolated from developments in near east. [on left margin:] History of Botany Reed. Britannica

21 Sept. 57 [Saturday, Day 2]

Early evidence of interest in nature

Assyrians

Cod of Hammurabi – Codes of law – specific

10 Commandments hidden (1900 BC)

Importations of Tiglath (1130 BC)

Egypt – Medical Papyri

"Astronomy well developed in Neolithic"

Civilization was well established before Greek Civilization.

Nile valley in Egypt (Stable civilization.) (Floods each year – as water receded seeds planted; always had a crop.)

Tigris & Euphrates valley not stable as Nile valley.

Greeks arrived & destroyed Cretin civilization & tried to develop a poor land. Turned into trading, explorers & settling of islands. Trading built up great cities. Cities had a middle class.

[page 4] Greek Civilization and Character

(times like our own – troubled)

A. Pericles' oration (431 BC)
One who does great deeds
Individual freedom
No universal military training
Psychology & human nature conduct guided by high morals
Alein's [Alien's ?] acts – no secret preparation for way

Most characteristic thing of Greek History Always a brilliant beginning & abrupt disappearances.

(Ex. Pericles time – then in 20 or 25 years Athens overthrown by Sparta.)

Science is a product of the times and people.

Good historians & recorders of happenings.

B. Attitudes – learning for learning's sake, all things had a cause, Religion – treated gods impudently – religion superficial.
In Egypt this attitude was opposite (Pharaoh was the god; economic servitude) – no atmosphere for science.
What sort of environment needed for science
    1. Freedom
    2. Tools
    3. Learning for learning sake
    4. Scientific literature
    5. Religious attitude – Got to be free to pursue science. Religious dogma. Has been much conflict in science and religion.

Science & religion

Authority over men's thinking – if thinking controlled it will stifle science. We cannot afford to have one who is in charge. All things have a cause.

[page 5] **9-23-57** [Monday, Day 3]

Student Reports

[he gives a list of possible report topics:] Bats, whales, Social Insects (honey bees), mimicry, carnivorous plants, mechanism for insect fertilization in orchids, Higher parasites – trematodes, Modes of seed dissemination, Amphibians becoming adapted to terrestrial life, Adoption of plants to desert conditions. [Byrd picked Whales as his topic.]

[Byrd added in the left margin:] Man Makes Himself – Chiles

Status of Science in adjacent empires.

Egyptian Medical Papyri – Labored under handicap that demons inhabited body. Excrement often prescribed for humans.

Greeks thought 4 elements comprised the universe: water, fire, air, earth

Concepts that are wrong may limit out thinking such as what the Greeks thought about Earth, air, fire & water.

Egyptian mathematics – not as highly developed as Ionians, but were good at some points.

Assyrians – quadratics; Assyrian astronomy very important in agriculture. Lunar (moon) year 354 days – Emperor inserted extra months occasionally.

Egyptians had 365 day year – corrected like ours.

[page 6]

In both Assyria and Egypt severe restrictions were placed on the thinking of astrology.

Water clock – principle same as sand glass.

Thales – obtained some malt from Egypt. Predicted Eclipse. Laid foundation of natural philosophers. Considered 1st modern scientist. Began to think in modern terms – began to generalize from particulars.

Anaximenes – idea of mist. Quantitative change w/qualitative change

Anaximander – Fishes to man – as moisture dried animals moved to land & changed to man. Not strictly an[imal?]

Pythagoras – politician, numbers, music – thought everything built on numbers. Worked in Italy – moved to Croton – confused by √2 [square root of 2].

Xenophanes – nature is a unit. If horses & oxen had hands & could draw, then horses would draw horses as Gods & oxen as Gods.

Heraclitus – Philosophy – everything composed of contradictions

Democritus – atomic theory – air vs empty space, dissolving things in liquids [Byrd drew a little diagram with a circle, extending from which are three hooks and the comment:] hooks to tie together atoms.

Alcmaeon – anatomist – described nerves of eye. Used fertilized chick eggs for embryological studies.

Hippocrates – assembled medicines of the times – all writings preserved. Reason he is so well know. [It would be well for the reader to follow the link to the Hippocratic Oath and read it. HVH2]

Cosmology limited by the tenacious hold of the 4-things that made up the universe.

[page 7] Cont'd 9-23-57

Socrates revolt –

> If you know man you know everything. Didn't believe it important to study nature. Was put on trial for corrupting youth. Condemned for political reasons. Put to death for reasons of jealousy.

Plato – understudy of Socrates (Dialogues of Plato)

> While Plato was teaching, natural science lapsed. Cannot construct complete cosmology by use of senses. Ideas are all important.

Aristotle – Student of Plato

9-28-57 [Sat. Day 4]

[assign. for:] Mon. Sept. 30

Greek Science Part II Chapter I, II, IV & about Galen in Chapt III, Hawton Chapters I & II

[assign. for:] Sat. Oct. 5 Peattie: Green Laurels, Chapt. I, Sci. Monthly 8(4): 230-239, 1955. [This should be 80(4) and it is by Ashley Montagu, who wrote a great deal about race in humans; the title of the paper is Vesalius and the Galenists. It is cited by a number of authors, but I cannot find the actual paper. HVH2] Western man (Life): Chapt. I, II, III. [This may have been a book published by Life Magazine called "Western Man".] Hawton, Chapt. III, Phil. for Pleasure.

Aristotle, Son of physician, taught Alexander the Great in Macedonia. Set up lyceum in Athens – had to run away to save life for political reason. No one told Greek scientist what to believe. Biology of Aristotle was mostly zoology – described over 500 animals – not a taxonomist by modern ideas. Had ideas on classification.

A. Modes of living – dichotomy could not be used as a basis of classification
B. Activities & functions
C. Characters & disposition
D. Parts

[page 8]

[note at top of page] Parapatus – those who walk about

[continuing from page 7:]

Believed that life originated from non living.

Never did set up classification system

Sponges between living & non-living

Catfish descriptions were verified in

Studied invertebrates

One of the greatest contribution of Aristotle was his thought system (systemized thinking into 1 process.

Aristotle

Four kinds of forms

Mineral – gives shape

Vegetable – gives life to plants & stationary animals

Sensitive – addition to power to metabolize – power of motion

Rational – intellectual ability to think.

All living things: matter & substance form

Must have both above for existence – different from Plato's idea (thought that matter & existence & form could exist separately – divine)

What is an idea –

Question of form & substance – philosophical debate of Plato & Aristotle

Doctrine of incarnation

Christian theologists today believe that Jesus was son of God, was human

Ideas can be potent even though we don't know what ideas are.

[**page 9**]

Thales – 1st of the Milesian [from Miletus, 624 – 546 BC] philosophers – visited Egypt & brought back a knowledge of geometry.

Borrowed improved navigation by stars from Phoenicians. Made fortune in olive oil.

Anaximander [610 – 546 BC] – Milesian [here Byrd drew 4 concentric circles with earth in center, water, then mist, fire on outer ring.]

Anaximenes [585 – 528 BC] – 3rd thinker – mist as first principle [Wikipedia says "air" was first principle]

Heraclites – fire – philosopher of change

Pythagoras [570 – 495 BC] – founder of European culture in Western Mediterranean sphere.

Democritus [born in Thrace c. 460 – 370 BC] – atomic theory [Democritus is called the father of modern science. His father was wealthy and Democritus took his inheritance and traveled extensively searching for more knowledge. In this way he was like JRH, or rather, JRH was like him. Democritus believed in the material world – everything has a cause and the cause can be found in this material world. His greatest idea was of atomic theory, which he borrowed from Leucippus, who may or may not have even existed.]

[So, we see here the pre-Socratic philosophers, who were called naturalists, because they sought explanations for things in this world in nature itself, rather than the supernatural. I suppose Harlan was lifting them up as the founders of science. HVH2]

[**page 10** – blank]

[page 11] Cont'd Aristotle

[here Byrd has a diagram of the 4 elements in a square with the point (Fire) at the top, Earth at the right side, water at the bottom and air on the left. Inside the square is another (dashed line) square touching

the midpoints of the straight lines and on the upper left it has “hot”, “dry” on the upper right, “cold” on the lower right and “wet’ on the lower left. Above Fire is written “yellow bile (gall)”, by Earth is written “flem (lungs)”, under Water is written “Black bile (spleen)” and by Air is written “blood (liver)”.

On the right side of the diagram is written:]

4 elements

4 qualities (hot, cold, dry, wet)

4 humors or fluids for medication

Blood, Yellow bile, Black bile & Flem.

For health above must be blended in proper manner for health. Many of our words are derived from Greek concepts of medicine.

Attempted to organize all phenomena into a system of thought.

How did Aristotle’s work come into the thinking of later generations? [Then on the left margin he wrote:] Aristotle [that is, Aristotle’s thinking] came quite late into Western Europe by way of Arabic conquest. 7th & 8th centuries.

[back to Byrd’s notes:] Mohammed conquests encircled Western Europe. Set up schools – translated Aristotle’s work into Arabic & his philosophy, medicine, etc. were abided by Christian followers of Spain came into contact w/Aristotle. About 12th Century works of Aristotle translated into Latin & incorporated into Catholic Church. Errors in copying manuscripts, etc. causes Aristotle’s writings to be quite different.

Aristotle one of first to evolve evolutionary theory.

Fishes – if all eggs develop the no of species would be infinite.

Considered species fixed.

Didn’t have complete evolutionary concept.

[page 12]

Aristotle in late years decided that in learning one must make observations – can’t think all out. [Above Wikipedia on Aristotle said that after Plato died he (Aristotle) moved away from Platonic thought and into observational based thought.]

Original thinker

Aristotle came to an end just after Alexander died and questions of Aristotle’s loyalty came up, so he fled.

Philosophy of Education

Ability to learn

Interrupting

Interest t solve and understand problems (attitudes)

Historical perspective

Objective (would be thought of by educated persons)

Sept. 30, 1957 [Monday, Day 5]

Aristotle founded Botanic Garden at Lyceum

Theophrastus – attempted to do for plants what Aristotle did for animals. Better experimental biologist than Aristotle. Less known than Aristotle because writing lost.

Greek practical Botany. Botany studied primarily for medical reasons. Class of people called rhizotomy [not sure what this word is HVH2] who dug roots. A class who stored roots – Pharmacy group. Physician – Esclepion [Asclepeion,?] – hospital

Roman and Greek empires built on slavery.

Strato – took charge of Lyceum after Theophrastus, a true scientist, Interested in pneumatics – more of a specialists than Aristotle. From Plato to Strato – started back to Ionians in thinking about science.

Ptolemy – general under Alexandria – Ruled Egypt

Museum – nine muses of fine art

[page 13]

Theophrastus – Philosopher and scientist was born in Eresos, Lesbos. He studied under Plato in Athens, then under Aristotle whom he succeeded as head of the Peripatetic school in 323 BC. His work paralleled Aristotle's in scope and scientific character. His writing on plants, which remain, represent his most original scientific inquiry, the product of large scale collection of materials, careful classification and detailed study.

Euclid Geometry 300 BC. Greek mathematician – received 1st training from pupils of Plato. Founded school at Alexandria. Peanengel [?] previously justing [?] books of geometrical elements offering new & more logical postulates & proofs. Wrote the Data which consists of 94 propositions proving that if certain elements in a figure are given the other elements can be detn [determined?]. [in left margin:] Taught Ptolemy geometry no royal road to learning.

Herophilus – Father of Anatomy – 300 BC. Greek anatomist and surgeon, one of the founders of Erasistratic of the School of Anatomy at Alexandria[4]. A pupil of Chrysippus [Praxagoras ?] & studied medicine under Pratagora of Cos. First to dissect human body publicly & is believed to have practiced vivisection upon condemned criminals. His systematic study of the human body has given him the title of Father of Anatomy. He studied the brain. He recognized the brain as the center of the nervous system & considered it the seat of intelligence, thus disputing Aristotle's view concerning the heart. Distinguished between heart & veins & was first to study the rhythmic beats of the heart, named the prostrate gland, studied eye structure.

Erasistratus – Father of Physiology – Greek physician and anatomist. Cofounder of school of anatomy at Alexandria, Egypt, was born at Julies on the island of Cos (Cheos). Was pupil of Metrodous & Theophrustus, traveled much, and for a time was physician at the court of Selenucus Nicator, king of Syria, at Antioch, then to Alexandria. Distinguished between motor & sensory nerves & traced both sets to the

[page 14]

Brain. Traced arteries & veins to heart. [Byrd added above the word 'brain':] father of physiology. Studied division and cavities of the brain. Recognized values of heart & gave them names "tricusped" & "sigmoid". Named the trachea. Developed doctrine of pneumatism, that there is air or "vital spirit" in the system. Believed diseases causes by excess of blood. (plethora). Was opposed to bloodletting. A pioneer in preventive medicine (hygiene).

[page 15]

Euclid – still using Euclid Geometry in schools of today.

Archimedes – "Eureka, I've got it!"

Specific Gravity – law of floating bodies

Screw of Archimedes – like impeller pumps of today

Tinderer

Catapults – wall breakers

Military engineer

Devised a planetarium – studied solar system

Made specific contribution to geometry, cones, spheres,

[4] I could not find the Erasistratic of the School of Anatomy on-line; however, Erasistratus worked with Herophilus and together they performed the first human dissections – in Alexandria.

Alexandrian School – center of learning for centuries

Great libraries

200 BC – translation of the Bible (oldest version of the Bible) [This was the Septuagint or Greek translation of the Hebrew OT, HVH2]

Dioscorides – Botanist, Greek military surgeon. Great milestone in history of botany. Was an Herbalist, book describing plants giving recipes for medicines.

Illustrations were excellent (prepared by Krateuas)

Last word in medical botany.

The above eras of science were wonderful beginnings in science but died out for 12 or 13 centuries. Why died out? Religion played important part. Authority played another important part. Economic reasons.

Roman Empire started – why didn't they do something?

[page 16] **October 5, 1957** [Sat. Day 6]

Mon. Oct 7 [Day 7]

[reading assignments:]

Peattie: Green Laurels, Chapt. 2 ["the Green World Opens", "The wonderworld of the microscope. The spirit of investigation in the seventeenth century. Rise of learned societies. Malpighi begins the anatomical investigation of insects; Summerdam discovers their metamorphosis; Leeuwenhoek, the consummate amateur, looks at the whole world through a lens. The precocity of early microscopy followed inevitably by sterility." Found at http://www.goodreads.com/book/show/17318608-green-laurels.]

Darlington: Facts of Life, Chapt. 1 & 2 [See review] [In the 3rd paragraph of the review of Darlington's book, the Facts of Life the reviewer relates some of the many questions raised by the book, including "Can we ourselves influence the future of our own evolution? These questions, of course, are inescapable to thinking men." Let me make a comment about this question. The medical miracles from which we all benefit are surely degrading our corporate genome. No longer do individuals die from deadly malformeities but we have marvelous ways of compensating for them and allowing the person thus afflicted to go about leading a normal life, marrying (maybe) and having children, which is the dream of every human – to have a normal life and have some children and grandchildren. It was mentioned many years ago, and I do not remember where I heard this, but eye glasses are allowing people who normally would be practically blind and unable to care for themselves to pass on their defective genes to the point that in the future everyone will be wearing glasses. So, yes, we humans are influencing our own evolution. We are turning it around into devolution.]

Peattie: Green Laurels about Linnaeus.

From Galen [129 – 200 AD, Roman physician & scientist] to 13th Century – almost no improvement.

Why? Socratic revolt started decline of Greek science. Revolt based on slavery. Plato's philosophy tried to justify causes of revolt. Economy, religion, etc. played an important part. Because of slavery no application of scientific principles (Fauing [?] to social structure such that few people would use new ideas. Those in power wanted to keep things status quo. The decline of science began sometime before the organized era of Christianity. Almost anything new or different branded a Hersey by the church slowed down development of ideas. Such learning as was preserved was done so by the church. Centers of learning for long periods of time. Economy.

Work of Aristotle, Dioscorides, Euclid, Galen & others was of such high quality that people thought no more could be done. A reverence of the classical teachers and periods. People of Roman looked upon the past as a great period. Roman Empire included an inferiority complex in the later peoples.

Some contributions evolved from the dark ages. 7th Century came rise of Islam. This religion spread very quickly and much of th East Empire was occupied. Greek works were translated into Arabic.

Abarroes [?] – Arabic medicine.

Islamic science founded on Greek science about 11th Century Arabic works translated into Latin & brought to western world.

[page 17]

Galen – Greek physician, the greatest naturalists and physiologist of classical times. Born at Mysia, Asia. Minor about 130 AD. Studied philosophy & medicine from 15th to 20th yr. in native city and then went traveling for study, visiting Corinth & Alexandria among other places.

Went to Rome about AD 161. Became physician to the Emperor Marcus Aurelius and later attended Commodus, Sextus, and Severus[5].

Galen was a careful observer and prolific writer. His works were used for centuries as standard for anatomy & physiology. He ranked highest as a brain & nerve anatomist and was aware that some nerves have to do with motion while others respond to sense impressions. He studied and made an accurate description of the respiratory system. Gave good descriptions of bones & joints. Could not dissect humans & thus made many errors in some systems. Observations on circulation incorrect. First to diagnose by use of pulse. Believed in one God.

Last word in medicine until 15th Century.

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[5] The phrase "and later attended Commodus, Sextus, and Severus" can be found in several books on the history of medicine and Jack Harlan was, undoubtedly, quoting form one of them. I found three 2nd Century Roman figures with these names and they are the ones' with the above links. These may or may not be the individuals referred to in the above quote. HVH2

[page 18]

Peattie – Green Laurels, Chapter I [a great deal of the following appears to be quotes, without reference, from Greed Laurels. HVH2]

Aristotelian logic, which was certainly a splendid discipline for the barbaric mind, is worse than useless to science. Aristotle and Aquinas could have talked about the soil & the spirit in it forever, but none of it was ever found under their fingernails. They were not only highborn gentlemen but lacked a certain practical inquisitiveness.

To those who must adore a hero, it is disturbing to find out that their idol did not originate the achievement for which he is famous (Linnaeus) (Bauhin – *Solanum tuberosum* L -) [Not sure what his point is here. *Solanum tuberosum* is the common potato and the name is now credited to Linnaeus. The following website contains the relevant pages from Green Laurels and it shows that the above statement, continued below was a direct quotation from this book" https://books.google.com/books?id=kkfpCAAAQBAJ&pg=PT35&lpg=PT35&dq=In+science+discoveries,+systems,+concepts,+bold+visions,+do+not+spring+full+born+from+the+brow+of+genius.&source=bl&ots=M2F0mVVQCV&sig=yii4ZLosoBnKVbvST1A7E_eJ1EA&hl=en&sa=X&ved=0CB0Q6AEwAGoVChMI4v2nh8W7yAIVwTo-Ch1Gnw8c#v=onepage&q=In%20science%20discoveries%2C%20systems%2C%20concepts%2C%20bold%20visions%2C%20do%20not%20spring%20full%20born%20from%20the%20brow%20of%20genius.&f=false. HVH2] In science discoveries, systems, concepts, bold visions, do not spring full born from the brow of genius. They come up slowly out of the sea of ignorance, with absurdities like seaweed clinging to their limbs, and barnacles of superstition adhering fast to them. By necessity many devoted intellectuals lift up the great idea into emergence. He who rises with it, standing upon the shoulders of his predecessors, appears the hero. So, what it with Aristotle, so with Darwin. [This is the end of the quote from Green Laurels, but Harlan may be continuing to quote from it, below.]

Vesalius (1514-1564) and the Galenists

Vesalius born at Brussels, son of physician, (5 gen. of physicians) attended military college at Louvain & acquired excellent knowledge of Latin & Greek. Developed a desire for natural science under direction of Andernacus. Went to Paris at age 18 to study medicine under Sylvius, a confirmed Galenist (Sylvius (1478 –) one of 15 children book learned.

Vesalius at age 22 was made State Prof. of Anatomy by Senate of Venice. Corrected Galens work for publication of Giunti edition. From 1540 to July 1542 Vesalius wrote the "Fabrica" which contained 663 folio pages – most original work on the human body published since Galen writings were first given to world.

[**page 19**] Cont'd

The Renaissance

Causes

- Pre-occupation of religion. Books recopied, much painting done – when painting one has to pay attention to detail. Observing plants, etc. These arts are credited with part of the awakening from the dark ages. New interest in nature. Painting led to development of anatomy.

Albertus Magnus – Univ. of Paris – wrote large Encyclopedia own obs. [observation] along w/ others. Wrote opus of plants.

[On left margin Byrd wrote:] Incunabula any book printed before the end of the 15th Century.

Roger Bacon - Univ. of Paris – mystic, cryptologist, wrote in code – toyed w/microscope. Was afraid of being burned.

Traveler – Marco Polo – made trip from Italy to china – Emperor of China interested in religion & sent Marco back to Italy to bring back missionaries. Was unsuccessful but went back to China & lived for awhile & then returned telling western world of the East.

Great traveler by foot. Ibn Battuta

The change from Dark Ages to Renaissance took place rapidly. Science & art worked together. Leonardo was an artist & because of drawings of human anatomy was also a science Built machine gun, wire tapping studied fossils. Pained Mona Lisa & Last Supper. Worked on theory of perspective.

[on left margin Byrd wrote:] Mandrake – plant resembling some part of man then that plant would make good medicine for that part of man's anatomy.

15th Century

Surge in Painting, printing, discovery, New World found – science stimulated by these.

16th Century had much to build upon. Herbals became much better.

[**page 20**] Paracelsus – odd ball burned Aristotle's work also asccinnes [?]

(the Arab)

Belon

Vesalius & Copernicus published (1543 & 1541) milestones in revolutionizing thought

Church authority conflicted with science development in the 16th Century. Reforms made in Catholic Church causing it to relinquish control of philosophy.

Schools like Padua developed.

Students

L'Obel –

Belon – later became head of school at Hamburg.

- Stimulated Ray who had tremendous influence on Linnaeus
- Divided botany into several fields. Coined words.

John Ray – Published flora of Cambridge. Flora of British Isles. System used orders as well as genus & species. Known for influence on Linnaeus.

HERBALISTS

Leonhard Fuchs (1501-1566)

Hieronymus Bock (1498-1554)

Gaspard Bavhin (1560-1624)

Otto Brunfels (1464-1534)

[all the above were grouped together with the following comment:] Described & published about various species of plants in relation to medicinal value. Herbalists were so free from the conventional dogmatism of their predecessor that they are generally regarded as the founders of modern botany.

[page 21] Sat. Oct. 12 [Sat. Day 8]

[reading assignment?] Peattie: Green Laurels, Chapts. 3, 7, 8, 13 on Reamur, Buffon, Cuvier, Lamarch, Wallace, Darwin.

Fabre: the Procession (ch. III)

Monday Oct. 14 Assign.

Darwin, Origin of Species – Introduction & Recap & Conclusion

Look at other works of Darwin

Huxley, Julian: Darwin.

10-5-57 [Byrd penciled in this date in the margin, but I am not sure what is the meaning. We already had Oct. 5 a couple of days ago.]

Kepler – Physicist & Mathematician – followed Galileo in Astronomy. Summarized astronomical works and reached conclusion, but had no basis for it.

John Locke: Set about limitations on man's mind. There are many restrictions on man's mind. Man will never understand some tings. Rising & setting of sun deceiving to man (very obvious).

DeKak [Descartes] "I know I exist because I think"

Swammerdam – microscopist – compound eye in insect insects composed of chitin.

Leeuwenhoek

Amateur – Great mind –

Malpighi – Intense worker – well trained, scientific minds.

DeGraf –

Hooke – discovered cells

Descried fungi

Apparatus of stinging nettle

Grew – discovered sex in plants

Diligent microscopist

Plant anatomy

Parkinson – a later herbal – wrote about Botanic Garden (wrote Paradise in the Sun) ornamentals. Gardener to King James I

[page 22, Blank]

[page 22] Linnaeus – Born in Sweden. Mainly classified plants but also did good job on classifying animals and minerals.

Summation of Linnaeus

1. Classification as a foundation for modern biology system of naming
2. Concepts of species – basic philosophy.
3. Initiate plant exploring expeditions.
4. Great naturalist.

[page 23] Peattie Chapt. II

First scientific society: "Accademia die Lincei, the Society of Lynxes" Organized at Rome in the beginning of the 17th Century. Included such people as Galileo, abandoned after 57 years – probably printed first proceedings of a scientific society in Europe.

"Accademia De Cunento" – experimental society with few naturalists.

Malpighi – born in 1628 near Bologna in the head basin of the Pa. Microscopist [in margin:] Adept demonstrator. Professional confidence because toward [back to text:] who worked w/Borelli the physiologist. Presented in great detail the anatomy, etc. of the silkworm – found that insects breathed

by means of tracheae. Respiration. Observed blood corpuscles. Worked w/embryology in chicks. Botanist – studied Swammerdam (son of a rich man) – Hollander – studied insects, made masterful drawings – made own dissecting tools. Good at microtechnique. Extremely hard worker. Discovered that the queen bee was in charge of hive.

Discovered metamorphosis of insects

Leuwenhoek - Giant of his times. 1632 on 300th anniversary Dutch made plan of microscopes used – wealthy, self-made, an expert lens grinder (270 diameters) – one of most eccentric personalities of scientific age. Belonged to Royal Society. Did not publish, wrote letters only not as scientifically minded as Malpighi & Swammerdam. [in left margin:] Amateur

So it may seem that the colorful 17th Century was almost within sight of our own, as it pursued the nature of the cell and attacked the paralyzing myth of spontaneous generation, penetrated close to the heart of sex and unwrapped the mystery that clings around the seed. Recorded seeing bacterial. Discovered protozoa. Discussed parthenogenesis in aphids. Studied red corpuscles. Discovered striated nature of muscles.

[page 24, Blank]

[page 25]

Louis Buffon – a titled [?] person – Burgundy, Wanted to write Encyclopedia that would sum of the world of the natural sciences for all time. A courtier as well as a naturalist – unusual. Very orderly – arose precisely at 6, dressed with exquisite care in full court costume and then proceeded to table to write while standing. Worked 8 hrs a day. Depended on Lady Pompadour. Wrote large opus – 44 volumes, took 53 year to cover. Thought world over 6000 yrs old. Interpreted fossils correctly. Traced earth's history thru epochs. Had some evolutionary ideas. Basically a degeneration concept. Degeneration of monkeys from man. Used degeneration.

Degeneration

[page 26, Blank]

[page 27] Cont'd Lamarck –

Lamarck believed that the need that an animal experiences to be adjusted to his environment forces the mechanism of the body to take on new forms in order to function in a new way. In this way a new animal results. Giraffe – Believed in inheritance of acquired characters.

Georges Cuvier – German anatomist – knew nothing of natural history except what Buffon had to tell him. Man of strong character, disagreeable in scientific circles. According to Cuvier there were 4 great types of animal structure: vertebrates, jointed creatures (crustaceans and insects), the mollusk form, and the radiate such as starfish and jellyfish. Definitely against any conception of evolution. Brought

about “Cataclysmic theory” – That old civilizations were underwent catastrophes that in one instant wiped out all animals & plants and that everything was started anew with new animals, etc.

The parallel between Buffon and Cuvier is striking. Both held practically laureate positions, had influence in high circles, never voluntarily retreated or revised, were given to making only official utterances, and, like the men of the world they were, masked their envy under urbane manners and cultivated a reputation for idleness [?].

Dictator of biology.

Law of correlation of animal parts.

Advanced the science of Paleontology - correlated one segment of earths crust with another segment. World wiped out – started again, etc. Developed idea of correlation of animal parts in animals, Birds have teeth, feathers related to wing system, that related to girdle, to sternum ???? = correlated into ?? Fixiton of species.

[page 28]

[page 29] Cont’d Cuvier

Animal kingdom was a major work. Science of high order. Main concepts – castrophie, fexity of species, correlation of animals.

Goethe 1748 – 1832

Philosopher, poet, author, interested in animal world. Last man who tried to learn all that he could learn in every field.

Common plan of variation within every taxonomic group. Flower parts are modified leaves. Catyledons are only 1st leaves of embryo shoot (correct). Basic idea of structure can be modified for different functions. Some vertebrae have different functions – skull is a system of fused vertebrae.

Law of balance within individual

Invented the word Morphology

Homeostasis – organism is so well balanced in its environment that it tends to remain stable. Genetic homeostasis – seln. For certain character usually brings other characters along also. A system tied together by heredity. Fitted to environment.

[page 30] [blank]

[page 31]

Lamarck, Jean Baptiste [he gives a long bio, but at the top of the page he lists 4 things which may be related to Lamarck.]

Assumed that organic evolution is due to 4 factors

1. The will to live
2. The use or disuse of organs
3. The influence of environment
4. The inheritance of body mechanisms due to use or disuse or to the influence of environment.

[After a long paragraph of Lamarck's life we have]

Lamarck declared that the species of the animal kingdom form a connected series, a graduated chain from the monad [single celled organism] to man. Assumed that evolution took a wondering source. Harlan also feels like Lamarck.

Harlan's review on Lamarck

Studied medicine first – found out about Botany. Studied botany for many years. Took a zoological job at 50 yrs. Of age. Did a wonderful job. Devoted attn to variation of domestic plants and animals.

Environment appears to be most important motive for evolution. Had a good basic concept of fact of evolution.

1. Species vary under changing external environment.
2. The will to live.
3. Species are subject to a progressive development.
   Was sure that evolution took place but did not know how. Tried to explain evolution by low of use & disuse (Geraffe) [last line cut off on pdf. GET BETTER COPY]

[page 32]

Lamarck believed in inheritance of acquired characteristics Disproved by Weisman.

Why were so many of the great scientists of the early 18th century Frenchmen?

1. Science supported by the government
2. Decided rise of the middle class
3. Freedom of press & speech
4. Much painting & sculpture
5. French imagination could run wild and did.

Malthus – essay on population – provided Darwin basic concepts on evolution-

A minister –

[page 33]

Wallace, Alfred Russell (1823 – 1913) [gives a whole page on him, including the following:]

Wrote an essay "On the Law which had regulated the introduction of new species," on the tendency of varieties to depart indefinitely from the original types. Suddenly got the idea of "survival of the fittest".

Wrote Survival of the Fittest & he & Darwin presented joint papers before the Linnaean Society in July 1958 [1**8**58].

Divided earth into six zoogeographical regions [and he lists them]

Visited US & Canada in 1887 & 1888 [see pdf version]

[page 34]

Lombok strait

Richest flora & fauna in the world, on Bali Island and poor on Lombok Island. Bali had at one time been tied to Asiatic mainland.

[page 35]

[This page begins with a typed bio of Charles Robert Darwin, edited in blue ink and then below it more about Darwin in blue ink. And beneath that, in pencil is the following:]

According to Darwin's hypothesis of natural seln., four factors affect organic evolution.

1. Variation
2. Multiplication
3. Competition
4. The inheritance of useful variations

[page 36, Blank**]**

[page 37]

<u>Darwin</u> – <u>origin of the Species</u>

When on board the H.M.S. "Beagle" as naturalist, Darwin became interested in the dist. of organic beings. When he returned home he thought possibly that something could be done to throw some light on the origin of species by accumulating and reflecting on all sorts of facts which could have any bearing on it. He worked for 5 years and then drew up some notes of speculation on the subject. These notes were enlarged in 1944 [1**8**44] into a sketch of conclusion and from that time on until the book was published he pursued the same object. He published (was urged) an abstract (this book) in 1859 (Wallace in 1858 had arrived at about the same conclusions regarding origin of species.)

Book does not contain references.

Naturalists of his time wee saying that all variability was caused by external conditions. Darwin thought it preposterous to attribute to mere external conditions the structure of the woodpecker, with its feet, tail & tongue so admirably adapted to catch insects under the bark of trees.

In order to gain a clear insight into the means of modification and coadaptation Darwin first began a study of domesticated plants and animals.

Variation under domestication

Variability of species in a state of nature.

Struggle for existence (Doctrine of Malthus)

Natural Selection

Instinct

Hybridization

Geologic succession

Darwin was fully convinced tht species are not immutable; but that those belonging to what are called the same genera are lineal descendants of some other and generally extinct species, in the same manner as the acknowledged varieties of any one species are the descendants of that species. Natural seln played a great part but not the exclusive means of modification.

[page 38, Blank**]**

[page 39]

Pre-Darwin workers

<u>De'amur</u> – French, hard worker, investigated metallurgy, described aunts, physiology of insects. Gest know work with insects – first who carefully studied insects.

<u>Buffon</u> – no real convictions

<u>Wallace</u>

Monday Oct 21

The Animal Kingdom I

See handout and elementary text on Zoology

Friday 4-6 pm The Modern Evolutionists (see handout) [this may be a special time for the Sat. class.]

10-14-57 [Also a Monday; not sure why this page has two dates, out of order. Byrd is not giving dates in Class. Ev. Like he did in Mech. of Evol.]

Darwin

Careful about observations

Experiment (simple)

Cautious about his ideas – sure of his ideas when published.

Honest in scientific work

Breadth of interest

Geology

Barnacle – basis of classification today

Insectorvous plants

Fertilization of orchards

Ecology of plants & animals in a community.

Ornithologist

Entomologist

Early tng.

Studied to be a doctor

" " " a clergyman at Cambridge

Quit clergy after 3 years of study.

[page 40]

Cont'd Darwin

Differences in species among Galapagos Islands

Found some islands that were like S. America & which

Had about the same climate but different forms. Geology seemed to be more important than climate in being associated with different species.

Found species endemic to certain islands with the whole group being endemic to the group of islands.

Did not have a job but had some sort of income.

Darwin's work was bucking custom more than religion although religion played a great part. The theory of immutable species (custom). Many accepted evolution but not Darwinism. The mechanics of evolution & time required was difficult to visualize.

There were many demagogues who liked to get their name before the public and made an issue of it. Made a political football out of it. Germany accepted the theory while France was cool towards it.

Valid biological arguments

Some accepted wholeheartedly

Some accepted theory but not mechanics

Some rejected completely

Mivart criticized Darwin

Natural seln is incompetent to explain steps in evolution.

Flat fish

Whale scream

Why would rattlesnakes start a button to get to rattlers?

[page 41] Cont'd Mivart

Is there grounds to believe that species came about slowly? Why not rapid change such as mutation, sports, etc.

Proposed that natural selection be replaced by vitalistic urge – species have urge to change with need.

READ HUMAN DESTINY [Not sure what this book is. Julian Huxley wrote Population and Human Destiny in 1950. Was this the book or what?]

[Mivart said that]Creation by evolution is derivative.

[page 42 Blank]

[**page 43**, typewritten Some Important Modern Texts on Evolution, See pdf version]

[then he lists 16 different publications, in alphabetical order by author's last name and the library number where it can be found. I will not re-type these.]

[**page 44**, Blank]

[**page 45**, Blank]

[**page 46**] From a textbook on Evolution // "Dodson"

[here he has a diagram with the following along the x-axis and a diagonal line sloping down from the upper left hand corner to the lower right hand corner and diagrams above & below the line:]

Algae Mosses Algae Ferns Gymnosperm Angiosperm

(ulothrex) (ulva)

[**page 47**, Blank]

[**page 48**]

[Harlan seems to be listing some laws or principles by which we know something about evolution.]

5. Vestigial organs – dwarfed and generally useless organs which are found in many plants and animals, relatives of which may have the same organ in a fully developed and functional condition (appendix, in man)
    a. Copes Law – trend in evolution that is toward increasing size individuals – demonstrable in plants, vertebrates & invertebrates, does not always hold true. Law of more specialization - better
6. Biogenetic law (Ernst Haeckel) – ontogeny recapitulates phylogeny.
7. Bergmann's rule – in a given species or genus, northern populations have a larger mean body size than do southern populations.
8. [8; Byrd had a 2nd 8] Allen's rule – In warm blooded animals, races which inhabit cooler regimes have relatively shorter tails, lets, ears, and beaks than those from warmer ones.
9. [9] Dolla's Law – law of irreversibility. An animal may change the general course of its evolution and return, but in doing so it does not revert precisely to its former structure.

Relict Species [This may have come from George Gaylord Simpson, but I am not sure]

1. Numerical relicts (groups once abundant & now rare)
2. Geographic relicts (groups once widespread& now restricted)
3. Phylogenetic relicts (Groups surviving from remote times with little change)
4. Fahonomic relicts (Groups once highly varied and now reduced to relatively few species)

1st Law of thermodynamics (Energy can change its form, but not its gersntby (intensity?) – or the law of conservation of energy)

2nd Law of thermodynamics - all systems tend to reach an equilibrium.

Teleology – purposeness of each organ

[**page 49**, Blank]

Neoteny – Those cases in which the young features of the ancestor have been retained in the adult stage of the descendants. This implies a relative retardation in the rate of body development as compared with reproductive glands. [I read somewhere that our domesticated dogs have retained the characteristics and attitude of ancestral wolves. HVH2]

Preadaptation – when a change in the organism may be of no particular benefit or may be harmful in present environment in which the species is living but would be beneficial in another environ.

Postadaptation – a more and more perfect adaptation of the species to the stable environment in which is already living.

Orthogenesis – Evolution in straight line – as any evolving line becomes more highly specialized, the variations which could possibly be of use to it are progressively restricted – Finally it attains a state of "orthogenesis" in which the only changes open to the species are those which push it farther along the path it has already pursued.

Teratology

Teleology – This is the law of fitness of structures for their special structures, and it expresses broadly the general adaptation of an animal to its home and habits.

Homology – Organic beings are composed of corresponding parts; that the variations of an original and fixed number of elements constitute their only differences.

[**page 51**, a typewritten page on onion skin paper. This is the same list given earlier. I will retype it. HVH2]

Some Important Modern Texts on Evolution

Blum, Harold F.	Time's Arrow and Evolution. 575 B 658t
Darlington, C. D.	The Facts of Life. 575 D 221f
De Beer, G. R.	Embryos and Ancestors. 757 D 286a
_____	Evolution. 757.04 E 93
Dobzansky, Th.	Evolution, Genetics and Man. 575 D 653e
_____	Genetics and the Origin of Species. 574.08 C 726
Dodson, E. O.	a Textbook of Evolution. 575 D 647t
Goldschmidt, R.	The Material Basis of Evolution. 575.01 G 623m
_____	Theoretical Genetics. 575.1 G 623t
Huxley, Julian.	Evolution, the Modern Synthesis. 575.01 H 986a

_____ A. C. Hardey and E. B. Ford Evolution as a Process. 575.04 H 986e

Jepsen, G. L., E. Mayr and G. G. Simpson. Genetics, Paleontology and Evolution. 575 J 54g *attempt at synthesis* [italics means hand written notes below the typed lines.]

Mayr, E. Systematics and the Origin of Species. 574.08 C 726 *Geographer distributionist A system of geographic races.*

Moody, P. A. Introduction to Evolution. 575 M 817i *General evolution textbook Zoologist.*

Simpson, G. G. Tempo and Mode of Evolution. 574.08 C 726 *Paleontologist*

Stebbins, G. L., Variation and Evolution in Plants *Karyotype evolution*

Make checklist of subject matter to see what modern evolutionists consider important.

Ford – genetic basis for mimicking insects.

What is mechanical basis. Genetic attempts to learn about classical problems.

[**page 52**, Blank]

[page 53-55, this is a two page type-written report on Whales by Byrd Curtis, November 13, 1957. I will not retype this report, but copy the list of evolutionary adaptations of Whales after a one paragraph general description of whales and followed by "Classification of Whales".]

Some evolutionary adaptations of Whales

Fused neck vertebrae (2, 3, or all 7 vertebrae fused)

Loss of hair on body surface.

Loss of hind limbs

Acquisition of flukes.

Modification of breathing system.

Acquisition of blubber to regulate body heat.

Acquisition of Baleen.

Modification of teeth.

Loss of sweat and sebaceous glands.

Modification of hearing apparatus.

Stationary eyeballs.

Highly developed retina Mirabella.

Increased surface of kidneys.

[**page 57**, This is a typed one page report by Ralph J. Ellis, 16, Nov. 1957 – I will not retype this. It is an outline of a report on Trematode Evolution and Adaptations.]

[**page 58**, is black except for a large hand-drawn diagram of something.]

[**page 59**, back to hand-written class notes by Byrd Curtis]

10-18-57

Blum

2nd Theory of Thermodynamics – natural tendency for things to become less organized. [this note was added above first note:] – more thorough development cause less entrophy [*sic*]. Species goes against 2nd Law of thermodynamics. Less randomness. Uses more energy.

Blum says whatever takes place its all in one direction unidirectional because of physical basis of it.

Darlington

Chromosomes – Genetics governs to a considerable extent of how we act & what we are. Genetic effects.

De Beer

Embryology – ontogeny – effect of environ. What can he contribute? When do genes become effective. Gene function – how individual genes change the ultimate outcome of the organism. Can probably throw more light on major changes.

Dobzansky – Geographic distribution of races and species. Genetics, adaptive polymorphian meaning = pays to be variable – variable populations has better chance of survival. Maintaining a variable population.

[**page 60**]

Dodson – undergraduate – Notre Dame

Summaries of animal and plant kingdoms

What Evolutionists

Genetics

Causes of variation

Speciation

Geographical isolation

Dynamic mechanisms

[**page 61**]

Blum, Harold F. Time's Arrow and Evolution 1951

[there follows an outline of the book]

[**page 62**, continuation of previous page]

[**page 63**]

Simpson, G. G. Tempo and Mode of Evolution 1944

[outline of this book]

[**page 64**, continuation of the outline]

[**page 65**]

Huxley, Julian. Evolution, the Modern Synthesis

[outline of this book]

[**page 66**, continuation of outline]

[**page 67**, back to class notes:]

10-25-57 (Return to page 137)

(Read in life book about animals) (Read 1st chapter in Neal & Rand)

Do not see exuberance or pre profusion of life in Okla. Reflect on whole animal kingdom & reflect what we think about it.

Locomotion

Reproduction

Ability

Ontogeny of the individual

Embryology – develop of complex system

Adaptability to range of ecology

Food habits

Nervous animals

Circulation

Continuity of forms

Dependence on plants

Major features of system of animal

A. Parallel & repetitious evolution
   1. How many phyla have sight
B. Adaptive Radiation
   Every group of any size goes into adaptive radiation.
   Find many cases of parallelism & convergence
C. Dallo's Law – law of reversibility – Birds have lost teeth – cannot go back

   once a parasite – always a parasite.

   Loss of legs in lizard

   Molemola – developed muscles but can't get rid of them

   "Ontogeny recapitulates phylogeny" [I do not think that this idea was still around in 1957; however, it might have been. Stephen J. Gould in 1977 spent half his book (*Ontogeny and Phylogeny*) trying to put this old theory to rest.]

[**page68**] Cont'd Dallo's law – Reduction of parts (tails)

Tremendous plasticity & cohesion – great variety in ways of doing things. If primitive forms were good enough why change to advanced type?

[**page 69**] Goldschmidt, R. B.

[another outline, ending with two paragraphs:]

Macro-evolution – small mutations, ecotypes, biotypes. How can an organism adapt to another generation without a macro-change.

Theory of Marco-change – repatterning, inversions, translocations (repatterning down the chromosome)

[**page 70**, Blank]

[**page 71**]

Prepare a list of

10 examples of homologies in plants

" " " analogy.

" " " convergent or parallel evolution in plants

" " " adaptive radiation in plants

" " " recapitulation in plants

[**page 72**, Blank]

[**page 73**] 11-2-57 [Sat.]

The basic patterns of plant kingdom are not far different than that of animals. Fusion of parts, innovations of structures. [The following website is a modern (2015) explanation of the evolution of plants: http://www.seedbiology.de/evolution.asp#evolution.]

Review of alternation of generations

Algae have a complete set of metagenesis and alternation of generations.

Homologies

Telome theory – Fusion and reduction of parts.

[Then he has two sketches each showing one simple form with an arrow to the right to another simple form. One sketch in first, then below it is the word]

Primordia

[And under that word is another similar sketch, under the second sketch the following:]

Cones originated early – sporophytes are subtending structures for sporangia.

Ovules are basically megasporangia

Antipodals thought to [be?] homologous to old thallus of gametophyte

Polar nuclei is a new innovation that is not evolutionarily understood.

Reduction & Fusion phenomena are widespread in angiosperms

Example from Stebbins

Cross section of oat [fairly complex drawing with a lot of parts named.]

[At the bottom there may be kind of a name for the drawing:]

lemma – leaf sheath

awn – mid-rib of leaf blade

[**page 74**, Blank]

[**page 75**, Blank]

[**page 76**] Recapitulation in plants

1. Eucalyptus – leaves of young trees are ovate, dark green on top and silver on bottom. Leaves of mature trees are long and narrow – much like peach.
2. First leaves of Curcubits. [Cucurbits]
3. Development of gametophytes.

[**page 77**, Blank]

[**page 78**] Convergent or parallel evolution

Widely different plants that look a great deal alike:

1. –
2. Salvinnea [salvinia] & leminae – floating ferns
3. Cup structure in likens also found in fungi.
4. Head of cabbage & head of lettuce
5. Epiphytes.
6. ..

[**page 79**]

10 examples of analogies in plants

1. Fleshly roots and tubers – both store food & are forms of reproduction.
2. Roots of higher plants and haustoria of fungi. Both serve to feed the organism but are of different structure.
3. Leaf and stem tendrils may be analogous to roots from the standpoint of support.
4. Roots of orchids became flattened and take over the function of photosynthesis. Analogous to a leaf.
5. Thorns of honey locust & spine of black locust.

[**page 80**, Blank]

[**page 81**]

Ten Examples of Homologies in Plants

1. Flowers and stems – similar structure
2. Scales of a pine cone and leaves of a maple
3. Orchid roots (leaves) homologous with roots of higher plants n that they flatten and perform photosynthesis.
4. Leaf tendril and leaf.
5. Potato tuber and stem.
6. Petals and leaves.
7. Needles of pine & leave of elm.
8. Black locust spine and stipules of leaf.

9. Spine of honey locust and branch.

[**page 82**, Blank]

[**page 83**] 11-4-57

Historical Geology I

A. Mountain building
   1. Mountains of accumulation
      a. Volcanoes, sand dunes, glacial debris
   2. Residual mountains (buttes, muses) (probably youngest mountains)
      a. Mountains left after surroundings eroded away.
   3. Fault and block [small diag.] Sierra Nevada
   4. Laccoliths – sedimentary system w/intrusion of igneous layers [small diag.]
   5. Dome mountains – igneous rock underneath layers [small diag.] then sedimentary rocks erode away forming concentric rings.
   6. Complexly folded mountains (very old) Appalachians, Rockies, Andes, Himalayans. Have advantage because of double life – crumpled strata at first then Peaks erode away and become valleys. [diagram]

Isosotory [Isostasy]– tendency of earth to equalize pressures.

[diagram: cross section of earth's crust]

What had been a geosyncline became a larger folded mountain [diag.] mountain built from geosynclines layers at base are lens shaped.

[**page 84**] [at top of page, as if added later, since page is only half filled with notes:]

Sedimants laid down in geosynclines are very deep 25 – 50 thousand feet deep. 3000' mountains could have 30,000' eroded away. In falling of synclines the surrounding areas shrink.

[now starts class notes:] Historic Geological Events

Volcano

Krakatoa – off coast of Java – blew up in 1880's. Tidal wave 50-80' high [watch video]

Mt. Pele – Isle of Martinique, 1902, killed all but 2 of 30,000 people. Spine first rose in 7 mo. to 1000'.

Faults [small diag. showing vert. displacement] 1951 in Japan 31' displacement.

Colorado River 1945 changed routes

Whag ho river changed course 250 miles because of buildup of sediments in old course.

Volvano

Paricutin in old mexico.

[**page 85**] 11-9-57 [Saturday]

At least 3/5 of earth's history before Cambrian. Difficult to study fossils prior to Cambrian. Probably 5 of the periods before Cambrian can be worked out.

[**page 86**, Blank]

[**page 87**] Classical Evolution 573

Monday 2-4

Sat. 7-9

Scope of course

Reports due Nov. 11- 22 & after Christmas

2 rpts per student

1st 1/3 of course

History of Science – develop of evol. ideas

Two review periods begin 21 Oct.

2 hrs. Bot.

2 hrs. Zool.

2 hrs. Geol.

Obtain Dictionary of Biology

Plant & animal Dist. 4 periods

Paleontology – up to xmas

Student reports

Assign

1st Greek civilization & character – Arnold J. Toynbee, pages 37-119, 123-134

Greek Science – Benjamin Farrington. pages 33-112

India & China short on indigenous

Science – definition

To know to distinguish, to separate systemized types of study. Can only study the physical world & its phenomena.

[**page 88**]

Philosophy – love of wisdom in actual usuage – See Webster

Original thinking about thinking

Read Plato

Philosophy for pleasure – Henry Haughton

[**page 89**]

[this is a typewritten sheet, a handout, title:

Readings in Biogeography

Biogeography I – Oceanic Islands: Continental Islands

[there follows 7 readings and one penciled in. Some are checked. I will give those, the others I will just give the author:]

Moody, P. A.

Lack, D "Darwin's Finches" pp. 208 598.8Il141d

Gulick, A. "Biological Peculiarities of Oceanic Islands", Quart. Rev. Biol. 7:405, 1932 [penciled in:] B12

Amadon, D. "The Hawaiian Honeycreepers" (Aves, Drepaniidae). Bull. Amer. Mus. Nat. Hist. 95: 155-265. 1950

Meyers, George S. "Fresh-water Fishes and East Indian Zoography", Stanford Ichthyological Bull. 4(1):11-21. 1951

Brooks, J. L. "Speciation in Ancient Lakes" Quart. Rev. Biol. 25:30-60, 131-176. 1950

[penciled in] Miller "Speciation of the Fishes in Death Valley", Evol. 4

Biogeography II – Antarctic Problem: Hystricomorph Problem

Wood, A. E. "Porcupines, Paleogeography and Parallelism", Evolution 4:87-98. 1950

Vanzolini, P. E. and L. R. Guimaraes "South American Land Mammals and their Lice", Evolution 9:345-347. 1955

Moody, Paul A. and D. E. Daniger "Serological Light on Porcupine Relationships". Evolution 10:47-55. 1956

Biogeography III – North America-East Asia Problem: Effects of Glaciation: Other Disjunct Distributions

Cain, Stanley A. "Foundation of Plant Geography", Chapter 17 Discontinuous Distributions p. 242-264 581.9C135f

Moody, P. A. "Introduction to Evolution", Chapter 12, pp. 239-255 575M817i

Biogeography IV – Geographic Race Problem: Summary and Conclusions [two papers not checked]

[**page 90**, Blank back of previous sheet]

[**page 91**, another typewritten, onionskin sheet]

Readings in Paleontology

Paleontology I – The Angiosperm Problem: The Tertrapod Problem

Axelrod, D. I. "A Theory of Angiosperm Evolution". Evolution 6(1):29-60. 1952

Gunter, Gordon "Origin of the Tetrapod Limb", Science 123:495-496. 1956

Ewer, D. W. "Tetrapod Limb" Science 122: 467-468. 1955

Orton, Grace L. "Original Adaptive Significance of the Tetrapod Limb", Science 120:1042-1043. 1954

Romer, Alfred S. "Early Evolution of Land Vertebrates", Proc. Amer. Phil. Soc. 100:157-167. 1956

Paleontology II – The Ear Problem: Other Innovations: Evolutionary Rates [nothing checked, three papers on evolution of the ear.]

Paleontology III – Simpson, Stebbins, Summary [nothing checked, 3 chapters from Simpson's book and one from Stebbins' book]

[**page 92**, Blank]

[**page 93**]

[Notes on "The Hawaiian Honeycreepers" by D. Amadon, see above, page 89]

[At the upper half of the page Byrd has drawn an "evolutionary tree" showing the divergence of several species of Hawaiian Honeycreepers from a common ancestor 'Dreponiidae'. Followed by his notes:]

Ancestors were generalized birds feeding on nectar – acquired a tubular tong early

Speciation – a number of species occur on the same island.

Species that now occur together were were once isolated by islands and now occur together as a result of inter-island range extensions.

Large islands often process types of habitat entirely lacking on smaller ones. This is particularly true if the large islands have greater elevations. When sympatric species completely the more varied the ecology of a large island max permit many of them to survive by occupying specialized or restricted ecological niches not available on smaller islands.

[**page 94**, continuation of notes, to be transcribed later]

[**page 95**, class notes] 12-1-57

Oceanic Islands

Characteristics of Oceanic Islands:

1. Disharmonic fauna
2. Poor fauna – i.e. few genera or families, but large no. of species within the family.
3. Specialization within a group of families.
    a. Finches
    b. Sicklebell or Drepaniida
    c. Snails (Parahalla)
        i. Parallel diversification
        ii. Parallel by distribution within groups

System of flexuating isolation in some islands.

Ideal for max rate of evolution

[here he has a sketch of a island peak with one line pointing to the top:]

Cold rainforest (moves up and down allowing exchange between valleys)

[and another note pointing to the lines on the diagram:] valley

Ways of getting fauna to islands

1. Sweepstake Winner
2. Winds & storms
3. Tides
4. Birds

[a note was added on the left margin:]

Some fresh water fishes can live part of life in salt waters. None of the freshwater fish can be found on oceanic islands. This situation has been used to deter. If islands are truly oceanic.

'4. [next in list at top of page] Loss of flight on part of some birds, Lyson rail, rail in Hawaii. Csuses restricted as to place to go can do better on ground

'5. Tameness of birds on islands – lack of predators.

[**page 96**]

Nature of the land masses of the Pacific.

1. Pacific islands prob. Not very old.
2. New Guinea group related

Origin of bird migration to Pacific

Mayr – does not understand how birds developed migration habit that they have without more land.

Summary

1. Disharmonic
2. Group rich in species
3. Diversification in groups (may or may not)
4. Few species
5. Hightlessness (?)
6. Tameness
7. High % of Endemission (?) in high or large islands
8. Almost all species can be traced to continent.
9. Lack in competitive competition.

[**page 97**]

[Notes on:] Lack, D. Darwin's Finches Cambridge 1947 [will copy later]

[**page 98**, continuation of prev. page]

[**page 99**]

[Notes on:] Skottsberg, Carl "Influence of the Antarctic Continent on the Vegetation of Southern Lands." Proc. 7th Pac. Sci. Cong. 5:92-99, 1953

Local floristic relations around the Antarctic continent includes 50 families and about 85 genera of phanerogams which are regarded as belonging to an element, derived from a Tertiary Antarctic flora now surviving in the zone called the Subantarctic.

There are 3 sectors – The South-American, the African, and the Australian – Neozelandic[6], including Tasmania. Only traces are found in the African sector, the bulk occur ni the other 2 sectors, the Magellanian and the Neozelandic. There is a considerable number of specialized Subantartic genera such as Juncacea, Liliaceae, Polygonaceae, Tagaceae (nothofagus). The example most frequently quoted is Tagareae, the southern beech, recently discovered also in Western New Guinea.

Families found north of the Subantarctic zone but have Antarctic origin include:

Liliaceae, Protoceae, Monimaceae & Cornaceae. These require a milder climate than the Subantarctic and Austral types have advanced north along the borders of the Pacific Ocean & entered Polynesia. A westerly path leads to New Guinea and Indonesia on the one hand and to New Caledonia, Fiji, Samoa, Tahiti, Marquesas, and Hawaii on the other, and along the western border of S. Amer. they have reached Jaun Fernandez and the tropical Andes; in rare instances they are found in Uruguay and Brazil.

A connection with Africa can probably be assumed because of the flora similarities with relict species from the Antarctica.

[**page 100**, Blank]

[page 101]

Vanzolini, P. E. and L. R. Guimaraes, S. Amer. Land Mammals and their lice. Evol. 9: 345-347, 1955

The lice of old world hystricomorphic are not directly related to those of S. Amer. forms. This is an indirect conformation of Wood's hypothesis of independence of the 2 groups. The consistent agreement between patterns of infestation and accepted phylogenic relationships in all other groups investigated adds strength to this negative evidence.

Moody, Paul A. and David E. Doniger. Serological light on porcupine relationships.

The order Rodentia is commonly divided into 3 suborders: Sciuromorpha, myomorpha, and Hystricomorpha . Different modes of attachment of the masseter muscle and modification of the zygomatic arch induced by the muscle from a primary basis for this classification. Despite the general assumption that similar modifications of masseter and zygoma are indicative of genetic relationship, recent investigators have stressed the frequency of parallel evolution among rodents and have questioned this assumption.

Rodents placed in the suborder Hystricomorpha have apportion of the masseter muscle arising on the side of the snout and passing thru greatly enlarged infraorbital foremen on the way to insertion on the mandible.

The hyst. appeared in the old world & in S. Amer. in Oligocene times but more occurred in N. Amer. until the Pliocene.

---

[6] Of or pertaining to New Zealand

[at the bottom of this page is a diagram of different branches coming out of a common base. To the right of the diagram is the following:]

The data give evidence that Amer. & Afric. porcupines are as closely related to each other as either is to such other Hystricomorpha as guinea pig and agouti but no more so]

[**page 102**]

Two anti-Amer porcupine sera and 2 anti-African porcupine sera were produced in male domestic fowl. The tests indicated that the new world and old world porcupines have but slight serological similarity. The findings correlated well with the fact that Erethizontidae were differentiated from other new world Hystricomorpha as long ago as the Oligocene. [according to what I was able to read about porcupines in S. Amer. Land Mammals and their lice, above, they were in group three of the S. American mammals, who were the island hoppers, and yet they are very closely related. So, this brings up the next paper.]

[**page 103**]

Wood, Albert E., Porcupines, Paleogeography, and Parallelism. Evol. 4:87 – 98, 1950

[Follows are Byrd's notes on this paper:]

The Hystricomorpha includes porcupines, guinea pigs, chinchillas, agoutis, peccas [pacas], vescachas [Viscachas], capybaras, [also] etc.

Only surv. Hystricomorpha north of Mexico is Erethizon (porcupine)

S. Amer. Hyst. Are all closely related and as the earlier fossils are ckd they find that only 4 or 5 families – prob. came from same ancestor in later part of Eocene.

The Hystricomorphs do not lend support to the hypothesis of trans-Atlantic land connect during the tert. S. Amer. forms can be shown to have definite affinities w/N. Amer. Eocene Paramyrdae [ParamyRdae] suggesting an orthodox geo. orig. of these rodents. N. Amer. forms derived from old world. In this case the similarities between the N. World hyst. must be parallelisms resulting from evol. trends in diff parts of the world. These similarities are largely in the structure of the jaw muscles & assc. Region of skull & jaws. If these are not the result of parallelism it means that 2 sets of S. Amer. rodents must have floated to Africa.

Vexing prob. of geol. dist. – why are suborder of rodents hyst. is characteristic of S. Amer., the S. parts of Eurasia & Africa, but does not seem ever to have been present in N. Amer. until very recent times.

Possible explanations

1. S. Amer. forms are descended from Old World (Africa) rodents which crossed what is now S. Atlantic.
2. That the African forms are descended from S. Amer. ones.

3. That an Old World hyst. Spread across Asia & N. Amer. into S. Amer. of
4. That the 2 groups have been indep. derived from non-Hystricomorpha ancestors. (probably rodent family Paramjidae (Probable One)

[**page 104**, Blank]

[**page 105**] 12-9-57

In January – take up origin of man

Read Hawks "Man on Earth" on the evol. of man. [Jacquetta Hawkes[7], 1955]

Cont'd Classroom discussion

Antarctic problem

What it means –

Fossils in Antarctic same a fossils in Polynesia

Tri-centric – common in Aust. Africa & S. Amer, strange dist. Of plants

Bi-centric = Africa missing from above

Southern beech (Tagcea [?]) has tri-centric dist

Penguin (ratite) – " " "

Most ratite birds are of S. hemisphere dist. (Antarctic).

Summary

Present dist. of some plants and animals are a little strange in being Tri-centric (Aus, Africa & S. Amer.)

Explanations

A. Land bridge to non-ice covered Antarctic

Objections are that bridge would have to be long

Would help to explain Glossopterous flora & fauna of Australia

Hystricomorphs may have used bridge but later evidence …

B. Hystricomorphs
Landry believed old and new world Hystricomorphs (Porcupines look like porcupines regardless)

[7] I had a hard time finding this book, but the link will take you to a Google listing of her & her books.

Woods group would like to make a case of parallelism throwing out land bridges, continental drift, etc. Landry states that such a belief as Woods would upset all taxonomic laws.

[**page 106**]

In addition to Parallel evolution

Flightless birds

Kee-Wee – able to survive as a relic under protection in New Zealand

Acaria [Acacia?] – goes back to Mesozoic.

Rather violent turbulence caused by the Tertiary destroyed much fauna & flora in northern hemisphere that had wide distribution – what is left are part of old distributions.

Antarctic distribution problem

Old distribution or populations may acct for large part of it. Trans-oceanic transport. Skottsberg (scattered across from Island to island), and also tri-centric.

[**page 107**] 12-14-57

Problem of E. North Amer. & East Asia

Discontinuous genera of plants & animals in E. Asia and North America

Alligator

Urediles [not sure what this means]

Salamanders (large) no mammals that are similar

Gar pike

Plants (Segregated by different species of same genera)

Magnolia

Calyx

Cypress

Kentucky coffee tree

Asa Gray thought that species of E. Asia were conspecific with those of N. Amer. Li points out at one time, and then wiped out in between.

Raises problem of

Rate of evolution – If we knew when these florescence separated then could we judge speed of evol. Why would same assemblage of species.

The Asia problem has some bearing on Antarctic dist. This is a new relic dist. Compared with Antarctic. Antarctic is much older. Old forms are prob. More discontinuous. We can trace pattern of relic disjunct dist. of E. Asia and E. N. Amer. Both floras are quite rich in species (more species of trees in Great Smokies Nat'l Park than in all Europe.) Deciduous rain forest located in Great Smokies.

Old forms mesophytic, woody species – characteristic of E. Asia & E. N. Amer. flora.

[**page 108**]

Survival of an assembly of flora does not indicate a source of origin.

Bamboo assembly (very primitive of family of grasses) found in most diversity in S. E. Asia & Indian islands. Does not mean that grasses originated there but in that kind of climate and now this relic climate is limited to that region of the world.

GRAPHIC RACE PROBLEM

Sympatric – Two forms or species existing together. No trace gene flow. [Species living together]

Allopatric - " " " " not existing together [Geographic separation]

Mayr – concept of geog. Speciation

If 2 forms overlap but do not interbreed – sympatric

If 2 forms live apart & are somewhat different but cannot tell of difference unless experimentation shows one way or another.

(Mayr) tried to prove that all species are formed geographically & that this is the only method. There is much evidence for this, particularly in animals.

Introgressive Hybridization – some characters of one pop. getting into another population without changing the basic forms of either.

Not one concept that will define a species will hold water when all instances are considered.

Superspecies – almost a genus – a group of allopathic species – not sure whether actually different species.

Summation

[the following were written vertically on the page under "Summation":]

Plant & animal, geography, sold, Darwin

[**page 109**] Cain, A. J. Geography, Ecology and Coexistence in relation to the biological definition of the species. Evol. 7:76-83, 1953

[following are notes from the paper. I will not transcribe them, since we have the original, above. This paper has to do with what we have just been talking about: allopatric and sympatric speciation.]

[**page 110**, Blank]

[**page 111**] Mayr, Ernst. Geographic Speciation in Tropical Echinoid Evolution 8:1-18. 1954.

[following are notes from the paper. I will not transcribe them, since we have the original, above. This paper has to do with geographic speciation and the study was done on the "distribution of the 16 genera of West Indian shallow water echinoids" (Sea Urchins). Byrd's notes appear to be a hand copy of some of the paper.]

[**page 112**, continuation of prev. page.]

[**page 113**] Moody, P. A. Introduction of Evolution Chapt. 12 pp 239-255 575M817i

[following are notes from the chapter. The book appears to have been written in 1952 with a second edition in 1962. Since it is a book and I cannot get to chapter 12 on-line, I will copy Byrd's notes.]

Africa – lions, elephants, rhinoceroses, hippopotami, antelope, giraffe

S. America – monkeys, tapers (camel family) mountain lions, sloths

Australia – Marsupials, monotremes (an animal [mammal] that lays eggs)

Eurasia & N. Amer – animals common to both – bison, moose, wapiti (elk), reindeer (caribou), mountain goat & sheep.

Accessibility

Three southern continents widely separated by oceans whereas, N. continents are nearly in contact. Fauna of Australia, Africa & S. Amer. very distinctly different as a result of this inaccessibility other mammals thrive in Australia (rabbits) so adaptability is not a factor in explaining types of animals in Australia.

If an animal is to live in a certain region (1) it must be able to reach that region & (2) the region must be suitable.

Centers of Dispersal

Tapers (camel family) odd toed, hoofed animals. 4 toes on front feet & 3 on hind ft. Resemble large pigs. Live in (1) Central & S. Amer. & (2) The Malay Peninsula & adjacent islands. Fossil record shows that they once ranged all over N. & S. Amer. & Asia.

Camels (Camel, Llama)

True camels inhabit Africa, Arabia, highlands of Asia. Llamas inhabit the highlands of S. Amer. Fossil record shows wide dist.

[**page 114**]

Barriers

Physical – water for land dwellers, land for water dwellers.

Biological – absence of food supply, predators.

In general a species can surround a barrier in 2 ways (1) by being adaptable to a variety of living cond. (2 by giving rise to new forms.

Adaptability most important but in least in evidence

Continuous Ranges

Birds, rats, etc.

[**page 115**] Paleontology Evol. 3 25-33

1949

Jan. 6, 1958 Article on rabbits – Rabbits are

573.2 c596f

Discussion of Clark, W. E. Le Gros. The fossil evidence for human evolution.

Quantum evolution – an evolution by jumps – stairsteps.

Angiosperm Problem

Good representation in Cretaceous but before that almost nothing. What were their ancestors – surely must have been antecedents. Few scattered remains to study that occurred prior to Cretaceous.

Bay – where bay threes grow – broadleaf evergreens. – built up of muck of bay leaves – much organic material.

Good situation for preservation of fossils.

Axelrod – believed that bay type areas contained evergreen while angiosperms were on hillsides and no fossils were laid down (if they were they were eroded away).

Tetrapod Problem

Why innovation of forelimbs – how did it happen?

How did fins go to legs and why?

Change of function.

Romer – population pressure – dispersal to areas of water.

Argument against is that surrounding ecology has to be correct.

Gunter – hypothesis that ray finned fishes developed to move away from dangers of sea.

Modern fish that navigate on land

Mud-skippers

Climbing perch – may move up to ½ mile

Air breathing rather common in fishes.

[**page 116**] Protecting the skin from drying

Amphibians go back to water to reproduce

Latimeria has jointed fins.

Fishes started developed[ing] fins that were directed towards limbs before they ever got out of water.

Jarvik – studied crossopterygians

Frogs stemmed from group of fishes & salamanders from another.

Is parallelism a characteristic of evolution?

The change from fin to leg is not a great change and took place without great change in the organism. Visualizes that change took place over larger groups. Major changes in external structures took place over large groups. Major changes in external structures.

An innovation – something new – jaws, limbs, eyes – so many things have evolved that we do not have fossil records for. Were there intervening steps – if so what were they Flying apparatus is an example (have fossil record of gliding apparatus)

Oliver, Gliding in amphibians and reptiles. Amer. Naturalist 85.?

Flying frog – has large hind feet

Flying draco –

Flying squirrel

Flying fish

Flying gundard

Flying fish

Flying flanger – marsupial

Flying shrew – Madagascar

Flying Pleridison – flying reptile

Question of whether gliding leads to flying.

[**page 117**]

Ewer, D. W. "Tetrapod Limb" Science 122: 467-468. 1955

[the above link only includes a few paragraphs of the paper, but matches very closely with Byrd's notes, so I will not try to transcribe his notes.]

Romer, A. S. Early Evolution of Land Vertebrates

[below this title there is a hand sketch of a tree with "BONY FISHES" at the bottom and various kinds of animals at the various branches, including Reptiles, terrapin, and Frogs and Toads]

[**page 118**, Blank]

[**page 119**] Axelrod, D. I., A Theory of Angiosperm Evolution. Evol. 6:29-60. 1952

Problems

(1) What were their ancestors? Turcula – late Triassic
(2) What is their antiquity? Late Triassic
(3) What was the general nature and area of environment?
(4) Did they actually assume dominance with bewildering suddenness during the Cretaceous?

Phylum had long history prior to its assumption of dominance in the middle Cretaceous. Oldest known plants are late Jurassic in age. Furcula is a leaf fossil from Greenland, which appears to be angiosperm. Many specimens of fossils are available from the Middle Cretaceous suggest a long prior history:

Leguminosae, Magnoliacea, Euphorbiacea & many others.

Permo-triassic Geol. & botanical data are adduced which support strongly the inferences that (1) Angiosperms probably were in existence by Permo-Triassic, that (2) they probably occupied upland regions remote from lowland sites of deposition, that (3) they wee distributed in the diverse environments of the tropical zone, that (4) at least some of them were ancestral to the modern

primitive types of mono & dicots which are now represented in tropical regions and that (5) they were undergoing quantum evol. from proangiosperms which occupied upland regions.

Late Triassic – Jurassic – with a return of more equable climates during this stage, some of the types which had developed earlier in the uplands of the more extreme tropical and marginal tropical environ. Probably because extinct as their area tended to disappear. This created in random manner numerous discontinuities between the earlier more closely related groups.

Early Cretaceous – Angiosperms attained some diversity of type over the lowlands during the Early Cretaceous, and by the middle of the period had replaced the Gymnophyte flora over the lowlands. Replacement was gradual – not with "suddenness" as judged from comparative data representing (a) time required for other major world

[page 120] to rise to dominance, and (b) the time for other phyla to assume dominance.

All known evidence seems to indicate that the temperate holarctic and Antarctic regions, as well as the drier areas are secondary centers in Angiosperm evolution. The area of basis angiosperm evol. was the tropical zone is indicated by the fact that the phylum is adapted primarily to tropical environ, & secondarily to the more specialized tropical & extratropical regions.

[**page 121**] 12-18-57

Evolutionists are today essentially neo-Darwinians. Parallelism is becoming more striking each day – expected events. Greater apprec. for organic behavior under seln pressure.

Simpson – Rates of evolution

Measuring rates of [evolution]

No. of new things that appeared in relation to those that are living

Horotelic [here is a vertical bar chart with "no. of genera" on the Y-axis and "rate, 'deciles' on the X-axis, with slow on the left and fast on the right side, and a comment to the right of the graph:] rate of evolution divided into .10. [the graph shows an upward trend and the biggest one is labeled:] horotelic (mode) [and to the right of the graph is;] Pelcypods (mostly evolving at a rapid rate. [and below, it says:] Basic pattern for all groups.

How does genus disappear – either change to another genus or become extinct.

[following this there is another diagram, with a single curve, with a steep ascent on the left hand side and then a leveling off and slow decreasing as you go to the right. The sharp rise is labeled: Tecitelic and the larger part is called: Bradytelic. Beneath the graph it says:]

Curves representing tacitelic and bradytelic. Tacitelic [Tachytelic?]groups change to bradytelic or become extinct.

Hypertelic – idea of momentum of evolution – when genera starts evolving, it keeps going until becomes unadapted and become extinct. Antlers of Elk – become so heavy and large that he couldn't carry them. Simpson doesn't think much of examples of hypertelic theory.

[**page 122**]

Course of extinction – inability for adaption to keep up with change of environ.

12-21-57

Hypsodont teeth character (shown in many animals that eat fibrous material) [following this is another graph with "change" on the Y-axis and Time on the X-axis. There are two lines sloping up to the right. A solid line and a broken line which seems to fork about ¾ of the way across. Then you have to the right some small diagrams a circle with a smaller circle inside it labeled;] hypsodont (1 cene in protocone), [and another larger circle with three smaller circles inside it forming a triangle, with the top circle being the largest of the three. It is labeled:] trichodont (3 cenes peri, proto [and the third I cannot read because it is in the crease of the book] [then there are some other words:]

Fragodent

Hyposome [Hypostome]

This shows that diff of traits of same animal chg at diff. rate and that any one trait may change rates or divide into 2 rates. [There follows another graph which may illustrate this]

[On Y-axis:] No of Ribs [and 25 at bottom and 40 at top] [on X-axis:] Cm of bed (strata) [and the following numbers on the X-axis:] 850 [on left and] 864.5[on the right, with a line with a discontinuity in it sloping up to the right. There is a note on the right which says:] increase in no. of ribs of a marine snail, correlation of increase in ribs in diff. beds of strata of geol time. [So, this may be illustrating how in a snail evolved over time, adding ribs.]

[page 123] Cont'd 12-21-57

Conservatism (bradytelic)

Forms that have undergone little change & still alive today

Latimeria – gasrop

Pattella – a limipial from lower Cambrian

Linguila – brachypod – dating from Ordovican [Ordovician]

Genkgoales – old genus

Ostrea – oyster

Rates of evol. vary enormously – within diff. rates at diff times.

Racial senility (senescence) animals form odd shapes

Amonites – evidence for senility was shown 100 yrs prior to extinctin.

Some of the sevile forms were most successful sign of impending extinction

For a time however the young forms (those that

Did not mutate) have remained.

Reptiles – Enormous horns, etc. – indicative of impending extinction.

[large brackets around "Racial Senility" including "Amonites" & "Reptiles" with note:] Simpson & Harlan disagree

A group about to become extinct may vary more than other groups.

Adaptive zones – [another diagram with the letter "A" inside a double circle on the right and arrows leading a double circle with the letter "B" inside it. By the B circles is written:] new adaptive zone [and between the two zones is written:] Valley – adaptation difficult [to the right of the diagram is written:] The ability of a pop. to bridge the gap may or may not be present in a pop. Seln. pressure may favor narrow limits (centripetal seln) of population. On the other hand the pop. may be scattered. Centrifugal seln – may cause wide dist.

[page 124] Cont'd 12-21-57

Adaptive Peak Topography (Speciation)

[another diagram of a 3-D tree showing that the trunk has a combination of A & B traits and when it splits it splits into two branches, one labeled A and the other labeled B. To the right there is a note:] Horse groups devided into browsers & grazers – browsers became extinct. [below is a note:] Adaptive zone of A + B population may have occupied same zones and then these zones divided.

Browser could not go directly to grazer. In the trunk of the horse tree the browser & grazer divided. The genetic variability has to be present for adaptations to occur. [Now another diagram of a tree sloping off to the right and branching. The top branch is labeled:] case of parallel evolution [and between the two branches is a note:] unadapted ness

[page 125] Cont'd 12-27-57

Relics

Numerical – rare survivors of groups once larger

Geographical – endemic that were once wide spread

Phylogenetic – unchanged from ancient ancestors – opossum

Taxonomic – much less varied than previously

Latimeria relect in all four sense

Limulus – phylogenetic relic

Traps and blinds

Islands are traps (Marsupials in Aus.)

Very seldom that island forms could compete with continental forms which may be a result of fewer environ.

Overspecialization – relation of specialization to adaptive zone; adaptive zone may become blocked thus species may die.

Examples: Irish Elk, Senility

[page 126]

Stebbins, G. L. Variation and Evolution in Plants: Chapt. Fossils, Modern Distribution Patterns and Rates of Evolution, pp 514-561.

The basis of evolutionary rates: Summary and Conclusions.

Rates of evol. change are very diverse, not only between different groups of org. living in different environ. or in same environ. but also within the same line at different periods in its evol. history and between diff. parts of the same organism. They may range all the way from the extreme rapidity which is considered sudden or explosive in terms of the geological time scale down to rates so slow that they line is essentially static.

[page 127; note he uses both black & red pencil] (1)

Clark, Le Gros, The Fossil evidence for human evolution. 596 R763m3

Comparisons

Ape & man – (1) The bony skeleton is constructed on the same general plan. (2) The muscular anatomy of man & apes is astonishingly alike, even down to some of the smaller details of attachments of individual muscles. (3) Close similarity of structure and disposition of visceral organs. (4) Human brain is little more than a magnified model of the brain of anthropoid ape.

It is because of such striking complex of resemblances that in schemes of zoological classification and the anthropoid apes have for many years been placed quite close together, and in recent years the tendency has been for still a closer approximation.

[now he has another tree for the apes & humans. On the left side he wrote this:]

The most important single factor in the evol. emerg. of the Hominidae as a separate and independent line of development was related to the specialized functions of erect bipedal locomotion. Herein the H. showed the most remarkable evol. divergence from the Pongidae (brachiating mode of locomotion). In H. the lower limb increased in relation to the trunk and in relation to the upper limb. In Pongidae the upper limb increased in length. The pelvic bones of Hominidae changed for erect posture while the pelvis of Pongidae remained as in other primates. [I will not try to reproduce or describe the tree]

[page 128] (2)

[this page consists entirely of a chart with three columns, entitled:]

Geological Periods	Cultural Periods	Homonidae
Holocene	Mesolithic	
	Neolithic and later	
4th Glaciation	Magdalenion, auroguaciam (Solistream	
	Mousterian (Neanderthal)	
3rd Interglacial period	Acheulian	
3rd Glaciation	"	
2nd Interglacial period	"	
2nd Glaciation	abbevillian	
1st Interglacial period	"	
1st Glaciation	"	
Villafranchian	"	

[there are some words written vertically which I will not try to transcribe. He is giving a general timeline of the evolution of humans.]

[page 129] (3)

Con'd Clark

Since the discovery of a skull cap and portions of the limb skeleton in the Neanderthal cave (near Dusseldorf) in 1836, "Neanderthal man" has become recognized by most anthropologists as representing a distinct group of the genus Homo which became differentiated probably in the middle Pleistocene period but did not survive the end of the Pleistocene. Lived during 1st phase of last Glaciation of the Ice Age.

Homo – supra-orbital ridges variably developed, becoming secondarily much enlarged to form a massive torus in the species H. nean. And showing considerable reduction as H. sapiens; facial skeleton orthognathous or moderately prognathous; occipital condyles situated approximately at the middle of the cranial length: temporal ridges variable in their height on the cranial wall, but never reaching the midline; mental eminence well marked in H. sapiens but feeble or absent in H. neanderthalensis; dental arcade evenly rounded, with no diastema; first lower premolar bicuspid with a much reduced lingual cusp; molar teeth rather variable in size with a relative reduction of the last molar; canine relatively small, with no overlapping after the initial stage of wear' limb skeleton adapted for a fully erect posture and gait.

The geologic antiquity of the genus Homo is not certainly determinable on the fossil record at present available – probably extends back at least 50,000 years ago. May be as old as 200,000 yr (1st Glaciation) as evidence by the mandible found at Heidelberg in 1908 in

[page 130] Swanscombe skull – gives some evidence that H. sapiens may have been in existence during the 2nd Glaciation.

-4-

Some of the Australian aboriginals of today have skulls very similar to H. Neanderthals.

Pithecanthropus – known from origins [?], Java (central and eastern) and China (Choukoutien, near Pekin). Both types now thought to be the same.

Javanese type = Pithecanthropus erectus

Chinese type = " pekinensis Probably only subspecific – now known from 14 calvarial or fragments of calvanie [not sure what these words are]

Fossils found in central Java in 1891 from beds of Middle Pleistocene (2nd glaciation in other parts of world)

Pithecanthropus - low cranial capacity (900 cc), flattened frontal region contains powerfully developed supra-orbital ridges. [Byrd drew an arrow from Pithecanthropus to the following:] presents a remarkable simian appearance.

So far as the scanty fossil materials permits a comparison of the Javanese & Chinese representatives of Pithecanthropus it is probably true to say that the Javanese were more primitive in their smaller cranial capacity, more marked platysephaly [flat head syndrome], greater flattening of the frontal region of the skull, more heavily constructed mandible, less pronounced curvature of the dental arcade, larger palate, etc. Also evidence that in Java Pith. Extended back to a greater antiquity than in China, for while (as already noted) the Jaunal correlations of the Djetis deposite are no earlier than the Middle Pleistocene (2nd glaciation). The two probably as closely related as two races of present man.

Cont'd Clark

It appears that the Pithecanthropus in China had already developed a communal life of a very active kind and had learned to use fire for culinary purposes (development of intellect).

There is a general consensus of opinion that Pith is an ancestor of Homo. Reasons:

1. The morphological characterists of Pithecanthropus conforms very well with the theoretical postulates for an intermediate stage in the evol. of Homo from still more archaic types approximating to the presumed common ancestral stock of the Pongidae & Hominadae
2. 2. The existence of pith. In Early Pleistocene, antedating any of the well authenticated fossil remains of Homo.
3. Pith., pre-Mousterian hominoids, and modern types of H. sapiens of the late Paleolithic provide a temporal sequence, a satisfactorily graded series of morphological changes leading from one type to another.
   Australopithecus (southern ape) not an ape in the taxonomic sense – Discovered in S. Africa – may well include stock of Homo ancestory.
   Cranial capacity = small 450-700 cc. This compares with 685 cc for the largest cranial capacity of a gorilla (2 times the weight of an Austral.
   It is now clear that the Australopithecinae must in the family Hominidae. They show none of the decergent modifications which are distinctive of the Pongidae, their only resemblance to the latter being the retention in common with theory of primitive is hominoid characteracrs, such as the small size of the brain, large
   [page 132] molar teeth, and certain rather minor features of the limb skeletons.

Montagu, M. F. Ashley. Time, Morphology & Neotemy in the Evol. of man. Amer. Anthrop 57:13-27. 1955

The problem is to throw some light on the means by which such modernlike forms of man came into being so early in the evolutionary history of man.

Time & morphology – in classical evol. maintained a 1 to 1 assn. the longer the elapsed time the more advanced the morphological development.

Orthogenesis – now considered unsound.

In humans (progression in time from simple to complex0 tools from the simple to more complex (C. J. Thomsen's system of 3 ages – The Stone Age, the Bronze Age & the Iron Age.

Pithecanthropus -

[page 130 seems to be a continuation of Byrd's notes on Montegu's paper.]

[page 131] Cont'd Clark - 3 -

[This is a continuation of Clark's notes on human evolution.]

[page 132] - 4 -

[A continuation of notes on Clark]

[page 133] Cont'd Clark - 5 –

[page 134, Byrd's notes on Clark, finished with just one sentence at the top of the page]

[page 135] <u>Class Discussion</u>

Why fossil record is sketchy

Man was rare beast (numerical quantity.)

Hyman fossils not preserved well.

Level of behavior

Mortality rate extremely high.

Non-gregarious nature.

Short record – evolved rapidly

Did not frequent places where could preserve skeletons.

Dubois found in 1891 in Java the Javanese.

[page 136, Blank]

[page 137] **10-25-57** [this page is out of order. It is a handout with two columns, the first:]

SOME CLASSICAL PROBLEMS IN EVOLUTION [the second:] SOME PROBLEMS IN ADAPTATION

[Above this Byrd wrote:] Things people have considered important in Classical Evolution

[there are 31 items in each column, and numerous notes on the paper near various items, as if they went through these in class and Byrd made notes on the lists. Below the lists are a series of semi-abstract shapes and beneath this:] An Example of Orthogenesis

Copes Law – Law of none specialization may give rise to new forms whereas specialized types already committed.

[then a horizontal line across the page and below that;]

Mechanism – That life phenomena involve merely complex patterns.

Vitalism – in addition to the forces similar in kind to those operating in inanimate nature, life involves powers which are restricted to the living world. [Return]

[page 138, Blank]

[page 139]

Waddington adaptations

Exogenous adaptation – one in which the org. responds to external stimulation –

Ex. Callus, remove one kidney, other becomes larger

Pseudoexogenous adaptation

Foot callus of man's feet – already there at birth

Kneepads of camel fetus – " " " "

Second molar of dugong – sea going mammal, inhabits coastal water. Vegetarian – eats seaweed – cone shaped tooth in fetus – cone is resorbed before birth and flat molar forms before birth.

Indogenous adaptation – fixed adaptations – development of part of skin to become cornea of eye.

Baldwin effect (Paper by Simpson, Evol. V. 7, 1953)

Obs. Of Baldwin's effect – characters by org. may event under seln. Become genetic characters. Timberline trees – stunted etc. – but how would they appear at lower elevations? Both dwarf & larger types have been shown to occur. Morphological change may become genetic change.

Adaptation bay become purposeful. – The finalist say that it is purposeful & materialists says not. Adaptations first appear by external stimulation (Callus, etc.) Genetic replicas appear in same population. Favorable seln and may become fixed.

[page 140, Blank]

[page 141] **Evolution 593**

[Note, these notes are for Evol. 573. Should this sheet be in with the others of Evolutionary Mechanics, FC 793 or is Harlan introducing them to 593? I think not. But look into this.]

Problem of Planned Purposes (Teleology – Simpson). Is there an ultimate goal?

What is life – must have growth and reproduction. Outside materials are brought into organisms and synthesized using energy. Viruses may [be?] separated in crystallized form. Living things have something that dead things don't.

Vitalistic Living things have something that direct their lineage to a certain channel. Has been argued in studies of evolution.

'Elan vital – Bergsons

Telefinalism – final goal to be reached.

[page 142 – 144, Blank]

[page 145] Readings in Evolution

Final list

Montagu, M.F.A., Amer. Anthrop. 57(1):13-27, 1955. Time, Morphology and Neotemy in evol. of man.

Weidenreich, Franz. Evol. 1:221-236. 1947, Frend of human evolution

The Holy Bible: Gen 3:1-24. Moses? 1100BC?

Sillman, L. R. Evol. 9:94-99. 1955, The Genesis of Man [Abstract: Psycho-analytical view of the forces which transformed "an impulsive 'eat, drink and be merry' Palaeolithic hunter into a quasi-compulsive Neolithic husbandman or bourgeois who saved part of what he possessed for future planting and breeding." From: https://books.google.com/books?id=uuLrCAAAQBAJ&pg=PA221&lpg=PA221&dq=Sillman,+L.+R.+Evol.+9:94-99.+1955,+The+Genesis+of+Man&source=bl&ots=9q_O4D31_T&sig=aXfiv5OpbCfqAADH4QJuqnX5_yw&hl=en&sa=X&ved=0CB0Q6AEwAGoVChMIk-ywyNnHyAIVgXs-Ch2IxQVr#v=onepage&q=Sillman%2C%20L.%20R.%20Evol.%209%3A94-99.%201955%2C%20The%20Genesis%20of%20Man&f=false.]

Simpson, G. G. Sci. Mo. 64:481-495. 1947. The Problem of Plan and Purpose in Nature.

Koch, Leo F. Sci. Mo. 85(5): 245-255. 1957. The Vitalistic Mechanistic Controversy. [A quick reading of the beginning of this paper reveal that Dr. Koch is basing his proposal on the fact that living things have a "dual nature": they have a genotype and a phenotype; and no non-living system has such an arrangement. This, he concludes, is the difference between living things and non-living things. This was

written in 1957, before the computer revolution. Now, in 2015, in the middle of the computer revolution I believe we can see that computers have hardware and software and this is exactly analogous to Dr. Koch's proposal. But, I would submit that computers are NOT living things and they never will be, in spite of the cleverness that they, of late, are picking up as the programming becomes more and more sophisticated and less and less deterministic. There is something else that living things have besides a DNA code that makes them living.]

[page 146, Blank]

[page 147] Midterm Exam.

A. C. 573
B. [This exam consists of 7 essay questions, for some of which the material has been covered, others will require some original thought, unless much more was covered in the class discussions – which is undoubtedly true.]

[what follows in the next 7 pages is Byrd's answers to the questions and a few comments by JRH.]