Lecture 1-8

Week	
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Notes	Learning

Lecture Notes

▼ What is Biology ?

study of living things

cellular basis of living things

energy metabolism
genetic basis for inheritance

evolutionary relationships

diversity of life

In life's hierarchy **new property emerge at each level.**

• Multicellular organisms have properties that emerge from the interaction of their cellular components.

👉🏽**Life is an emergent property**

👉**Virulence is an emergent property. (Requires 1.Susceptible host 2. a Host that is not immune)**

▼ Hypothesis building and its validation

A hypothesis is an assumption that is made based on some evidence.

it translates the *research questions into predictions*

variables, population and the relation between the variables

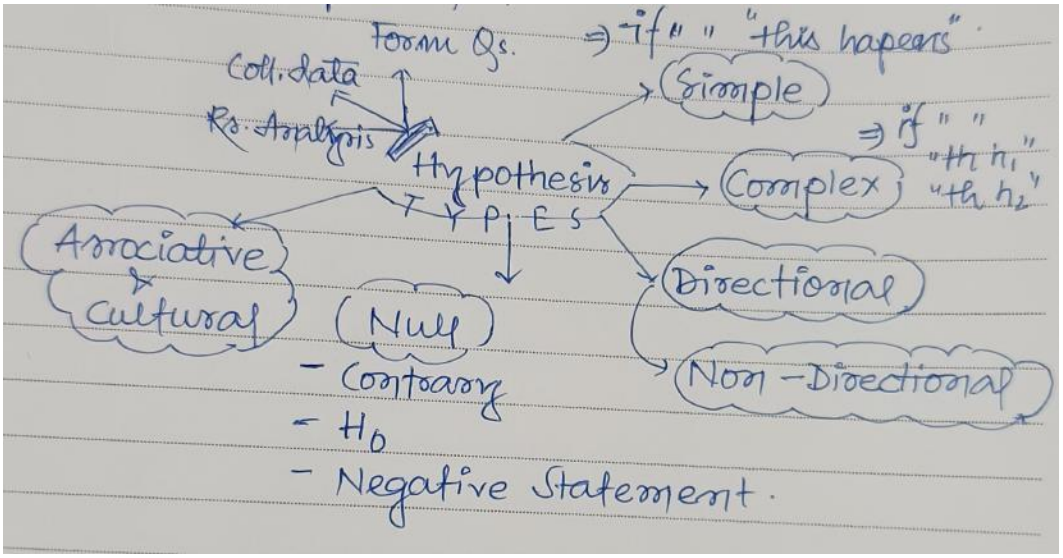
A research hypothesis is a hypothesis that is `used to test the relationship between two or more variables.`

Characteristics:

• specific and should have scope for conducting more tests.

• should be stating the relationship between variables.

• explanation of the hypothesis must be very simple



▼ Reductionism and Systems Biology overview

In `reductionist` view, the `behaviour of biological systems can be explained by the properties of components`.

The `system oriented approach` insisted that `biological systems have emergent properties that only can have a system as a whole and not its constituent parts.`

Reductionism gives explanatory significance only to one factor, while the system biology considers a number of factors in order to describe the behaviour of dynamic

system

▼ ***Evolution***

To develop, to change, to adapt

Change in the heritable characteristics of biological populations over successive generations.

Population: Group of organisms belonging to same species living in a particular area.

Species: A group of living organisms consisting of similar individuals capable of exchanging genes or interbreeding

Life > Domain > Kingdom >Phylum>C>O>F>Genus>Species

French naturalist Jean-Baptiste Lamarck

British naturalist Charles Darwin.

Darwin referred to this process, in which groups of organisms change in their heritable traits over generations, as “descent with modification." Today, we call it evolution.

Lamarck	Darwin
No Extinction	Extinction (species creation)
	The differential survival and/or **reproduction of classes of entities that differ in one or more characteristics** . To constitute natural selection, the difference in survival and/or reproduction cannot be due to chance, and it must have the potential consequence of altering the proportions of the different entities.

The theory of evolution conveys `chance and necessity` jointly enmeshed in the stuff of life; randomness and determinism inter- locked in a natural process that has spurted

the most complex, diverse, and beautiful entities that we know of in the universe: the organisms that populate the Earth.

▼ Design Without Designer

Paley makes two remarkable observations, which enhance the complex and precise design of the eye. The first observation is that rays of light should be refracted by a more convex surface when transmitted through water than when passing out of air into the eye. Accordingly, “the eye of a fish, in that part of it called the crystalline lens, is much rounder than the eye of terrestrial animals. What plainer manifestation of design can there be than this difference? What could a mathematical instrument maker have done more to show his knowledge of this principle . . . ?” (Paley, 1802a, p. 20).

The second remarkable observation made by Paley that supports his argument is dioptric distortion: “Pencils of light, in passing through glass lenses, are separated into different colors, thereby tinging the object, especially the edges of it, as if it were viewed through a prism. To correct this inconvenience has been long a desideratum in the art. At last it came into the mind of a sagacious optician, to inquire how this matter was managed in the eye, in which there was exactly the same difficulty to contend with as in the telescope. His observation taught him that in the eye the evil was cured by combining lenses composed of different substances, that is, of substances which possessed different refracting powers” (Paley, 1802a, pp. 22–23). The telescope maker accordingly corrected the dioptic distortion “by imitating, in glasses made from different materials, the effects of the different humors through which the rays of light pass before they reach the bottom of the eye.

▼ Germ Plasm Theory :

Heritable information is transmitted only by germ cells in the gonads (ovaries and testes), not by somatic cells. The related idea that information cannot pass from somatic cells to the germ line, contrary to Lamarckism, is called the Weismann barrier.

Points -

// “theory” indicates a body of thoroughly-`tested and verified explanations for a set of observations` of the natural world.

// Individuals do change over their lifetime, obviously, but this is called development and involves changes programmed by the set of genes the individual acquired at birth in coordination with the individual’s environment.

// The theory of evolution explains how populations change over time. It does not shed light on the beginnings of life, including the origins of the first cells, which is how life is defined.

// Chance is certainly a factor in evolution. But natural selection is not random.

// Evolution has no direction

▼ **Artificial Selection**

▼ **Sexual Selection**

Males have higher reproductive variance :

If a male gains a disproportionate share of reproduction, he will take away reproductive opportunities from other males, leading to a high reproductive variance among males.

Females have lower reproductive variance :

A successful female, on the other hand, will not take away reproductive opportunities from other females, leading to a smaller variance in reproductive success.

BATEMAN’S Principle:

Variance in reproductive success in a particular sex can lead to development of secondary sex characteristics for that sex

Sexual dimorphism : where the sexes of the same species exhibit different characteristics, particularly characteristics not directly involved in reproduction.

Intrasexual selection (Male-Male competition)

Intersexual selection (Female Choice)

Good Genes Hypothesis

Secondary sex characteristics signal increased fitness.

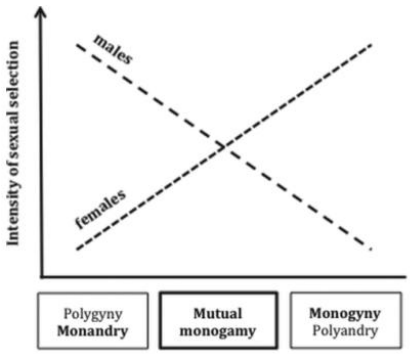
Handicap principle

Sexual selection can be so strong that it selects for traits that are actually detrimental to the individual's survival, even though they maximize its reproductive success.

Adaptations evolved for Intra vs inter sexual selection

Cryptic female choice (CFC) represents **postmating intersexual selection arising from female-driven mechanisms at or after mating that bias sperm use and impact male paternity share.**

Sexual selection in relation to mating pattern



Sexual selection is generally highest in males under polygyny and monandry and in females under monogyny and polyandry, since successful individuals can then reach a very high mating success both in terms of number and quality of mates,

Males invest more than females in offspring. (Examples: seahorses, pipefish, giant water bugs)

▼ **Hopi Hoekstra - Camouflage**

Colors are important in

- Mate Choice(Peacock)
- Warning(Poisonous Frog)
- Mimicry
- Crypsis

Approach:

1.Genetic Cross

2.Linkage Maps

3.QTL Analysis

4. Candidate Genes

5. Molecular Change

The results confirmed the intuition that light-colored mice survive better in light-colored habitats, and dark-colored mice in dark habitats.

The experiment also allowed researchers to pinpoint a `mutation` related to survival, one that `affects pigmentation`, and to understand how it produced a novel coat color.

Papers-

🐀 The selective advantage of crypsis in mice

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▼ **Malthusian theory**

▼ **Speciation**

Asexual organisms and hybrids pose problems for the biological species concept.

> Aspergillus niger .
>
> This species consists of a very large collection of asexual clones , and each clone is reproductively isolated from all other clones.

> Taraxacum Officinale
>
> The species consists of a very large collection of sexual diploid plants and asexual triploid plants.
>
> According of biological species concept each group should be named separately.

> BSC Is also problematic in case of inter species hybrids.
>
> For the carrion crow and the hooded crow , the current opinion is that both belongs to same species and BSC holds .
>
> But in case of Wolves and coyocytes , each has 78 chromosomes and hybrids are fertile. Some wolf populations are threatened with extinction through hybridisation.

▼ Evolutionary origin of sex

SEX in contrast to reproduction , is the process that forms individual organisms containing genes from more than a single source or parent.

SEX isn't intrinsically required for replication , autopoiesy or reproduction.

Articulated significantly in the 19th century by Sigmund Freud.

Sexuality began in single celled microbes and is still a fundamentally a cellular phenomenon.

Chromonemal sex in bacteria(DNA Recombination) is not directly is not directly ancestral to chromosomal(meiotic) sex of eukaryotes .

Bacterial sex is an Archean phenomenon (3500-2500mya) whereas meiotic sex appeared to Proterozoic Aeon(2500-580mya).

Bacterial sexuality in which no fixed number of

What ensures the separation of equal chromosomes

https://www.youtube.com/watch?v=rTZEzIoZuh4&feature=youtu.be

What ensures equal segregation of genetic material during gamate production? Why equal and not 1/3 and 2/3?

When hardy-winberg equal to can be more than 1?

▼ **Why viruses cannot reproduce or carry out metabolic activities outside of a host cell?**

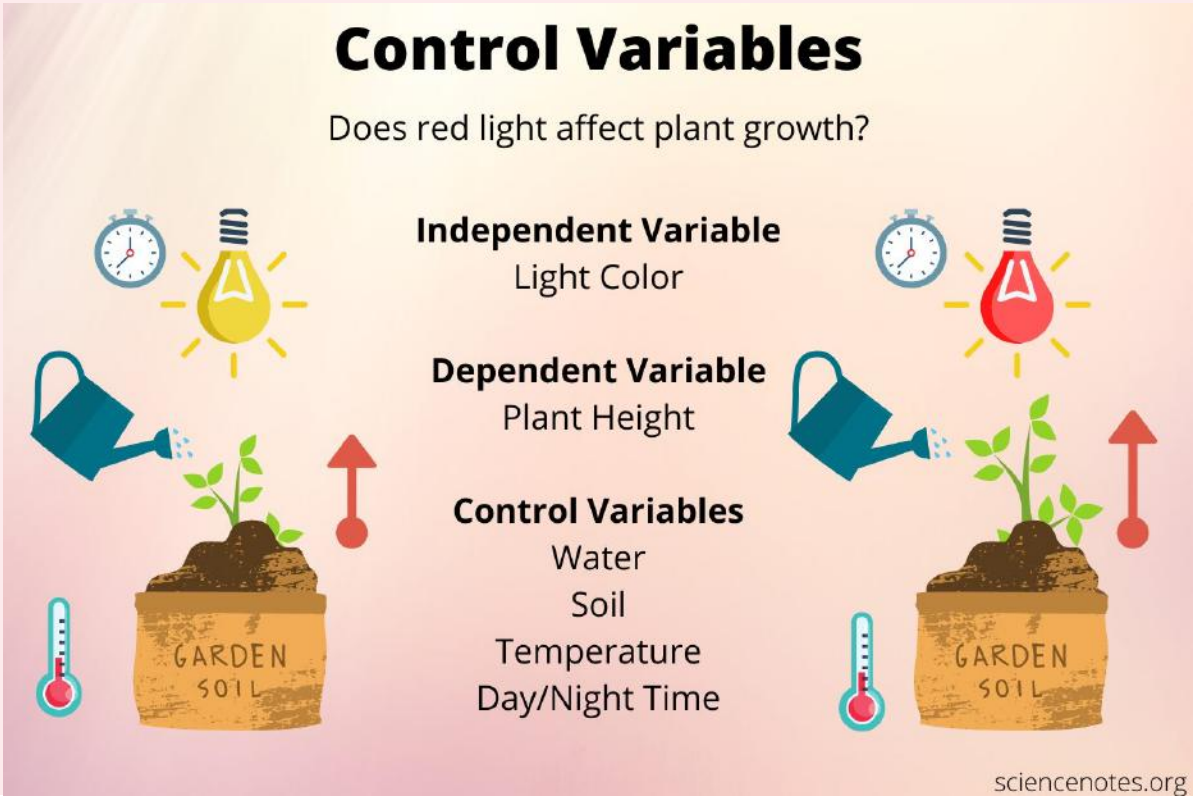
They *do not possess ribosomes* and cannot independently form proteins from molecules of messenger RNA. Because of these limitations, viruses can replicate only within a living host cell.

Review Notes

▼ What is controlled experiment?

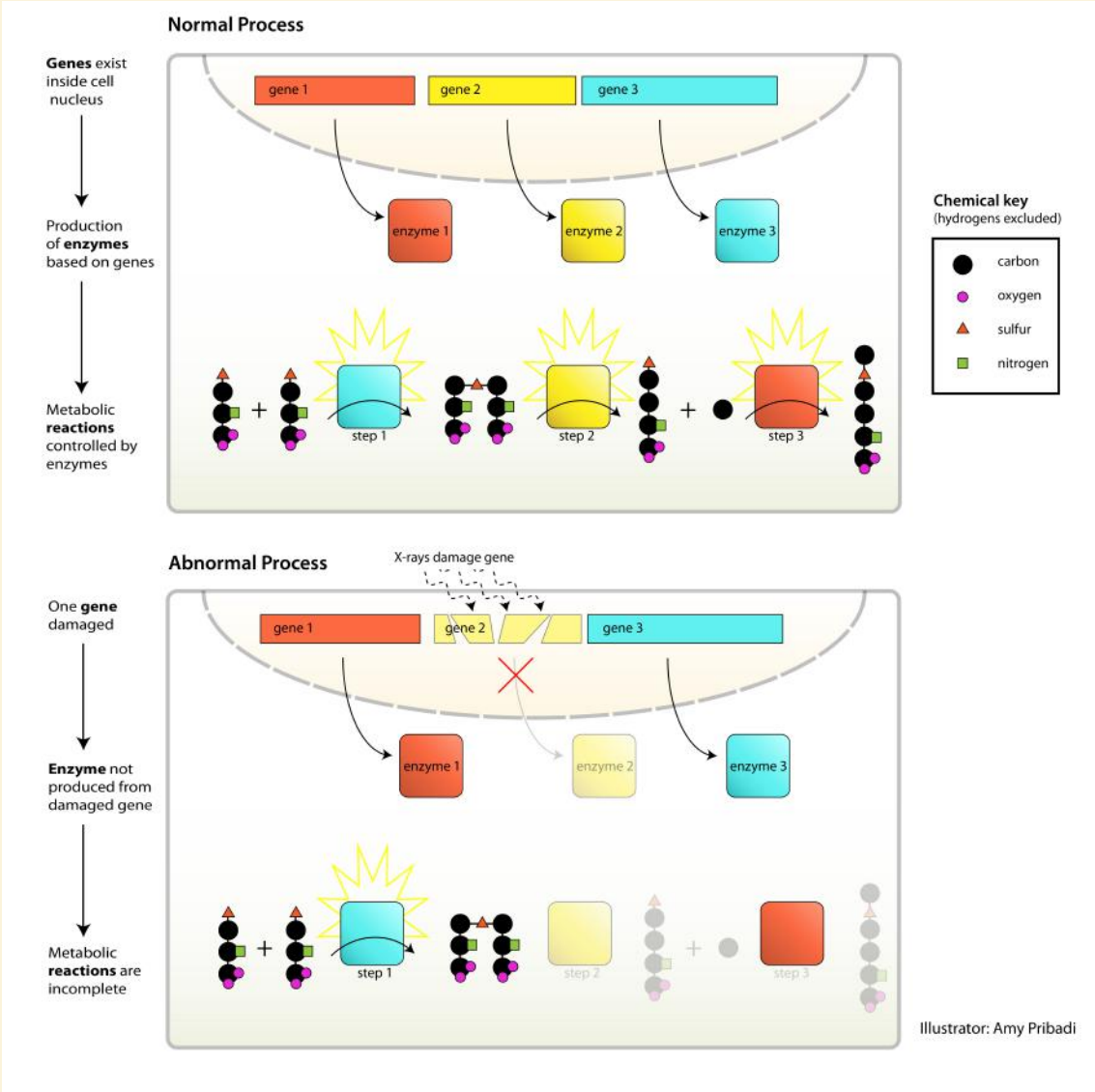
Control group: Gets normal treatment.
Experimental group: Gets the substance or the treatment you are testing.

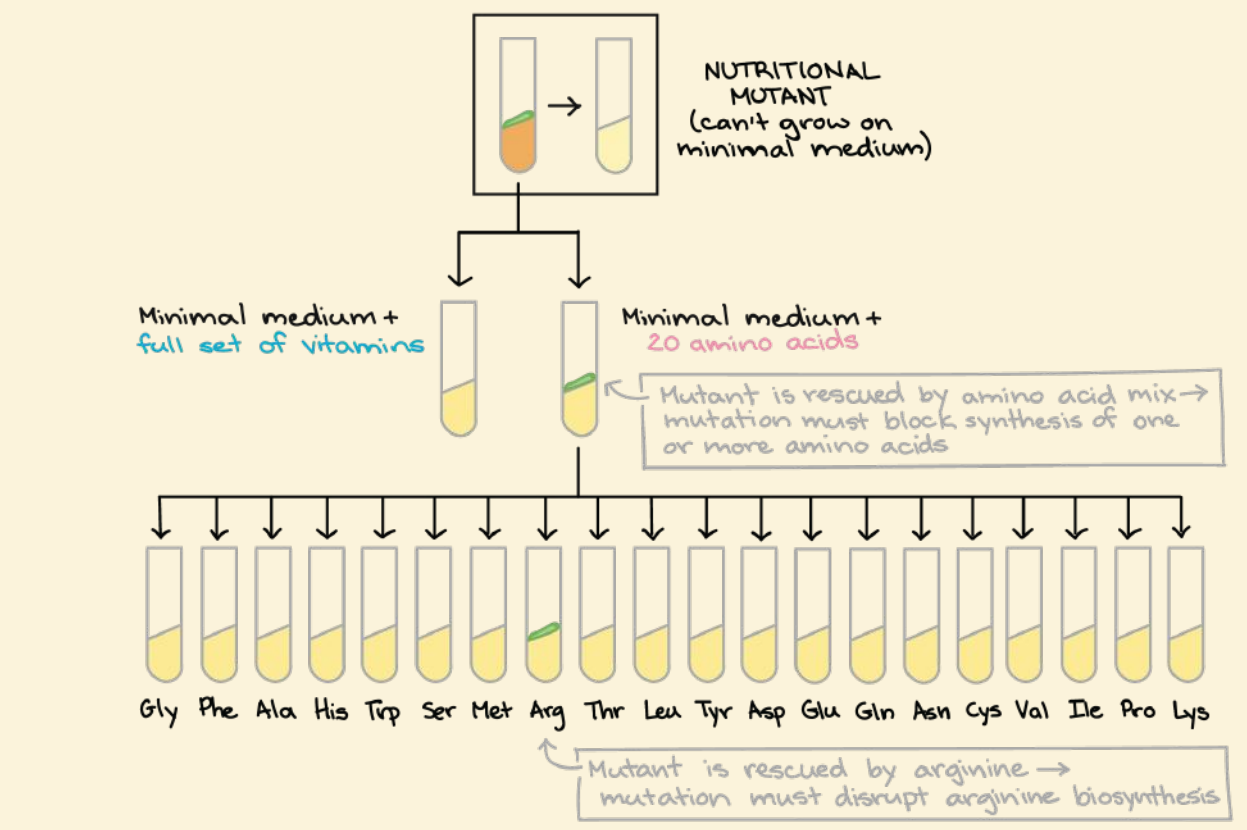
Independent (manipulated) – what the scientist controls or changes. (Ex: Exercise)
Dependent (responding) – the variable that is changes because of the independent variable. (Ex: Heart Rate) what you are measuring
Controlled (constant)variable – variables that are the same in each group. (Ex. Age, Exercise Type, Time of Day, etc.…)



▼ Beadle & Tatum Hypothesis

- **One Gene-One Enzyme Hypothesis**





▼

- So YOU won't be! Have a great semester 😊

▼

▼ Place the answer here!

▼

▼ Answer