

## Tutorial 1

(14<sup>th</sup> March 2023 for D4 and 16<sup>th</sup> March 2023 for D3)

### 1. *Invention versus discovery*

(a) How is an invention different from discovery?

(b) Is the study of Biology invention or discovery? Give reason(s).

### 2. *Biology: scale of study*

Biology can be studied at 10 levels starting from the biosphere going all the way up to molecules (slide #31).

At which levels do the following belong:

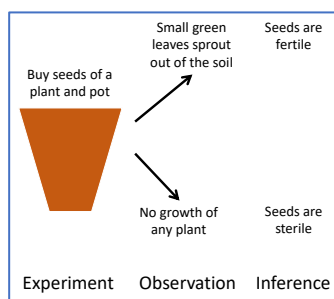
(a) Consequences of consanguineous marriages

(<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7703949/>)

(b) Preconception counselling

(<https://www.ncbi.nlm.nih.gov/books/NBK441880/>)

### 3. *Controls: potting seeds*



Suggest control experiments to validate the inferences drawn in the two scenarios.

### 4. *Reductionistic approach and integrative / holistic approach*

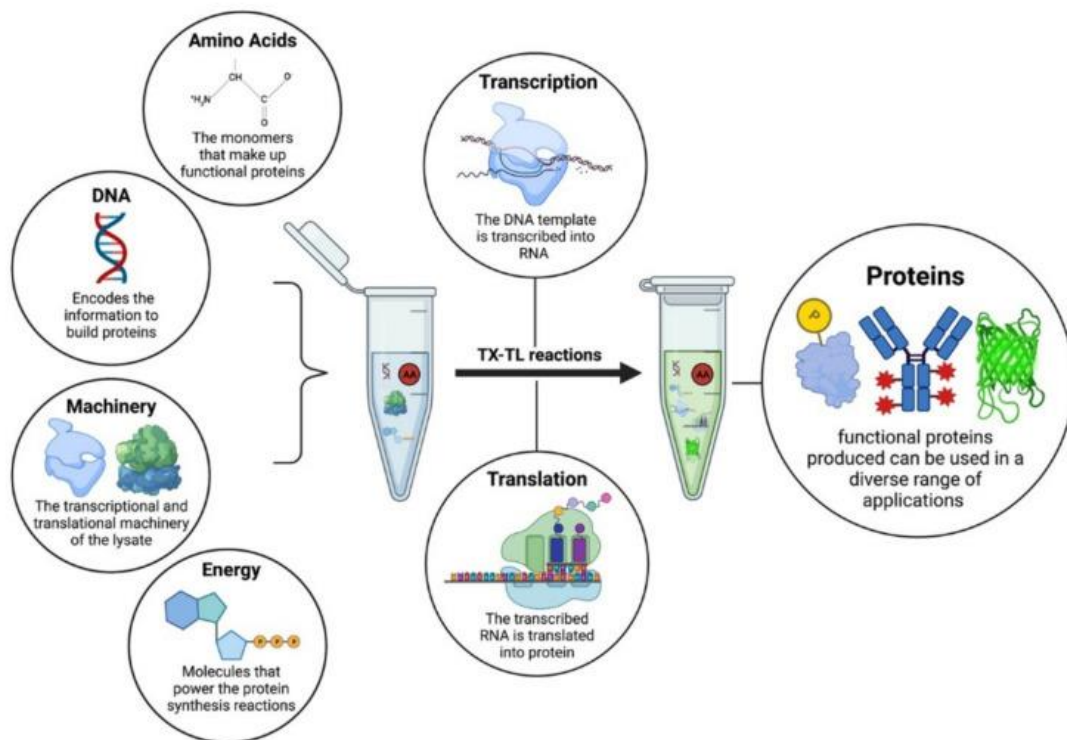
Suppose we disassemble a mobile phone to study the various components that make up the phone. Then we put all the components in a bag and shake it well. Will the components collectively work as a mobile phone? (Concept: Emergent Property).

As far as Biology is concerned, the second half of the 20<sup>th</sup> century was dominated by a reductionistic approach to understand how living systems work. Can one put all the components found in a cell together to study how the cell works as an integrative approach?

5. *Cell-free systems*

[Quote from [Life \(2021\) 11:1367](#)] Cell-free systems can generally be defined as platforms where biochemical reactions occur independently of living cells. Cell-free systems are divided into two types based on the method of preparation: extract-based systems and enzyme-based systems. The extract-based cell-free systems were first introduced over a century ago by Eduard Buchner. Buchner demonstrated that cell extracts prepared from yeast could ferment sugar independent of the living yeast cells themselves, a discovery that earned him the 1907 Nobel Prize in Chemistry. [unquote]

(a) Can the use of a cell-free system be an integrative approach to study how living systems work? Why or why not? Give reason(s).



Legend to the figure: The components of a cell-free protein synthesis reaction. The reaction is assembled in a test tube, i.e., DNA, amino acids, and energy buffers are mixed along with the molecular machinery present in the cellular lysate to initiate transcription and translation for the synthesis of functional proteins. Taken from [Life \(2021\) 11:1367](#).

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