كلية العلوم

القسم : **علم الحياة**

السنة : **الثالثة**

المادة : بيولوجيا حيوانية

المحاضرة : الاولى/نظري/د.ميسون

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The Origin of Life on Earth

We know that all living organisms on earth are made of cells, and that everything on earth is related by some common ancestry.
But where did the first cell form, and how did it happen?

As our understanding of chemistry and biochemistry became more and more sophisticated in the 20th century, we began to learn about the components of the cell, especially DNA, which we call the molecule of life, since it carries the genetic code for an organism.

We began to understand the processes it undergoes, like replication, so that every new cell can have a copy of all the DNA, as well as transcription and translation, which dictate exactly how DNA serves as a code for all the components that make a species unique.
We began to wonder, how could these molecules have assembled by themselves billions of years ago?

Stanley Miller and Harold Urey experiment

A crucial experiment was performed by Stanley Miller and Harold Urey in the 1950's to shed some light on this mystery.
They set up a system that was meant to mimic conditions early in earth's history, just after it cooled down enough for liquid water to exist.
In this apparatus, they placed water, ammonia, methane, and hydrogen, all of which was exposed to heat as well as an electric current, meant to simulate lightning.

After about a week, they found that the reaction mixture contained a number of different amino acids, which are the building blocks of proteins.
Since proteins include enzymes, which catalyze the formation of nucleic acids like RNA and DNA, this offered good evidence that it is indeed possible that the basic materials needed for life could have been generated.
Furthermore, this experiment was only a week long, so half a billion years of molecules sloshing around in the primordial soup could conceivably produce much more impressive results.

These findings prompted further speculation as to the specifics of how the first primitive cell could have formed.
If small building blocks like amino acids and nucleotides came about, how did they then polymerize to form larger molecules like proteins and nucleic acids?
How did the plasma membrane of the cell come about, to encapsulate certain molecules and define the dimensions of the cell?

Hypotheses Of The Origin of Life on Earth

1- Some believe that biomolecules first arose near hydrothermal vents at the bottom of the ocean, where heat emanated from the hot core of the earth, catalyzing chemical reactions and producing a variety of organic compounds.
2- Others say things are more likely to have begun in mineral-rich tidal pools where all manner of catalysis could have occurred on various solid surfaces.
3- Some even propose that the first organic compounds were transported to the earth from space, arriving on meteors, This is called the panspermia hypothesis.

Whatever the case may be, we don’t know exactly what happened, but with a firm understanding of biochemistry, it’s not much of a stretch to assume that the

basic organic components delivered from the Miller-Urey experiment were able to polymerize, and were then encapsulated in a lipid bilayer, which we know can form because of hydrophilic interactions between the polar heads and water molecules, and hydrophobic interactions where the nonpolar tails hide away.
And there you have the first proto-cell.
This first cell must have been incredibly primitive compared to even the simplest ones today, and subsequent cells grew in complexity over time.

This was due to the ability of nucleic acids to self-replicate, as well as mutate, which is what led to the evolution of all the diverse kinds of life on earth over the eons.

Wishing you the best of luck
Dr. Maissoun Ziadeh

Animal Biology
3rd Year
Biology Major

Lecture 1

The Origin of Life on Earth

شرح مفردات المحاضرة الأولى

Ancestry	نسب - أسلاف	Evidence	دليل
Sophisticated	تعقيد	Generated	تولد
Components	مكونات	Spontaneously	تلقائيًا
Molecule Of Life	جزيء الحياة	Sloshing	المتدفقة
The Genetic Code	الشفرة الجينية	Primordial Soup	(الحساء البدائي)
Organism	الكائن الحي	Conceivably	من المعقول
Undergoes	تمر بها	Prompted	حث
Replication	التضاعف	Speculation	تكهنات
Transcription	النسخ	Specifics	تفاصيل
Translation	الترجمة	Primitive Cell	الخلية البدائية
Dictate	تحدد	Polymerize	تبلمر
Serves	يعمل	Encapsulate	يغلف
Species	أنواع	Hydrothermal Vents	الفتحات الحرارية المائية
Unique	فريدة	Emanated	تحفز
To Wonder	نتساءل	Tidal Pools	برك المد والجزر
Assembled	تتجمع	Occurred	تحدث
A Crucial Experiment	تجربة حاسمة	Propose	يقترح
Was Performed	تم إجراء	Meteors	الشهب
To Shed Some Light	لإلقاء بعض الضوء	Hypothesis	فرضية
Mystery	اللغز	Firm Understanding	الفهم الراسخ
Set Up	أنشأ	Biochemistry	الكيمياء الحيوية
To Mimic	يحاكي - يقلّد	To Assume	افتراض
Apparatus	جهاز	Hydrophilic Interactions	التفاعلات المحبة للماء
Exposed	تعرض	The Polar Heads	الرؤوس القطبية
Electric Current	تيار كهربائي	The Nonpolar Tails	الذيول غير القطبية
To Simulate	محاكاة	Proto-cell.	خلية أولية
Lightning	البرق	Subsequent Cells	الخلايا اللاحقة
Reaction Mixture	خليط التفاعل	Ability	قدرة
Amino Acids	الأحماض الأمينية	Self-replicate	التكاثر الذاتي
The Building Blocks	لبنات بناء	Mutate	التحور
Catalyze	تحفز	Evolution	تطور
Formation	تكوين	The Eons	العصور