Origin of Life (OoL) Chemistry Implies Design was Necessary

or

How to interpret OoL chemical experiments correctly

Dr. Royal Truman

Endless theories, ever unlikelier scenarios

- In Origin of Life (OoL) publications we find many, many theories and hypothetical reconstructions
  - Many theories arise when answers are not known

- OoL explanations are becoming more exotic
  - The most reasonable possibilities have been exhausted

- Nothing worth discussing has been reported under plausible prebiotic conditions
  - Look for phrases like “Under plausible (or realistic) abiotic conditions” in papers
  - I have never found an example that was plausible when claimed to be

- Goals are identified and experiments expertly designed to guide towards that goal

- This has proven that intelligence can produce results chance won’t.

What needs to be explained? Cells and their biochemistry

Cells indispensable for all biology, from bacteria to multicellular life

1) Highly adaptable to changing conditions

2) Manufacture thousands of distinct parts to produce an immediately living offspring

OoL chemists try to find natural ways to:

- Produce amino acids
- Have them link to form huge proteins
- Produce the necessary sequences for catalytic and structural purposes
- Produce sugars called ribose and deoxyribose
- Produce nucleobases: adenine, guanine, thymine, uracil, cytosine
- Have sugars, nucleobases and phosphates attach chemically to form nucleotides
- Have nucleotides link to produce RNA and DNA
- Produce carbohydrates
- Produce lipids
- Combine lipids and carbohydrate groups to form cell membranes.

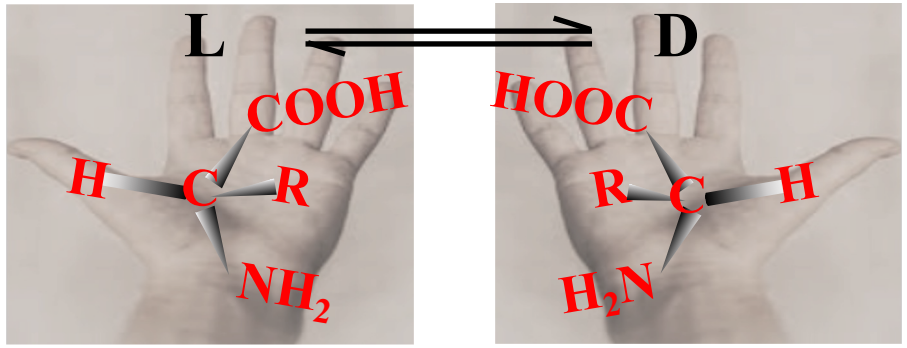
Some chemical realities

- Correct combinations of chemicals are not available in nature; in pure; highly concentrated form
- Unguided reactions form a mess of wrong products
- Getting the desired outcome requires deep expertise. The conditions are not prebiotically plausible
- Optimized laboratory conditions to solve one task are incompatible with other requirements

Five key issues to forming proteins

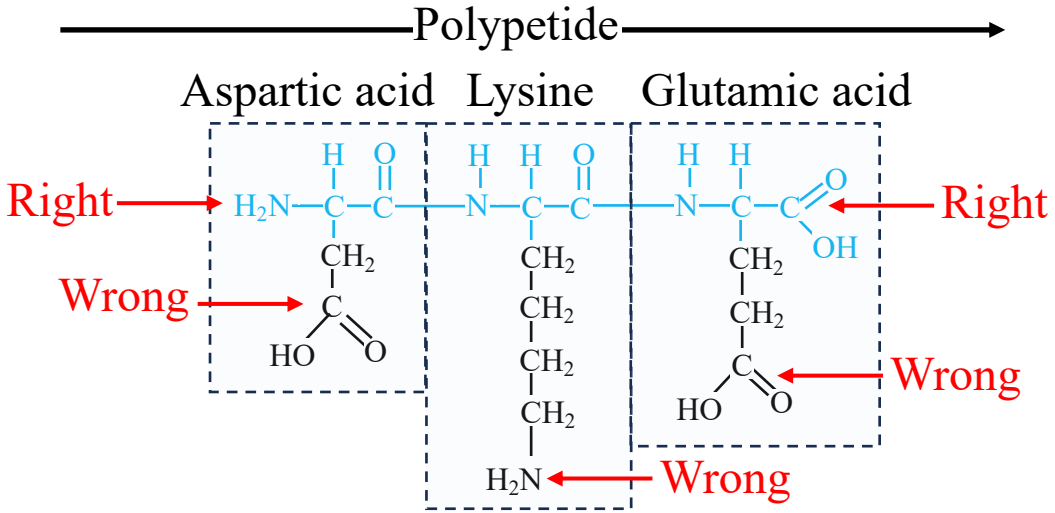
1: Only the L-enantiomers must react together

- They naturally form in 50:50 L- and D-enantiomers
- An excess of L or D equilibrates to the other form later (especially after forming peptide chains)



2: Only the ends of the amino acids must react

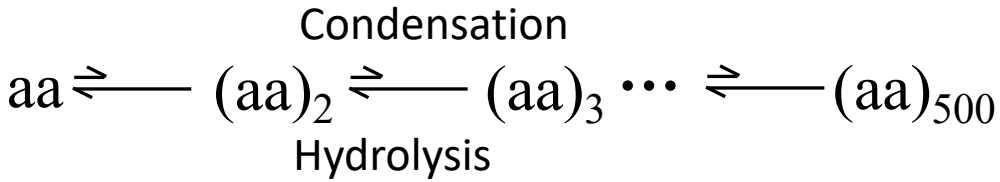
- About half contain one or more side-groups which also react



Five key issues to form proteins

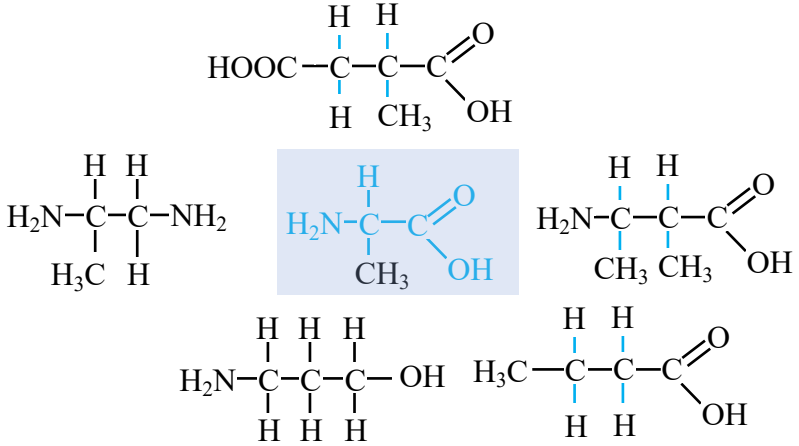
3: Hundreds of amino acids (aa) must be linked

Amino acids thermodynamically favored over peptides



4: Amino acids surrounded by wrong reactants

Carboxylic acids; amines; non biological aa's; …



5: Precise sequences needed to perform biological functions

- To fold correctly
- Each protein requires different sequence
- Many copies of each are needed
- Proportion of non-functional : functional astronomically high

Optimizing for one goal damages another

Very long, L-enantiomer proteins are needed having correct sequences and no side-chain reactions

To form long peptides:

I. High temperatures (often under pressure)

Impossibly high concentration of pure amino acid (not plausible)

- D- and L-enantiomers equilibrate much faster ("Racemize")
- Other chemicals can now react
- Amino acids decompose

∴ Use extremely high concentrations; the aa glycine; short time durations

II. Freeze-thaw cycles (evaporate-crystallize)

Impossibly high concentration of pure amino acid (not plausible)

- D- and L-enantiomers equilibrate much faster ("Racemize")
- Other chemicals can now react (highly concentrated)
- Side chains react
- Redissolving later (necessary for biogenesis) leads to hydrolysis long-term

Optimizing for one goal damages another

Lower temperature to slow down $L \rightleftharpoons D$ **(to preserve L excess)?**

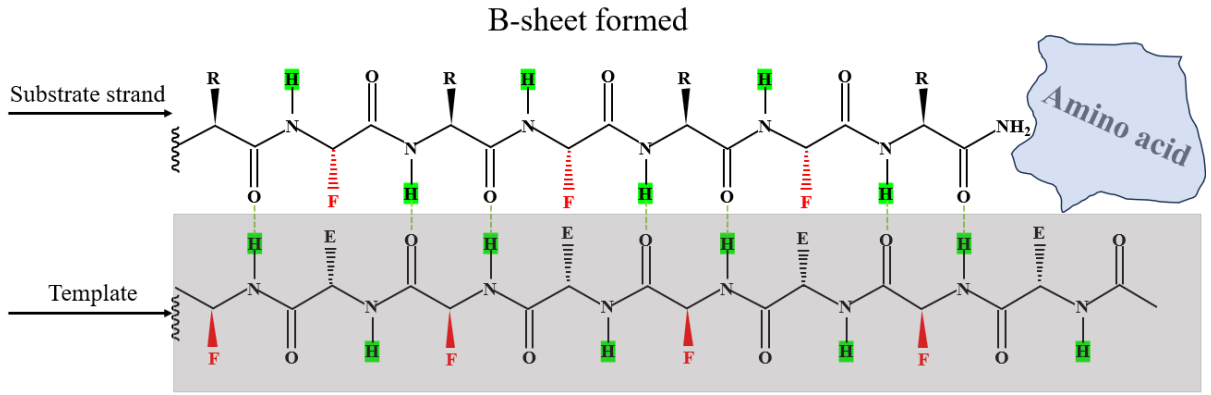
- Now $aa \rightleftharpoons (aa)_2 \rightleftharpoons (aa)_3 \cdots \rightleftharpoons (aa)_{500}$ gets worse (too slow)

Raise temperature to increase polymerization?

- Racemization faster
- Side chain reactions indiscriminant
- Other compounds react
- Hydrolysis to destroy proteins facilitated

Experiment example: L-amino acid should add to a peptide

- Use specific L-only peptide (high conc.)
  - ✓ Led to more D-enantiomer adding instead
- Design another peptide so both together form β-sheets
  - ✓ Both ends and the aa chemically transformed!
  - ✓ Forces specific aa's to add a peptide
  - ✓ Need variety of functionally relevant sequences!



Ideal laboratory conditions necessary taking tradeoffs into account

Experiments focus on only one of the 5 requirements for proteins. Example goal: produce ongest peptides possible

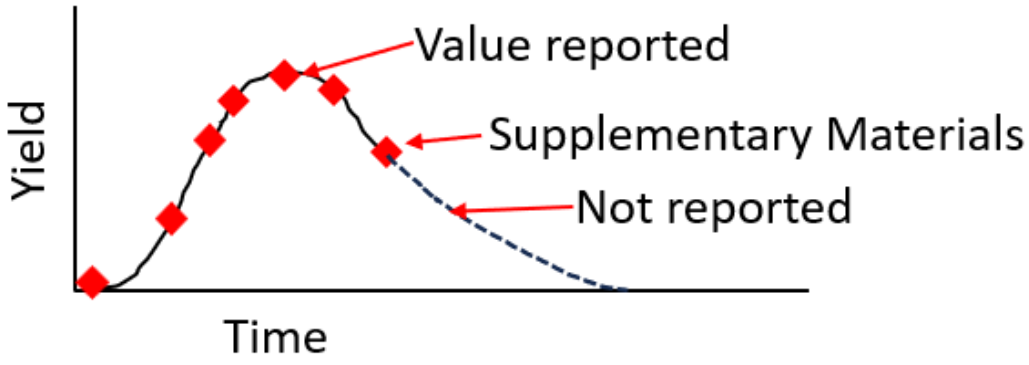
- Use only glycine, the only aa having no side-chain nor L- and D- enantiomers

Summary of OoL experiments: Outcomes insignificant after years of careful design and experimentation!

- Ideal temperature and pH
- Rapid mixing
- Chemically modified peptide end groups and amino acids
- Chemically protected side group so it can't react
- Ideal proportion of pure reactants, and cofactors (Cu, Zn…)
- Laboratory solvents not produced naturally
- Laboratory purification and separation techniques

Tip where to look for implausibility (time!):
When were measurements made and experiments *terminated*?

- Sometimes secs, since molecules decomposed or racemized



Origin of life research is proving the need for design

- Chemicals not mixed under putative prebiotic condition to see what happens naturally
- Reaction conditions must be expertly designed to obtain a desired outcome
- Mutually incompatible constraints require a brilliant all-or-nothing solution
- Experiments are eliminating one possible explanation after the other
  - After optimizing every parameter: largest peptide obtained is far too small and in miniscule amount
- What brilliant intelligence can't accomplish in biogenesis chance won't produce.

Intelligence can produce artifacts chance can’t

Intelligent beings can do incredible things

- Chemists could design a secret code based on amino acid sequences and send eachother messages back and forth
  - Equipment could be designed to create the polypeptide having any desired message
  - Recipients would need to know the alphabet letter meaning of each aa

Could this arise by chance? What about the genetic code?!

Intelligence can produce artifacts chance can't

- Could a million years of tornadoes turn a huge junkyard into something like a Boeing 747?

- Would it be more or less likely to find a fully fueled plane after 1 thousand or 1 million years?

- Could a team of chemists and engineers build an airplane from the components of a huge junkyard?
  - Yes. After chemically converting the components into the raw materials needed (e.g., fuel)

- Chemists could build almost anything from earth, water, air and fire using the right processing steps

- Could a chemist build a living seed, able to reproduce endlessly using only non-biological substances?
  - Hundreds of kinds of proteins; many kinds of RNAs; DNA; membrane… are needed
  - Having all the components in the right proportion would not create a living seed!
  - The biochemical processes and interactions must be put into an operating state
    - ✓ Regulated processes with feedback

Only a super intelligence could have produced biological organisms on earth!
This is what the Bible teaches us happened.