Il Mondo ad RNA

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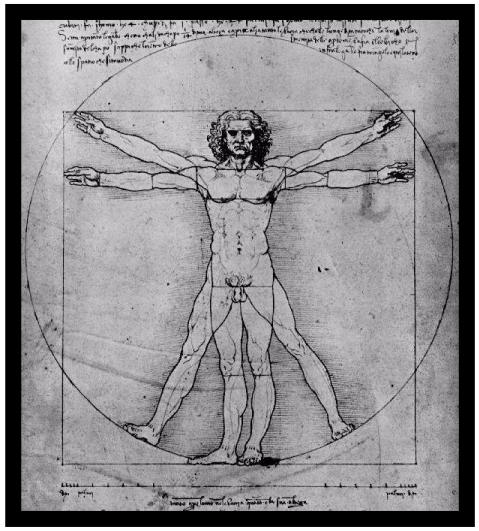
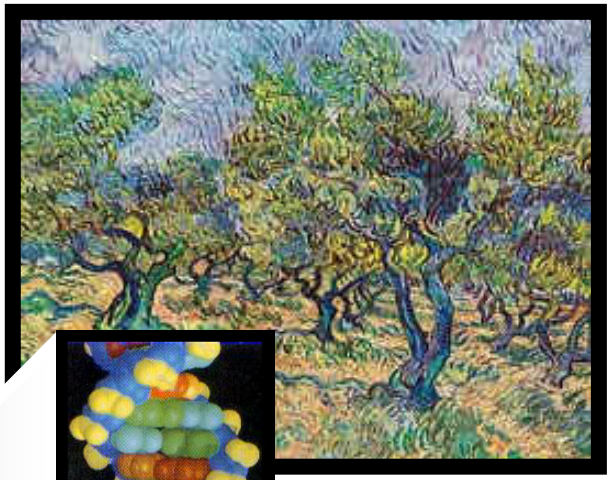
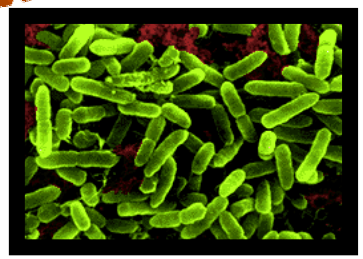


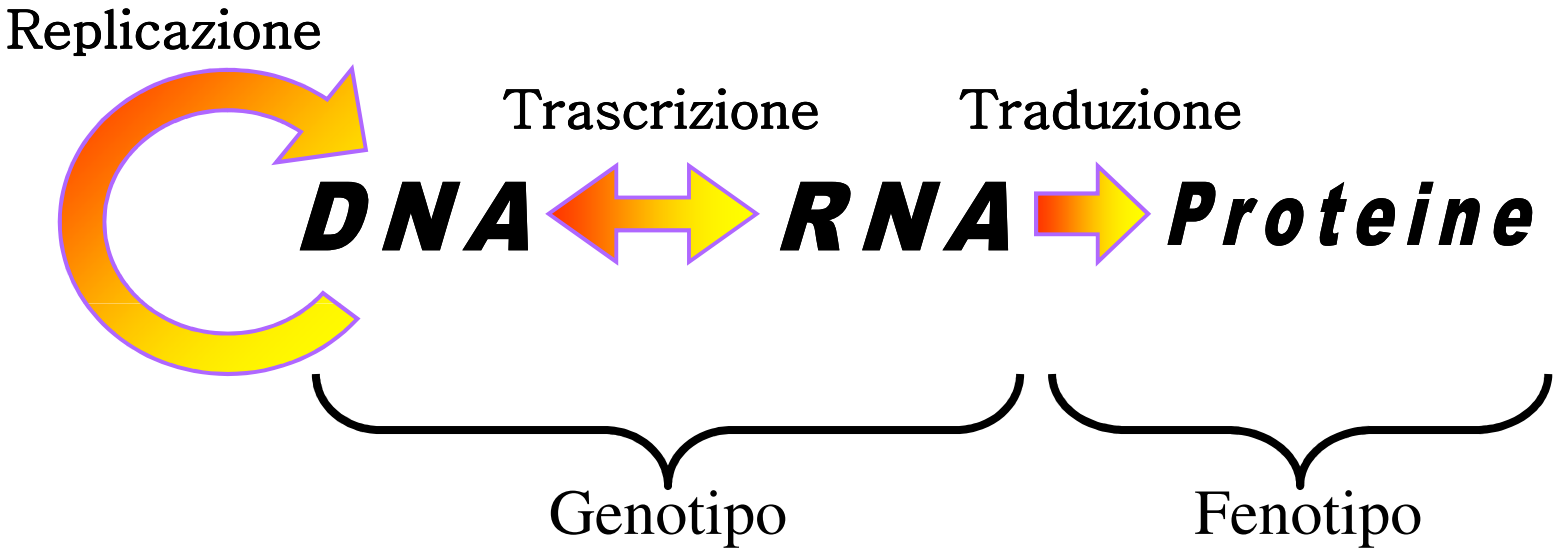


DNA

“Che cosa è la Vita ?”



Il Principio Centrale della Biologia

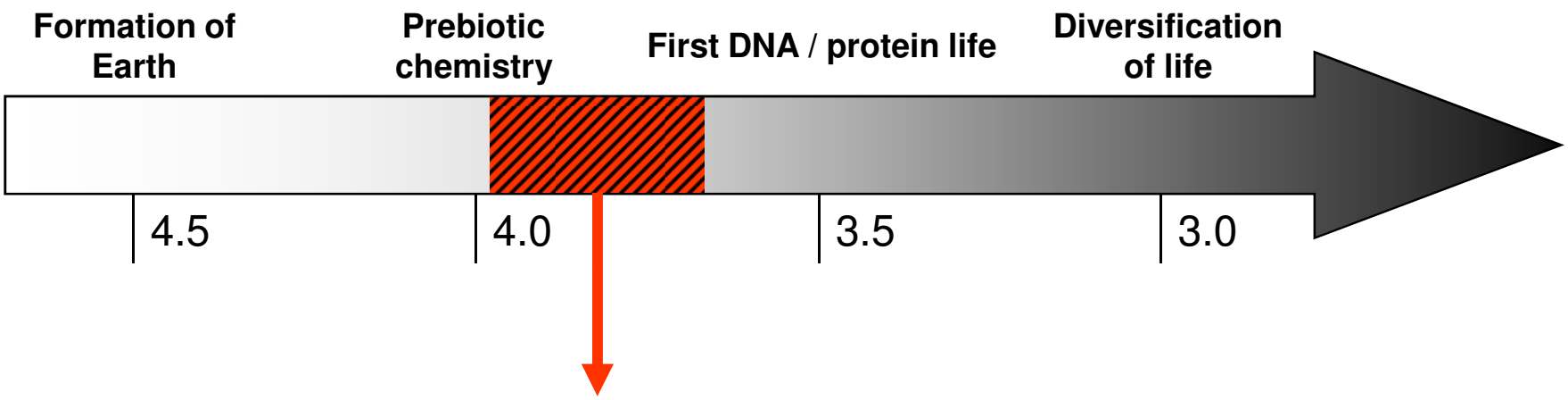


Definizione di vita secondo la NASA

“Life is a system able to self-maintain + self-replicate, and capable of undergoing Darwinian evolution”

La presenza di un sistema genetico è “fondamentale”

Evoluzione Molecolare



La “comparsa” di un polimero *nucleic acid-like* capace di evolvere da un punto di vista Darwiniano segna

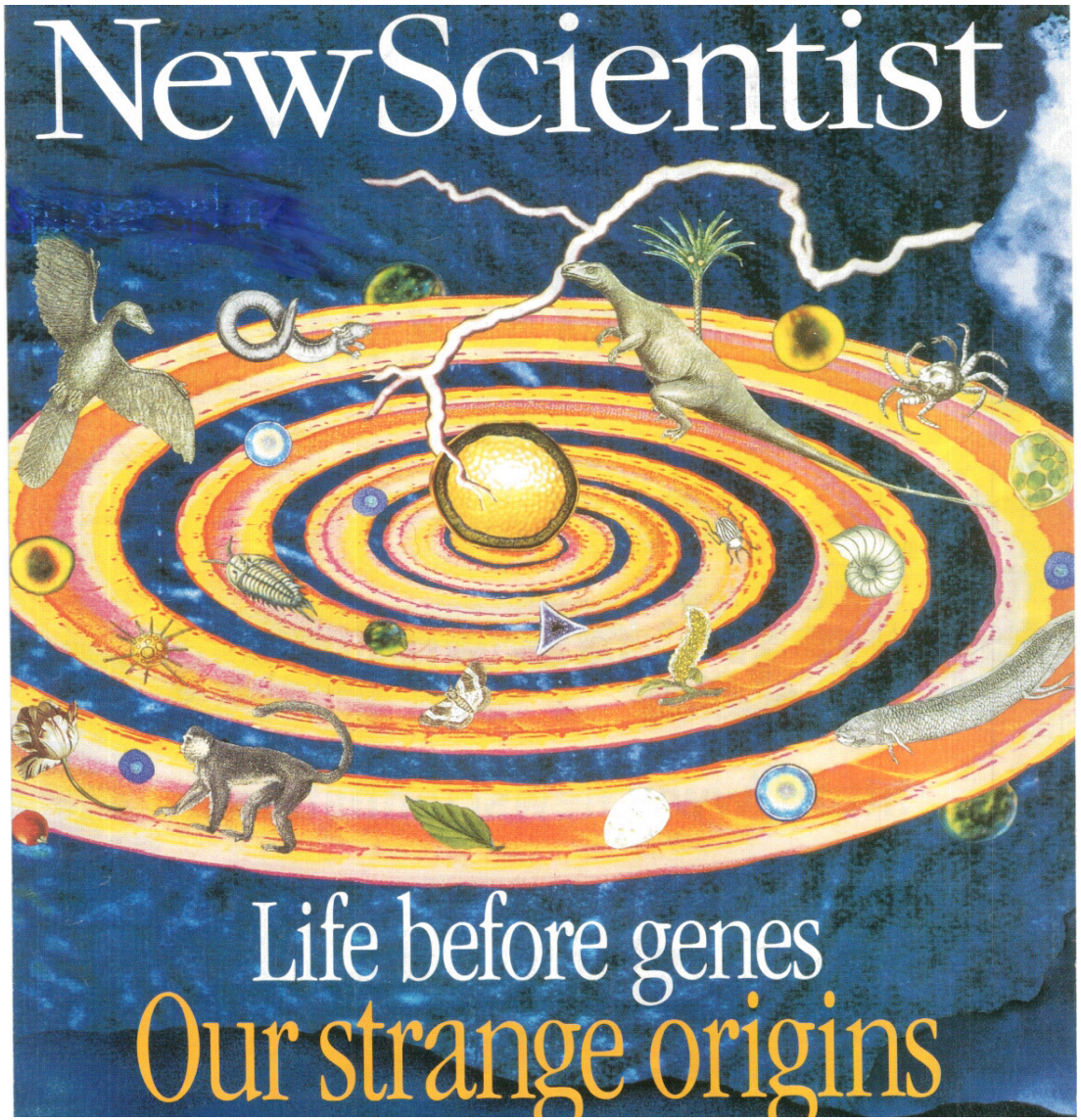
l’inizio della vita

F.Crick, L. Orgel, C. Woese (1968) → **RNA ancestrale**

T. Cech & R. Altman (’80)

Ribozimi: Molecole di RNA con attività catalitica

W. Gilbert (1986): *"RNA World"*



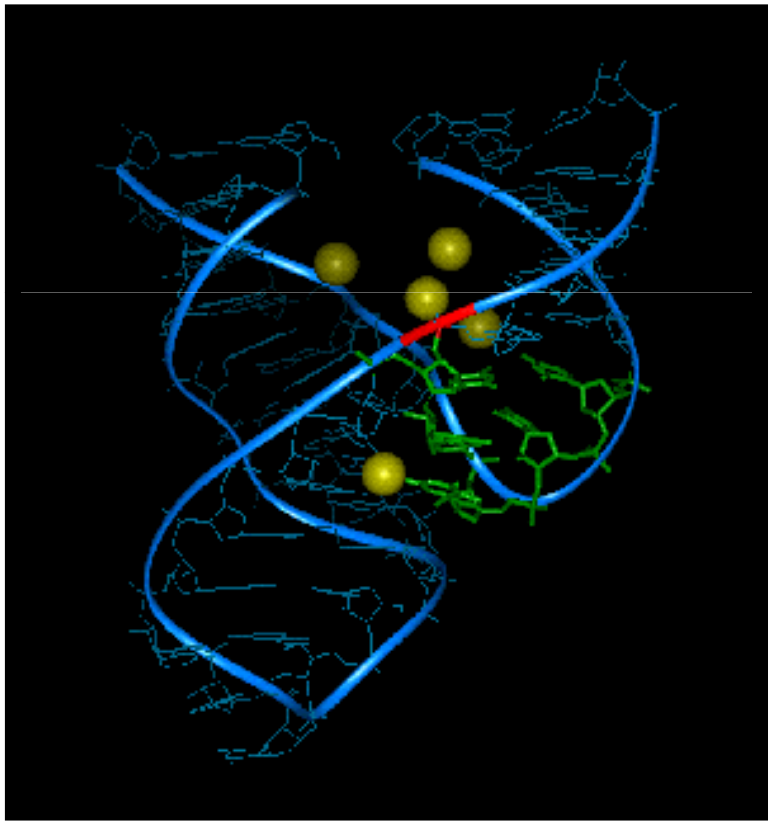
“Ribozimi” presenti in natura

Introni del Gruppo I e II

RNasi P

“Hairpin”

“Hammmerhead”

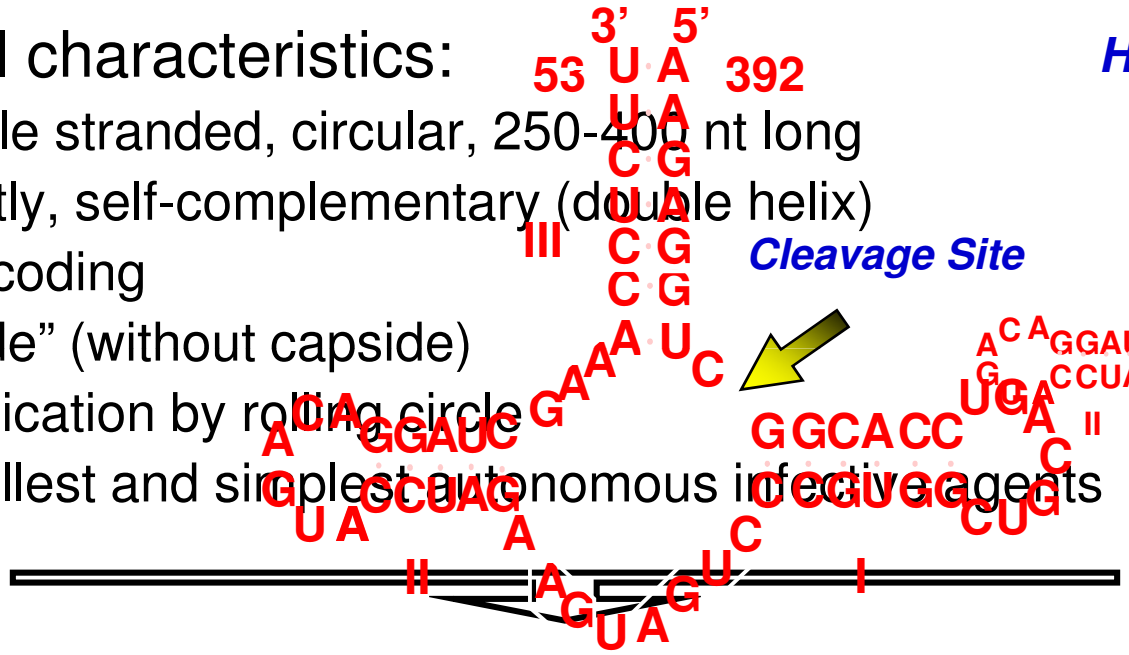


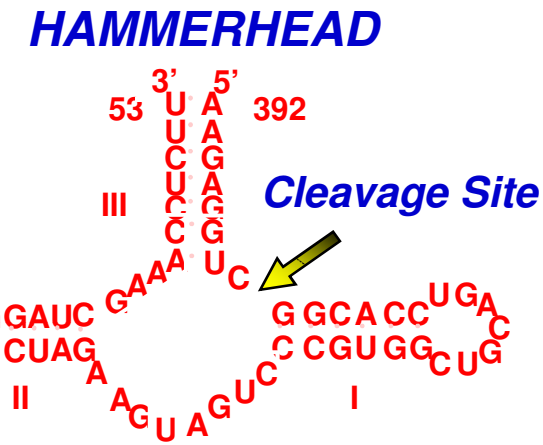
Viroidi

HAMMERHEAD

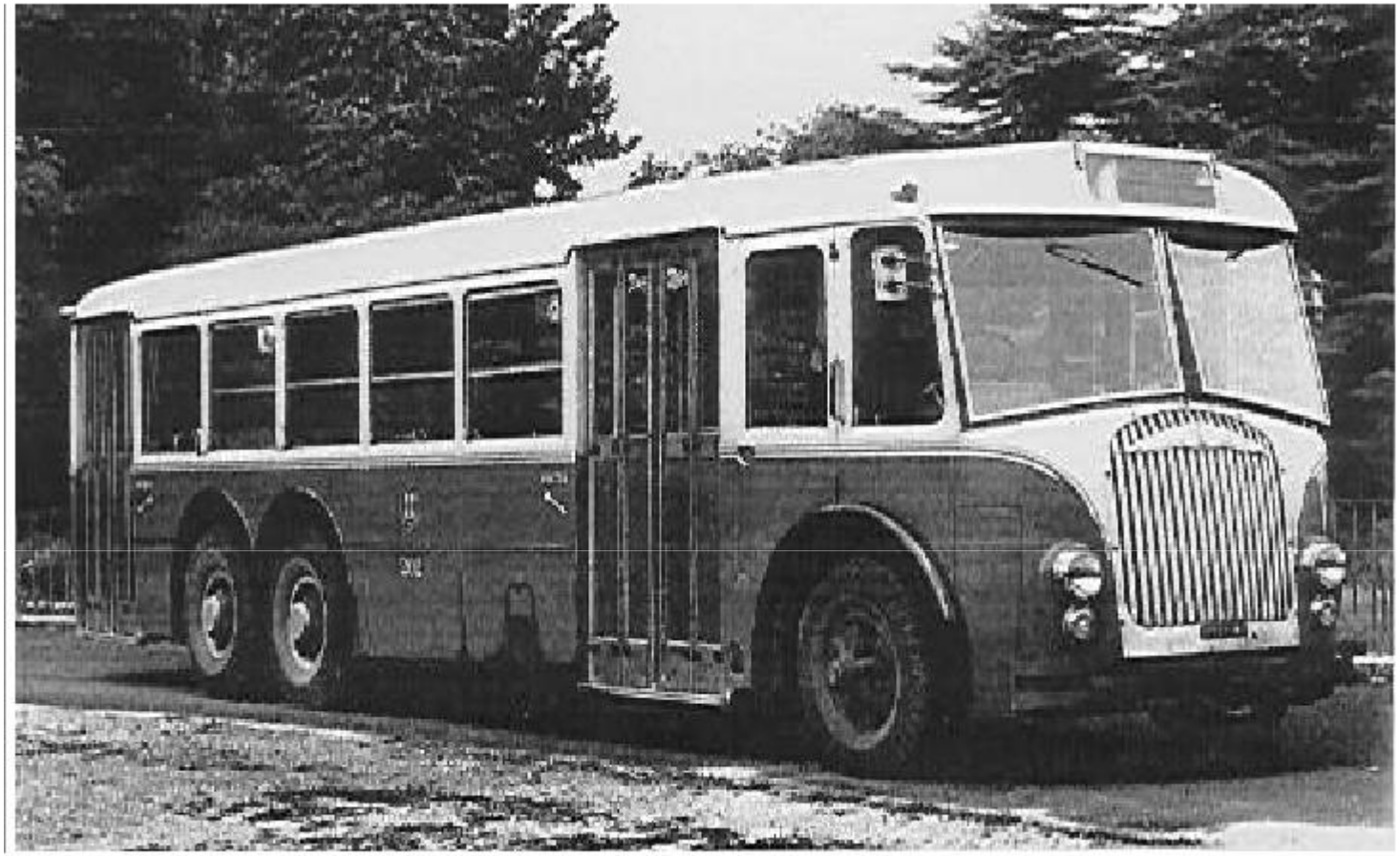
Structural characteristics:

- Single stranded, circular, 250-400 nt long
- Mostly, self-complementary (double helix)
- Not coding
- "Nude" (without capside)
- Replication by rolling circle
- Smallest and simplest autonomous infective agents



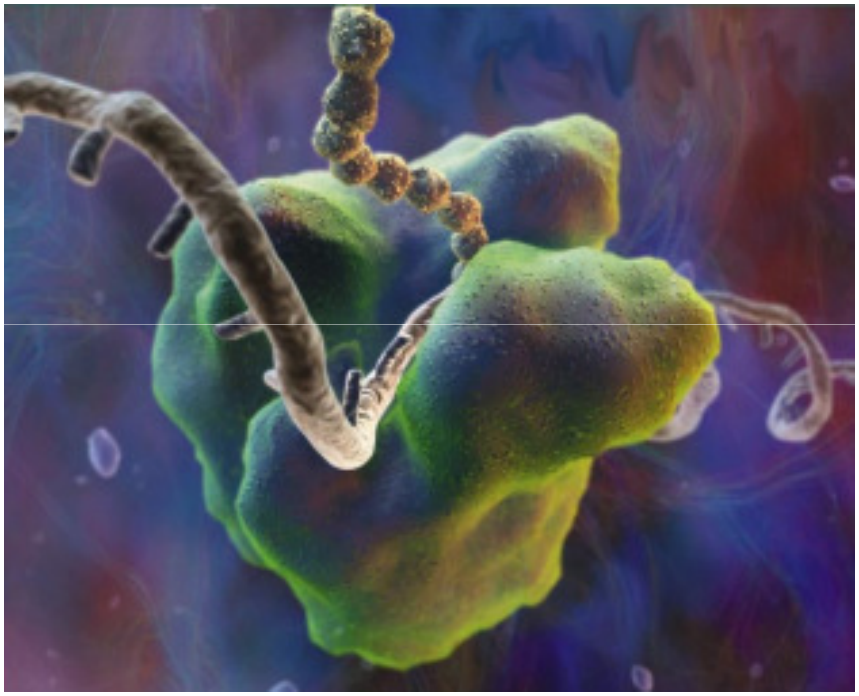


I Viroidi sono considerati dei "resti" del Mondo ad RNA



Autobus FIAT RNA del 1939

Il ruolo dell'RNA nei processi biologici

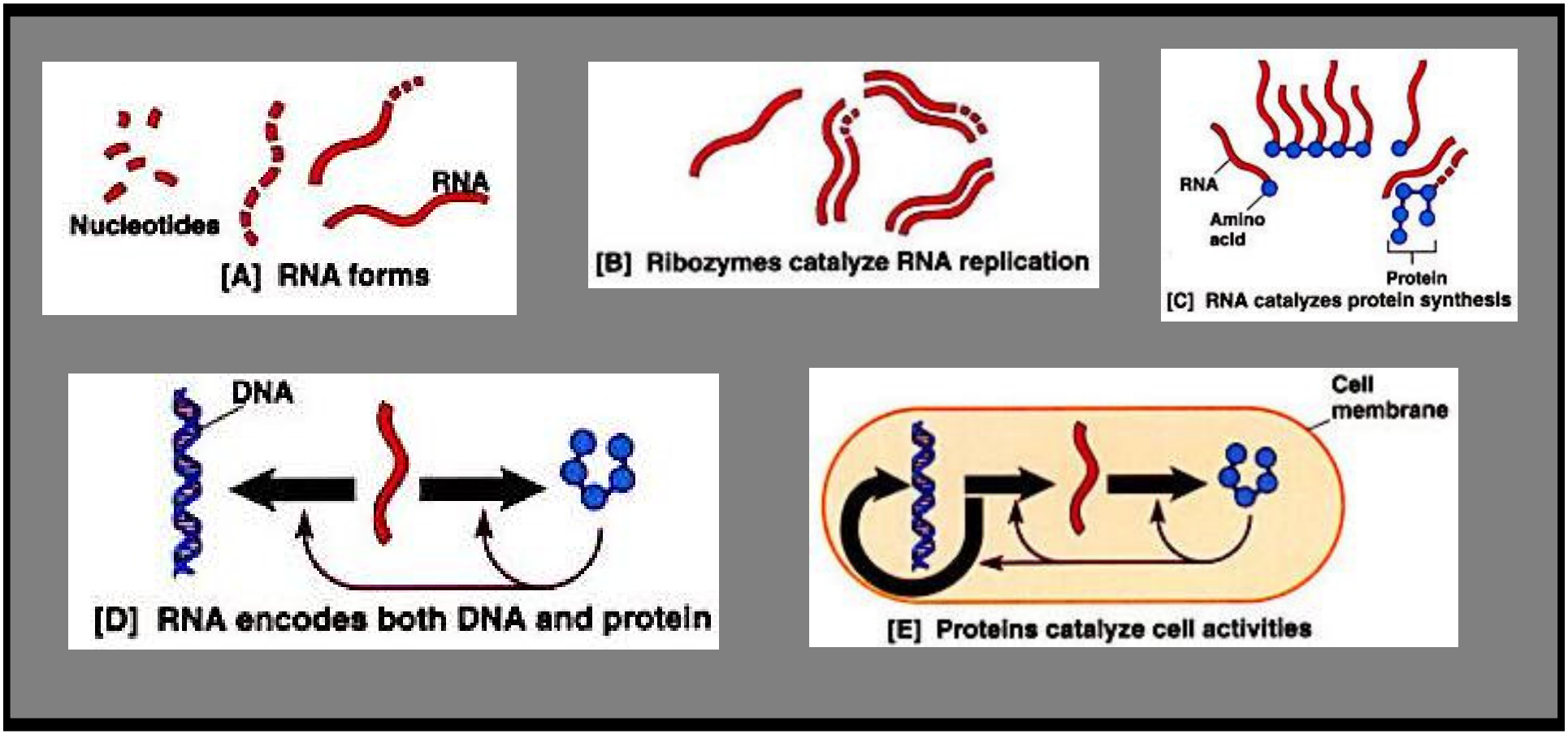


"The Colossal Enzyme"

T.A. Steitz

- Materiale ereditario di molti virus.
- Coinvolgimento in moltissimi processi cellulari (replicazione del DNA, "splicing" ed "editing" dell'RNA, "gene silencing", . .).
- Coinvolgimento nel funzionamento del **Ribosoma** (sintesi proteica).

La transizione dall' RNA World al DNA World

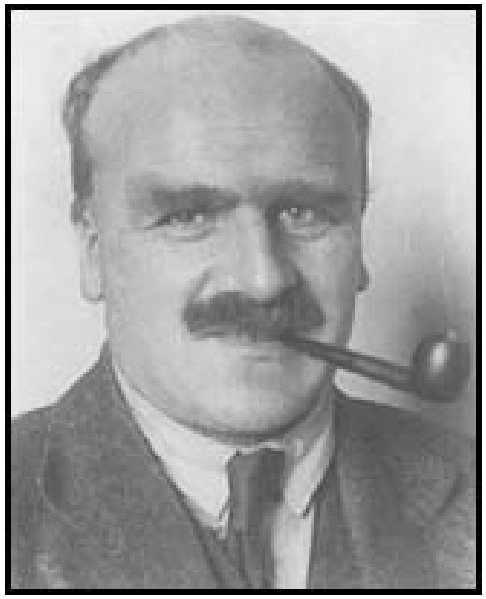


Come si originarono i primi polimeri "RNA-like"?

Verso il Mondo ad RNA

- Sintesi dei precursori (nucleotidi) e loro polimerizzazione;
- Persistenza / protezione dei nascenti polimeri in un ambiente in continuo cambiamento;
- Espressione della “potenzialità biologica” dei polimeri informazionali originatisi.

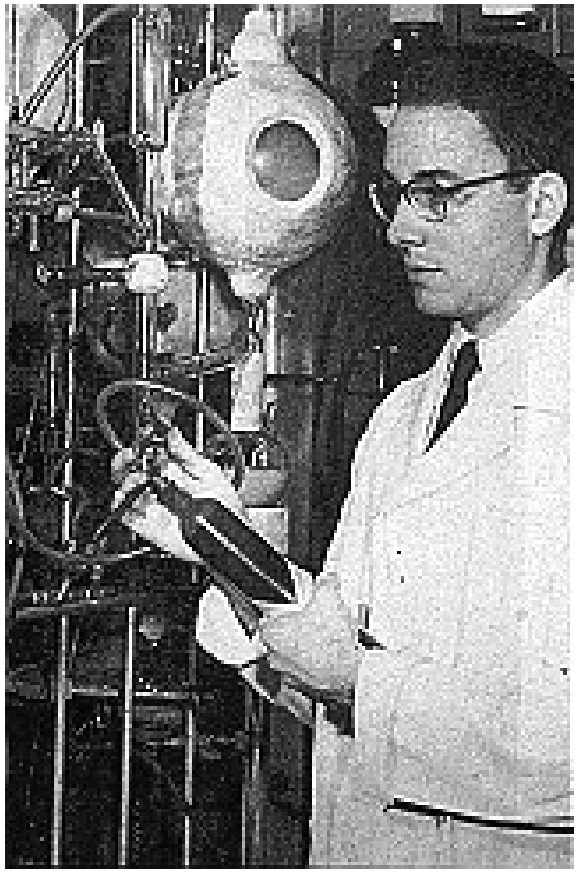
Sintesi dei Precursori: chimica in soluzione acquosa

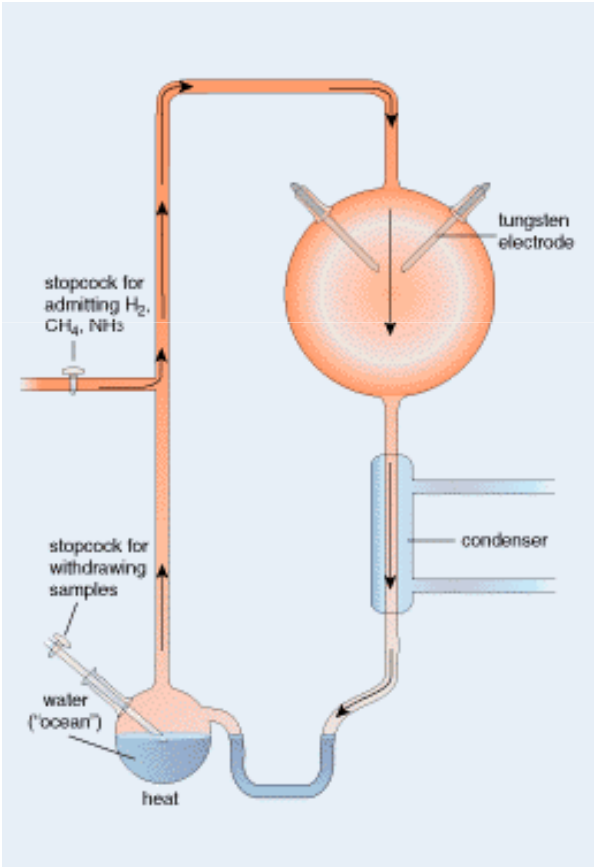


A.I. Oparin (~1924) - J.B.S. Haldane (~1930)

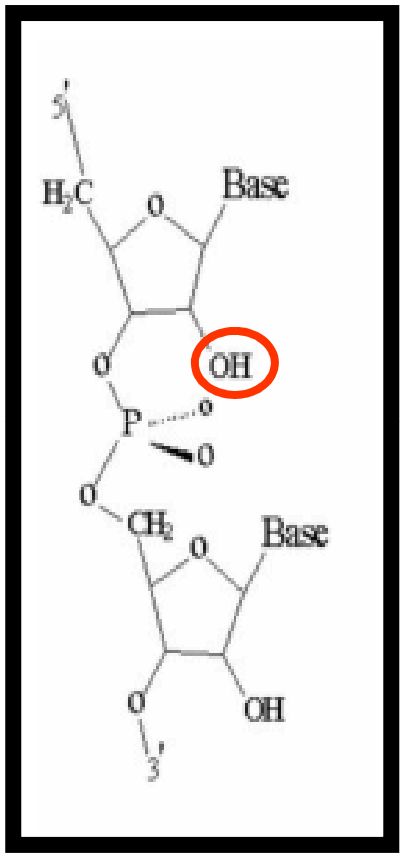
"The Primordial Soup"

Stanley Miller (1953)





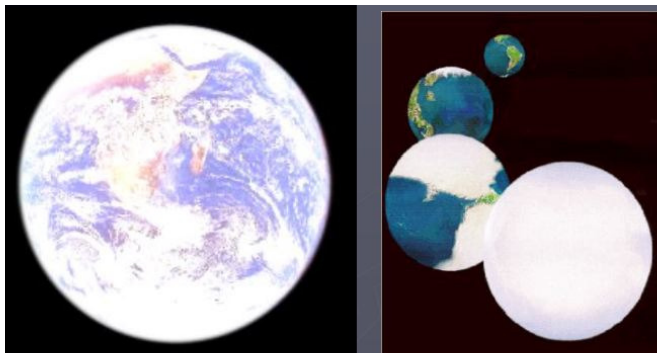
Polimerizzazione dei precursori



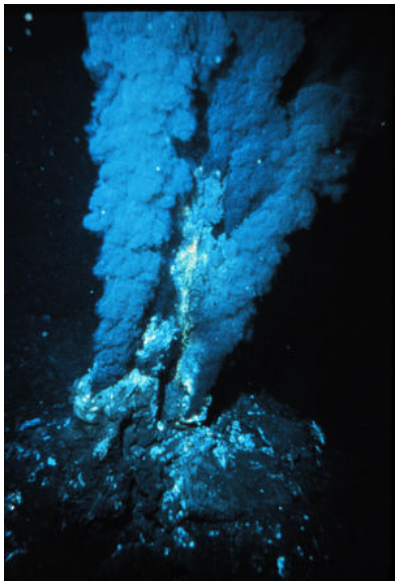
In soluzione acquosa (oceano primordiale) non si ha polimerizzazione bensì idrolisi!

Ricerca di un ambiente “idoneo” dove le molecole genetiche possono essersi originate e abbiano mosso i “primi passi” sul cammino che ha portato alla “vita”

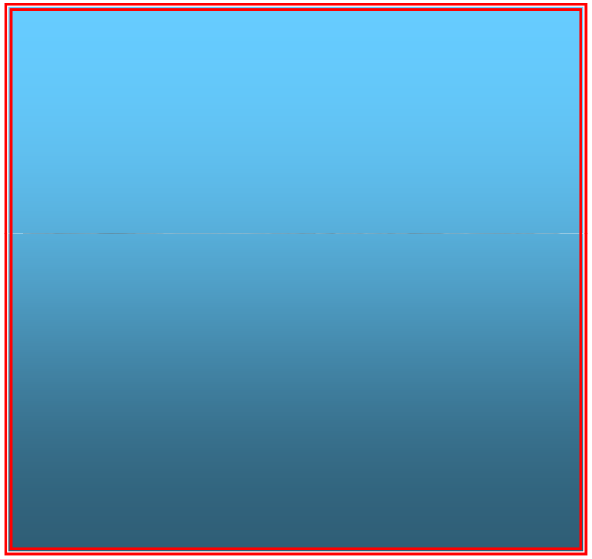
Possible Physical Settings



The "snowball" hypothesis
(L.E. Orgel, A.V. Vlassov)



Hydrothermal vent & pyrite
(G. Wächtershäuser M.J. Russel)



Clay Minerals