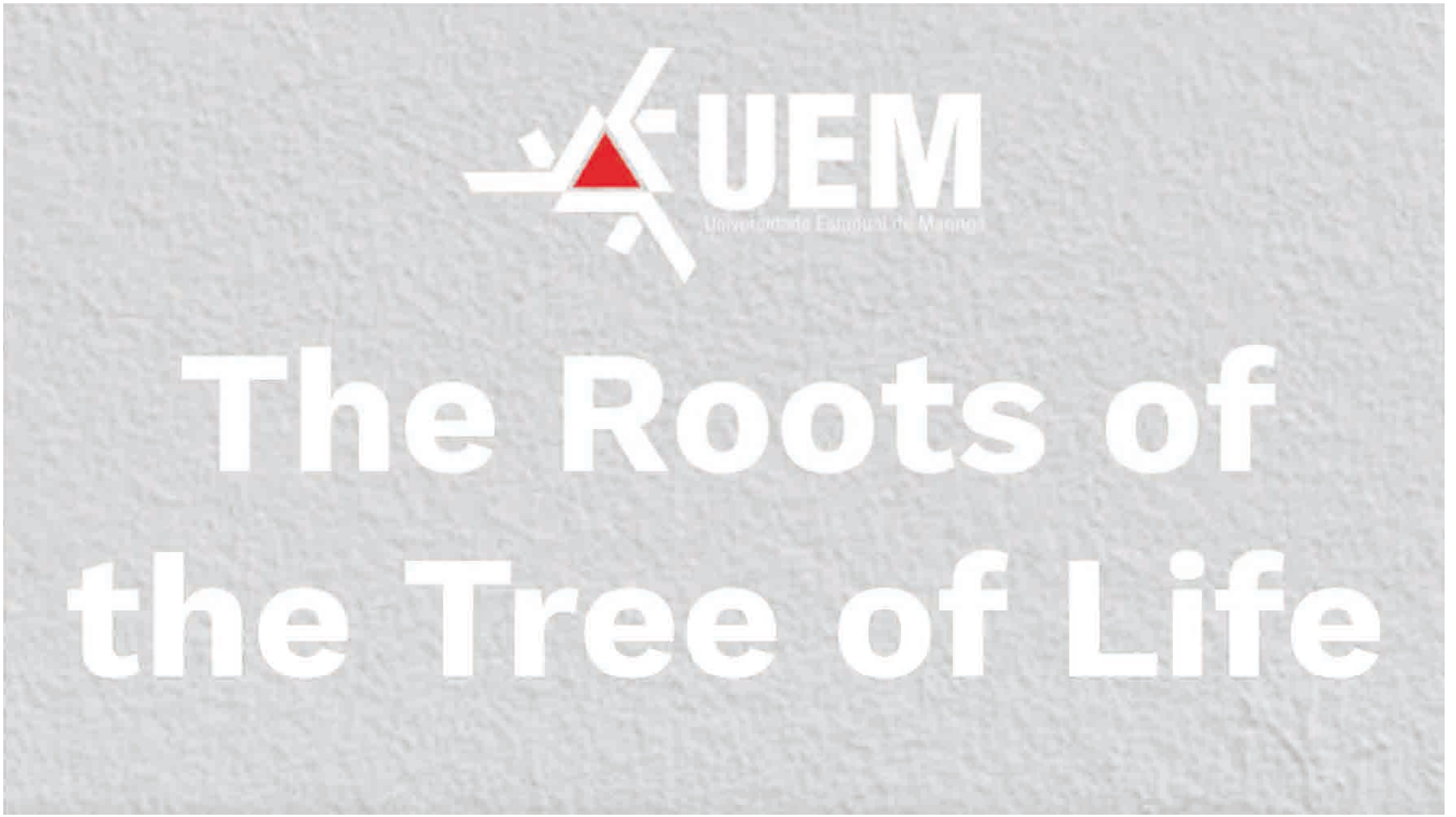
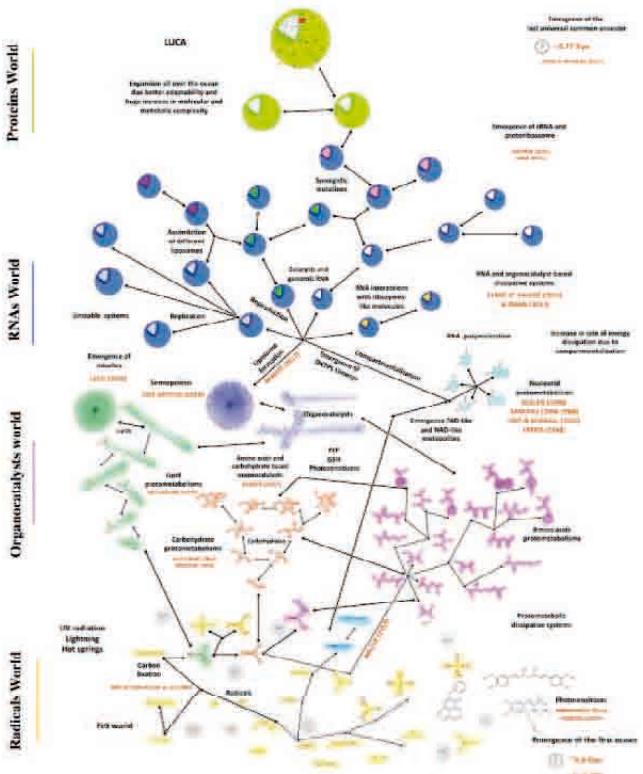
UEM

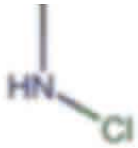
The Roots of the Tree of Life


UEM
Universidade Estadual de Maringá
The Roots of
the Tree of Life

UEM

The Roots of the Tree of Life


Proteins World
RNAs World
Organocatalysts world
Radicals World
LUCA
Lightning
Hot springs



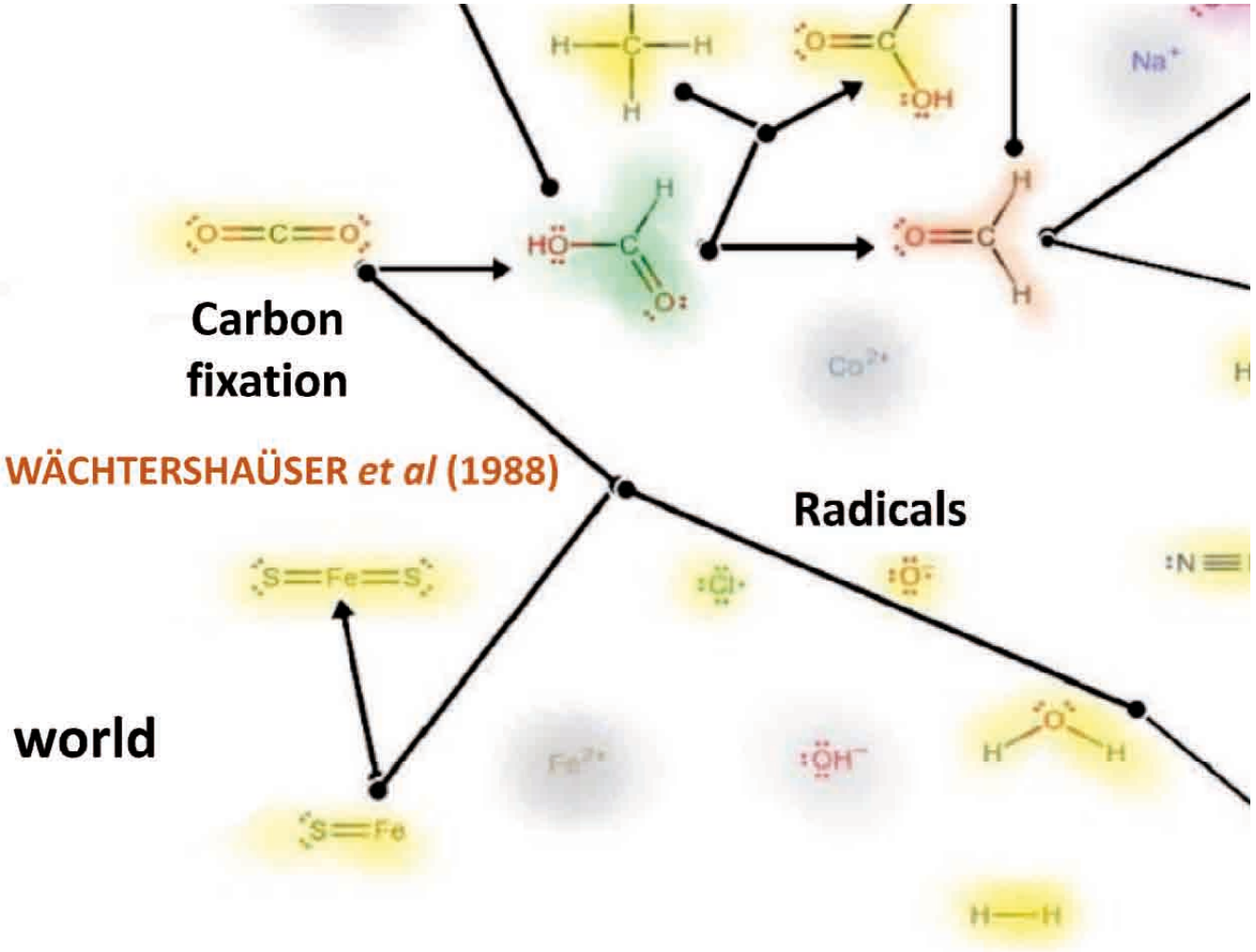
Emergence of the first ocean

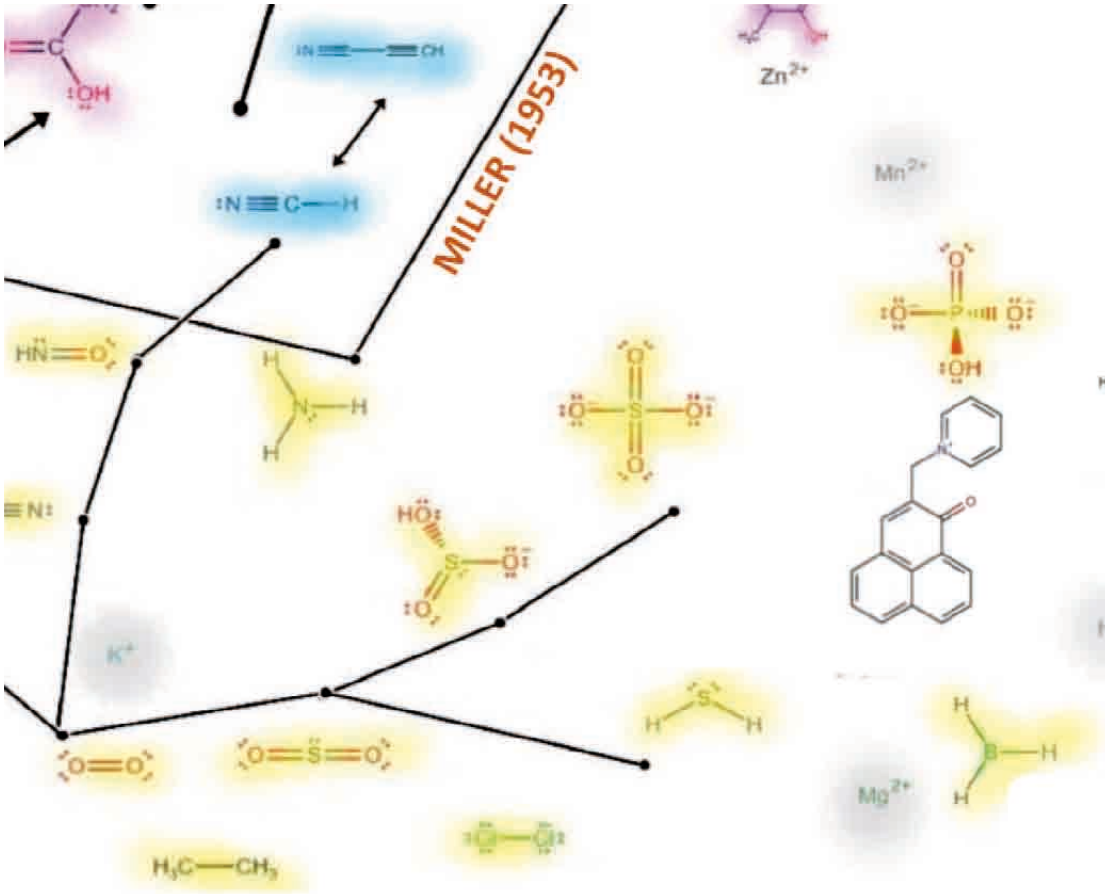
~4,4 Gya

WILDE (2001)

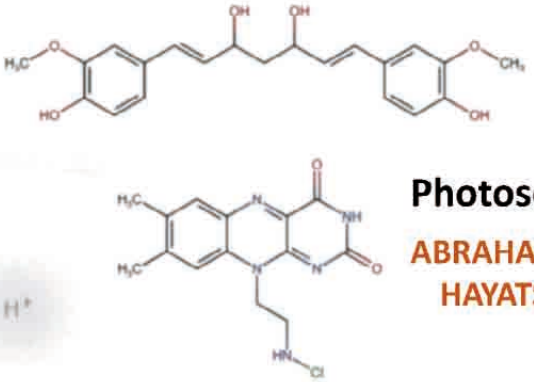
UV radiation
Lightning
Hot springs

UV radiation
Lightning
Hot springs





Protometabolic dissipative systems



Photosensitizers

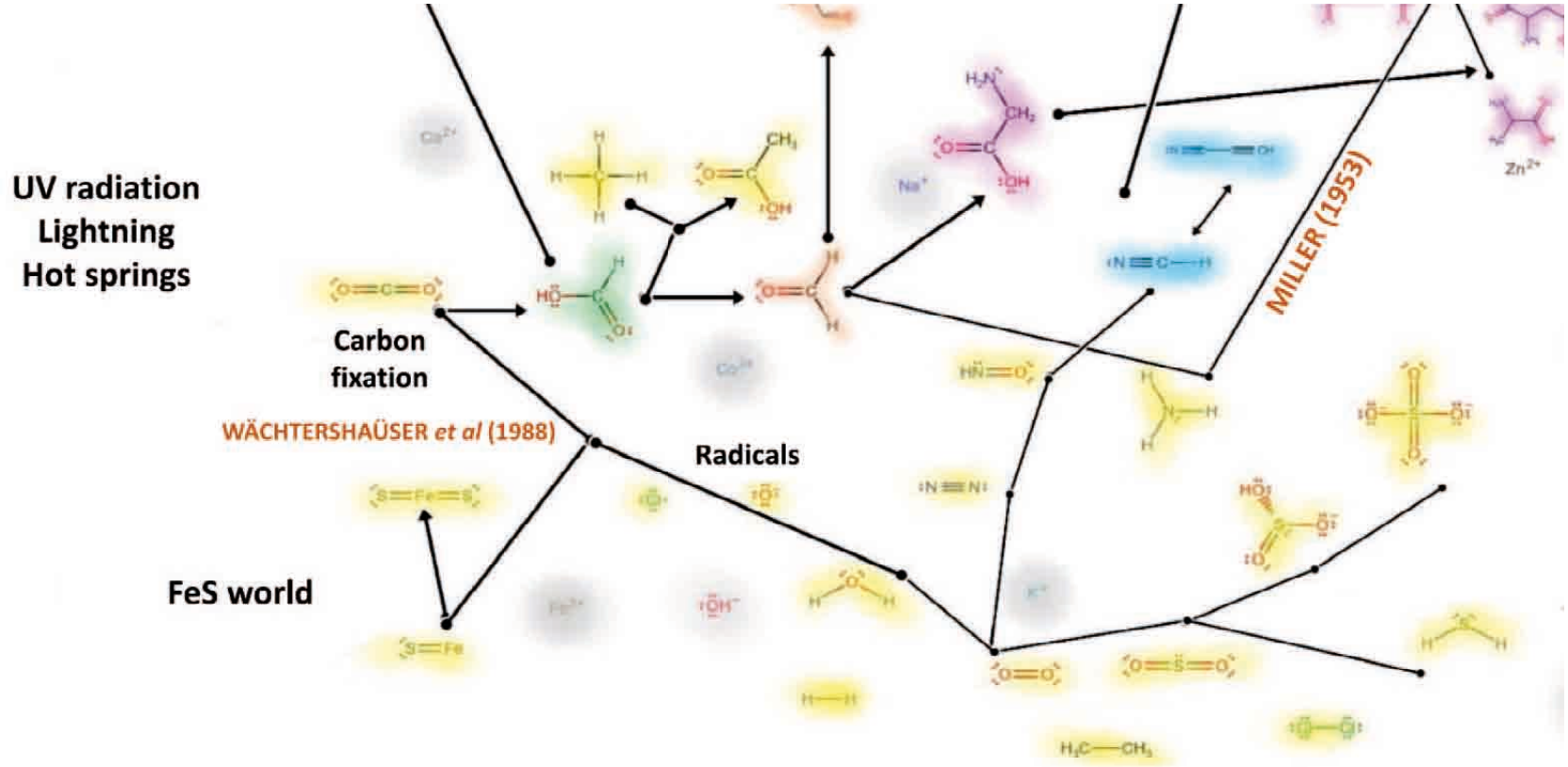
ABRAHAMSE (2016)
HAYATSU (1977)

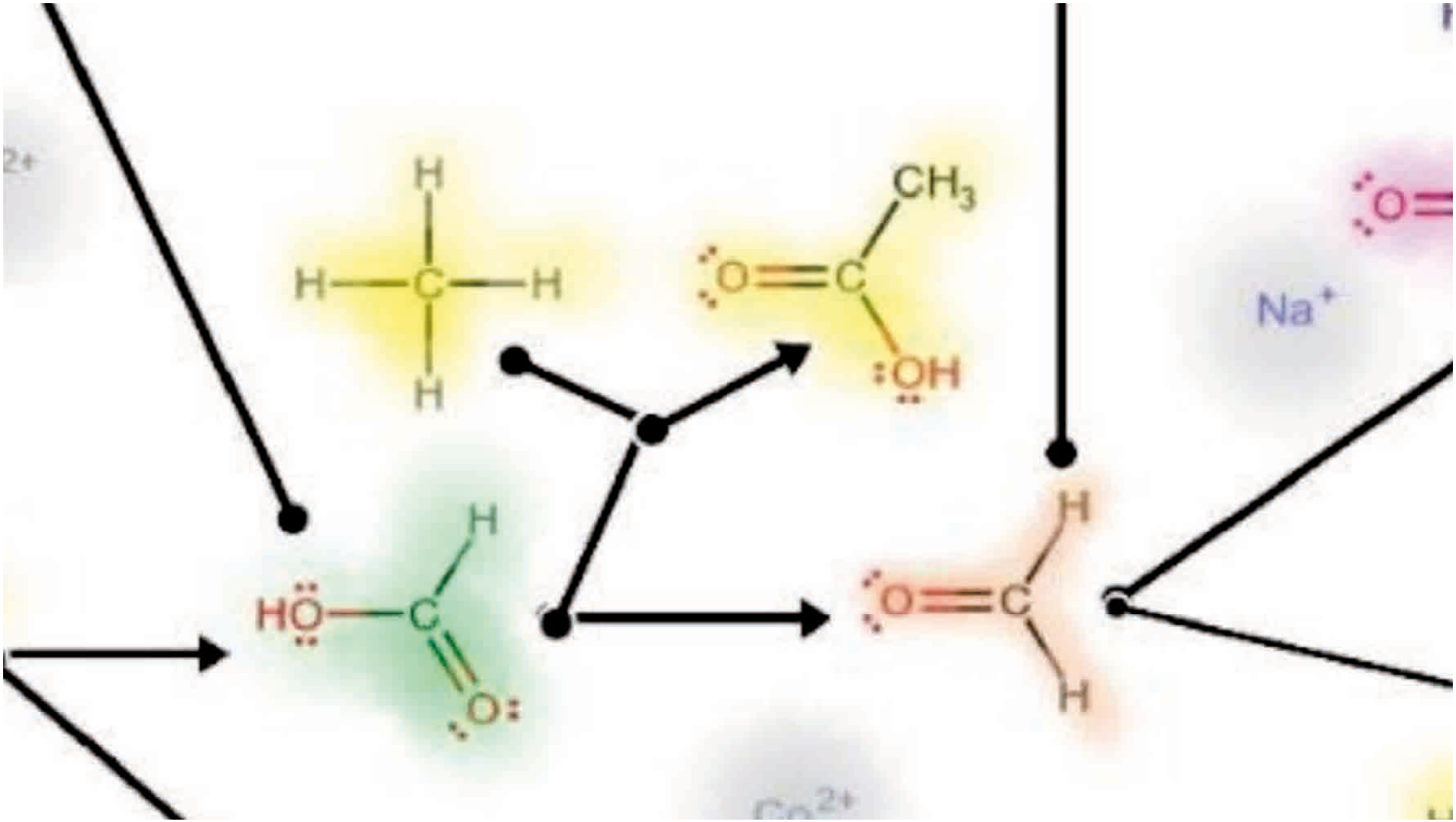
Emergence of the first oce

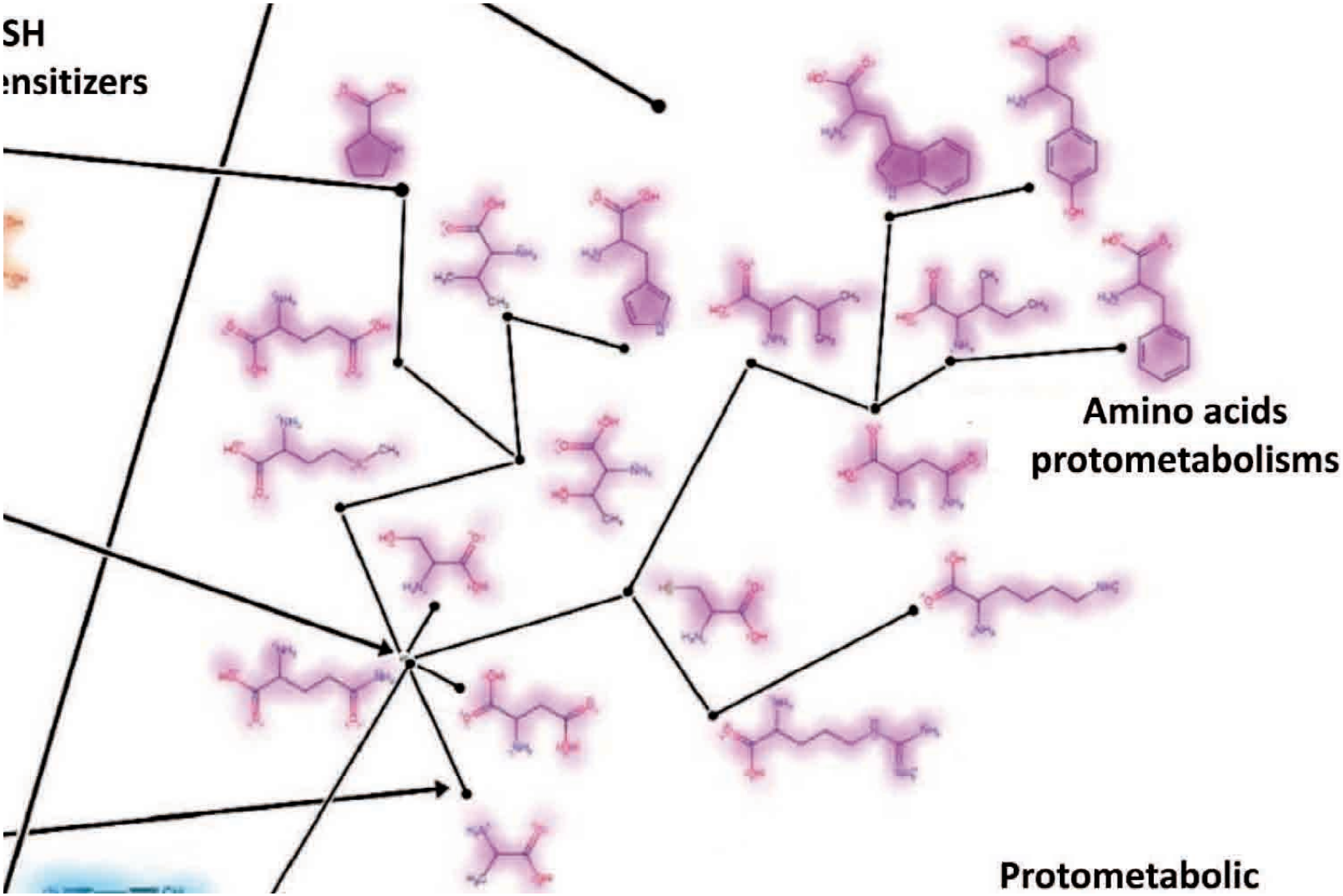
~4,4 Gya

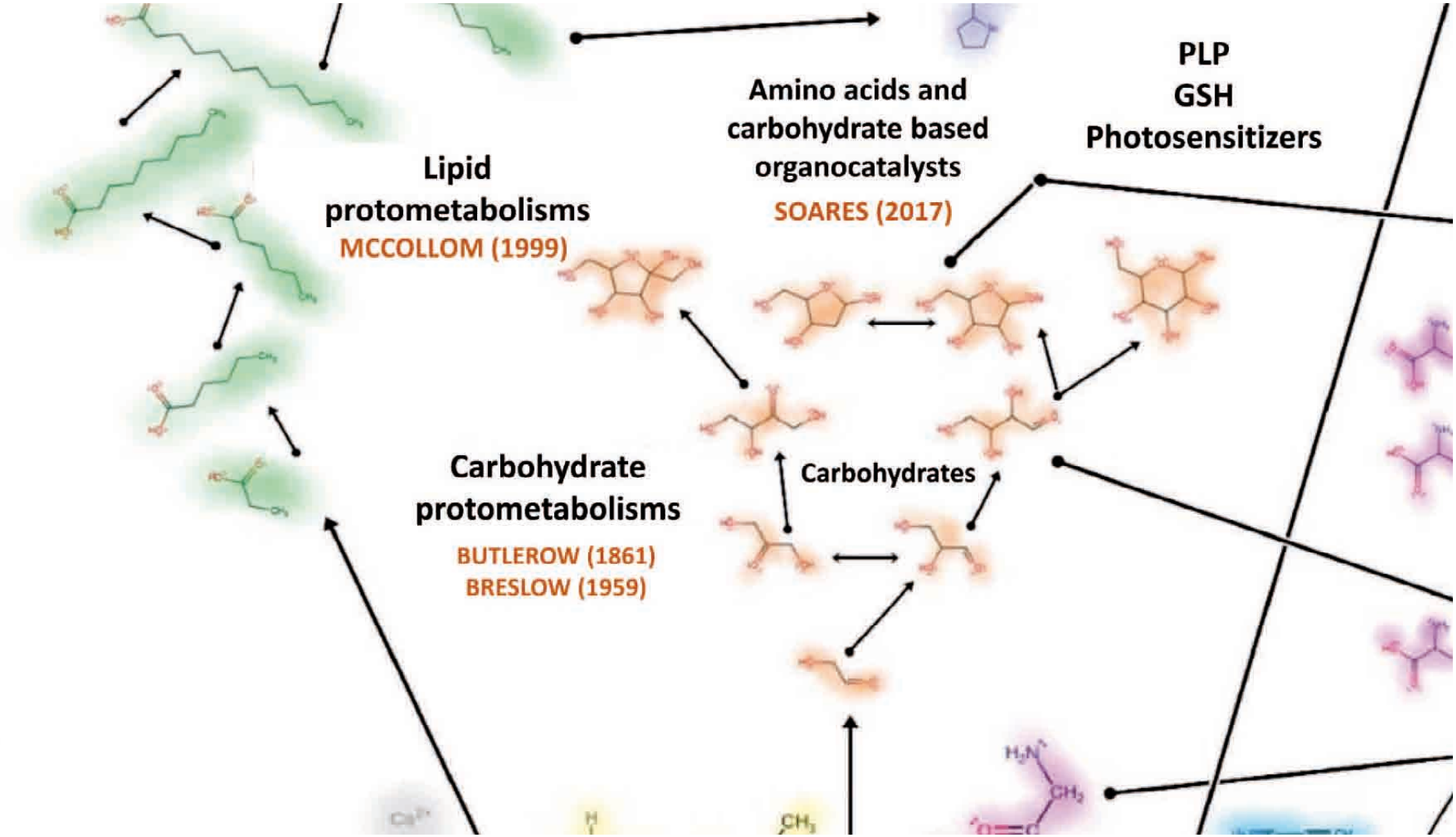
WILDE (2001)

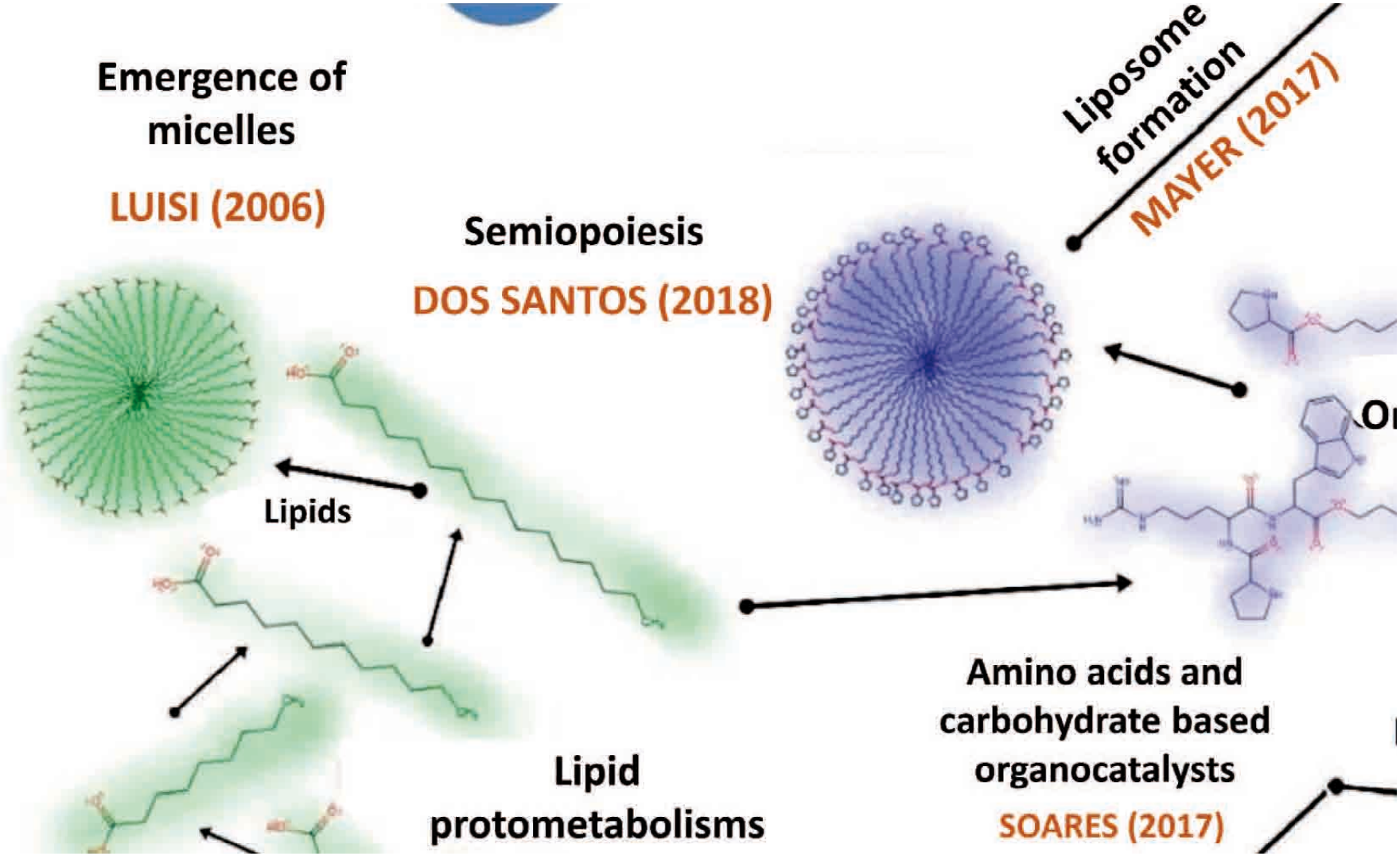
Radicals World

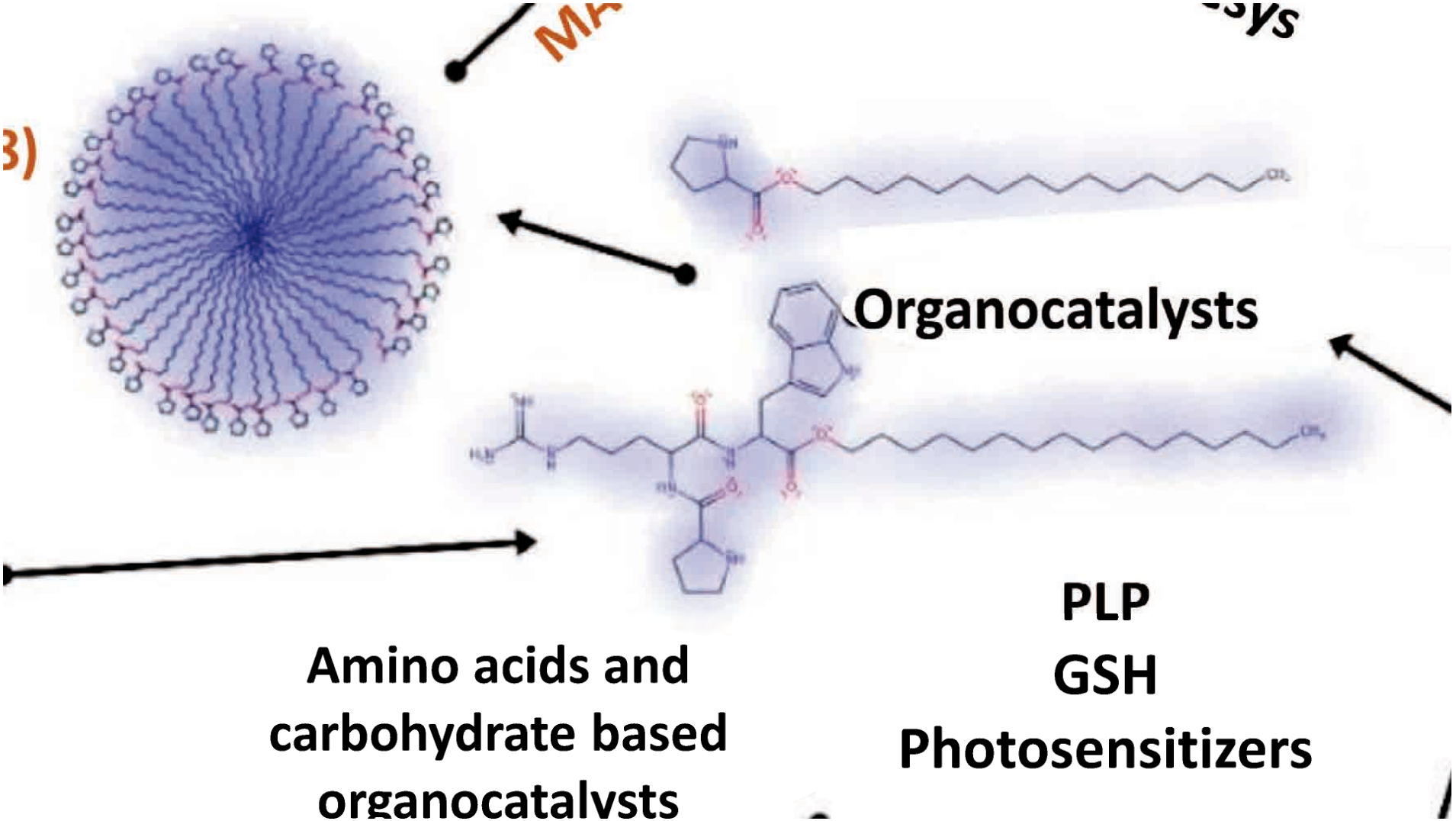



H
H
C
H
H
CH3
O
C
OH
Na+
H
HO
C
O
H
O
C
H

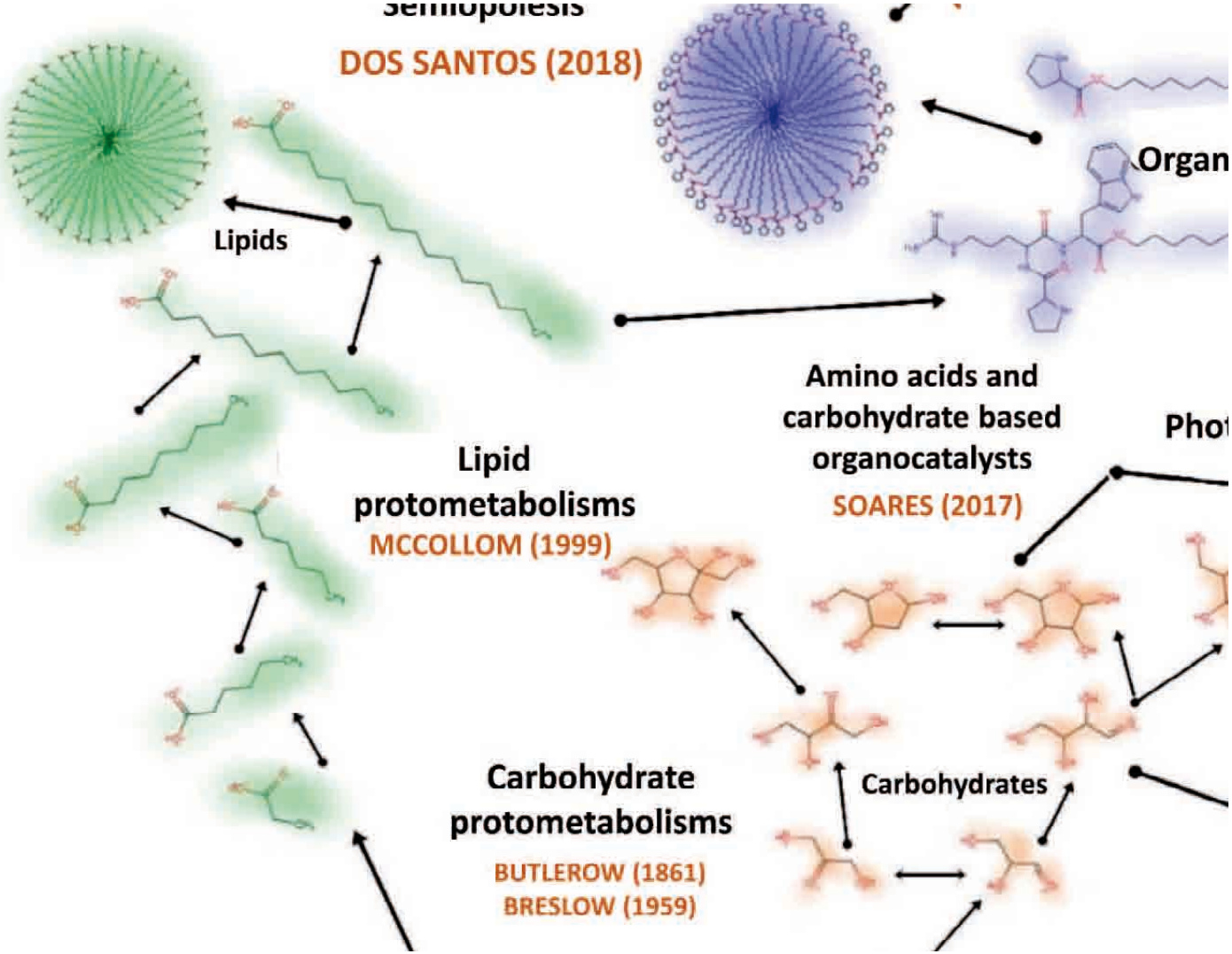

SH
ensitizers
Amino acids
protometabolisms
Protometabolic


Amino acids and
carbohydrate based
organocatalysts
SOARES (2017)
PLP
GSH
Photosensitizers
Lipid
protometabolisms
MCCOLLOM (1999)
Carbohydrate
protometabolisms
BUTLEROW (1861)
BRESLOW (1959)
Carbohydrates


Emergence of micelles
LUISI (2006)
Liposome formation
MAYER (2017)
Semiopoiesis
DOS SANTOS (2018)
Lipids
Amino acids and carbohydrate based organocatalysts
SOARES (2017)
Lipid protometabolisms

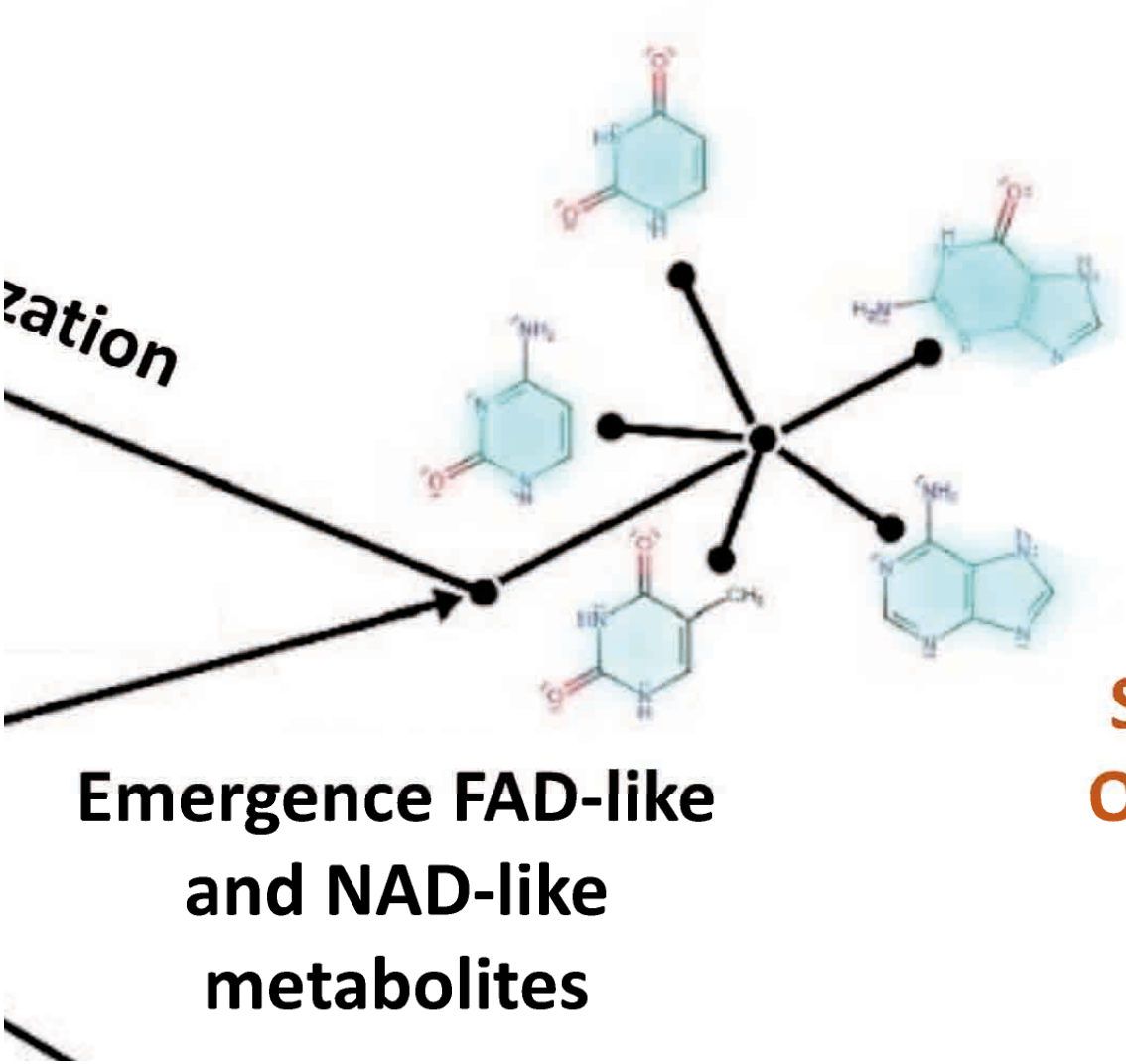

Organocatalysts
Amino acids and carbohydrate based organocatalysts
PLP
GSH
Photosensitizers

Organocatalysts world



Increase in rate of energy dissipation due to compartmentalization

compartn



Emergence FAD-like and NAD-like metabolites

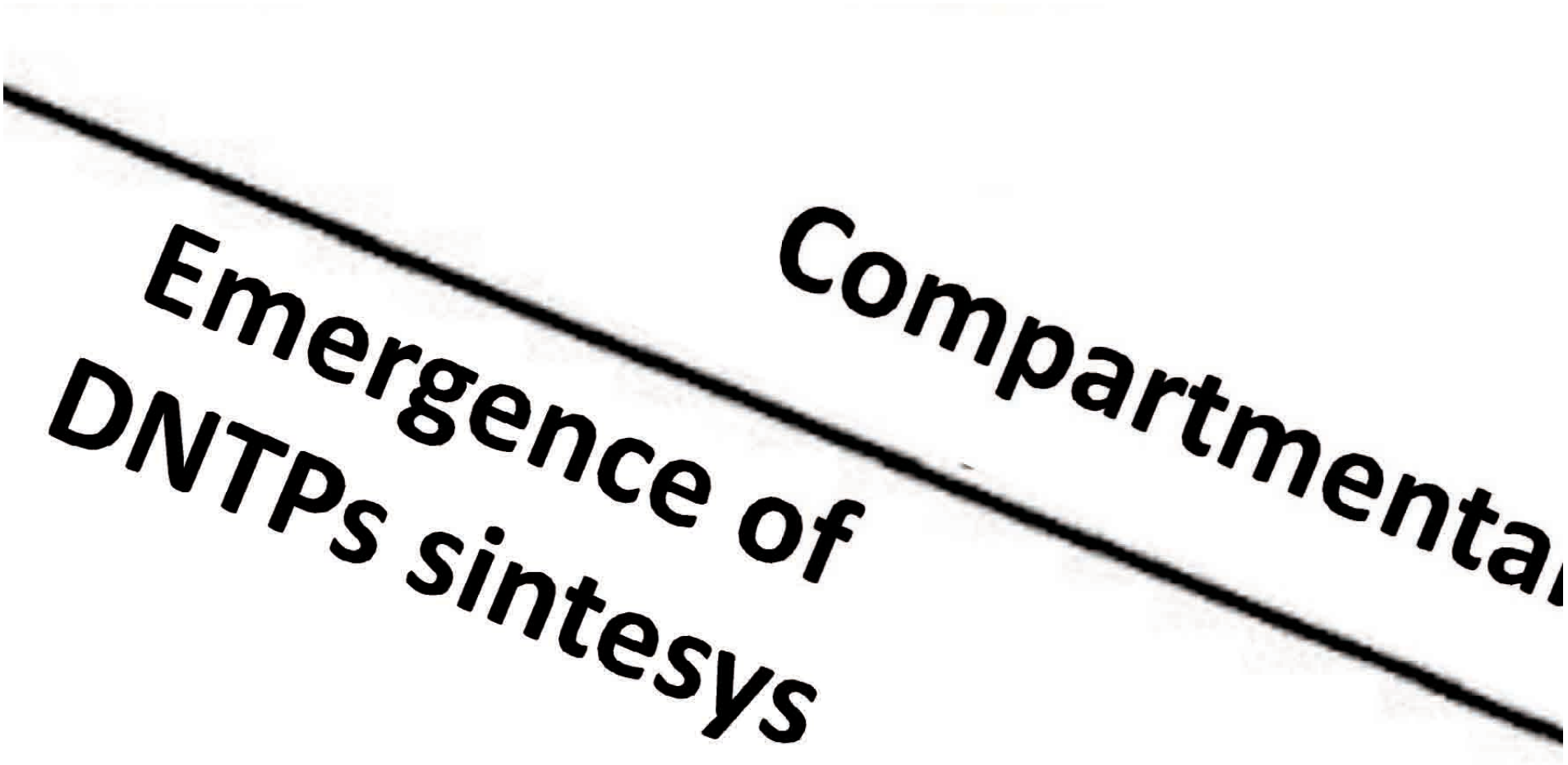
Nucleotid protometabolisms

MILLER (1998)

SANCHEZ (1966-1968)

ORÓ & KIMBALL (1962)

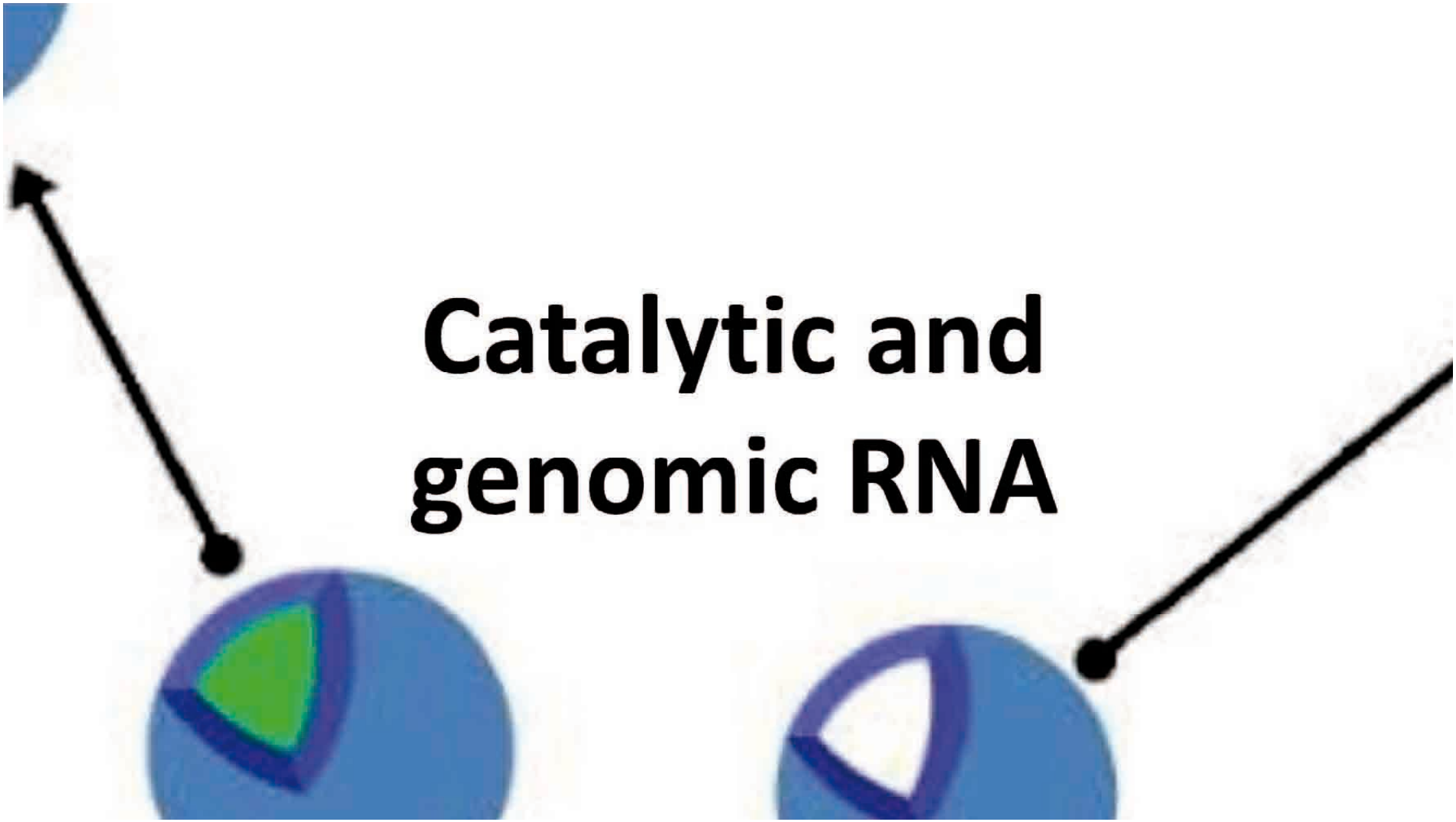
FERRIS (1968)

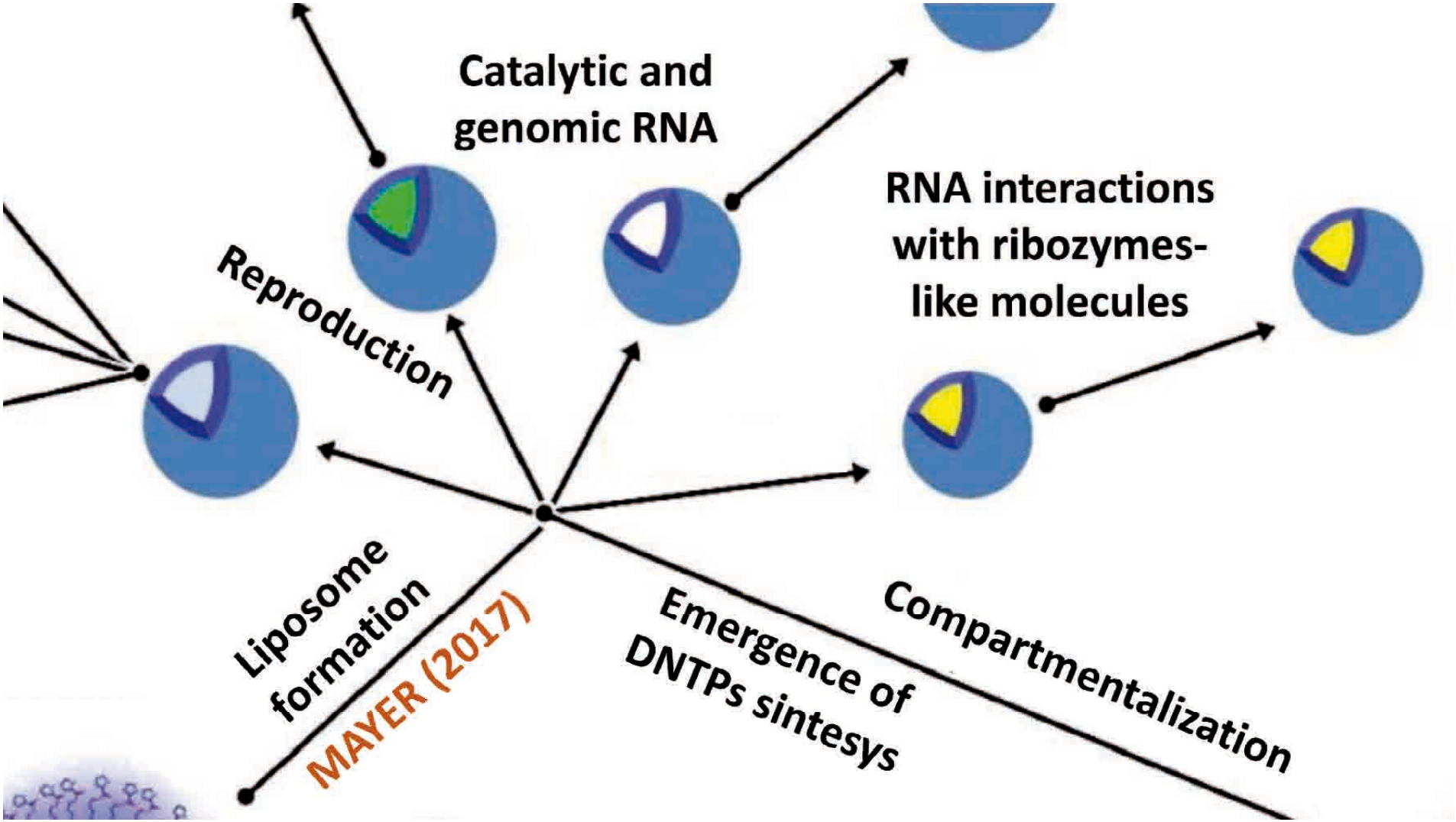

Compartmental
Emergence of
DNTPs sintesys

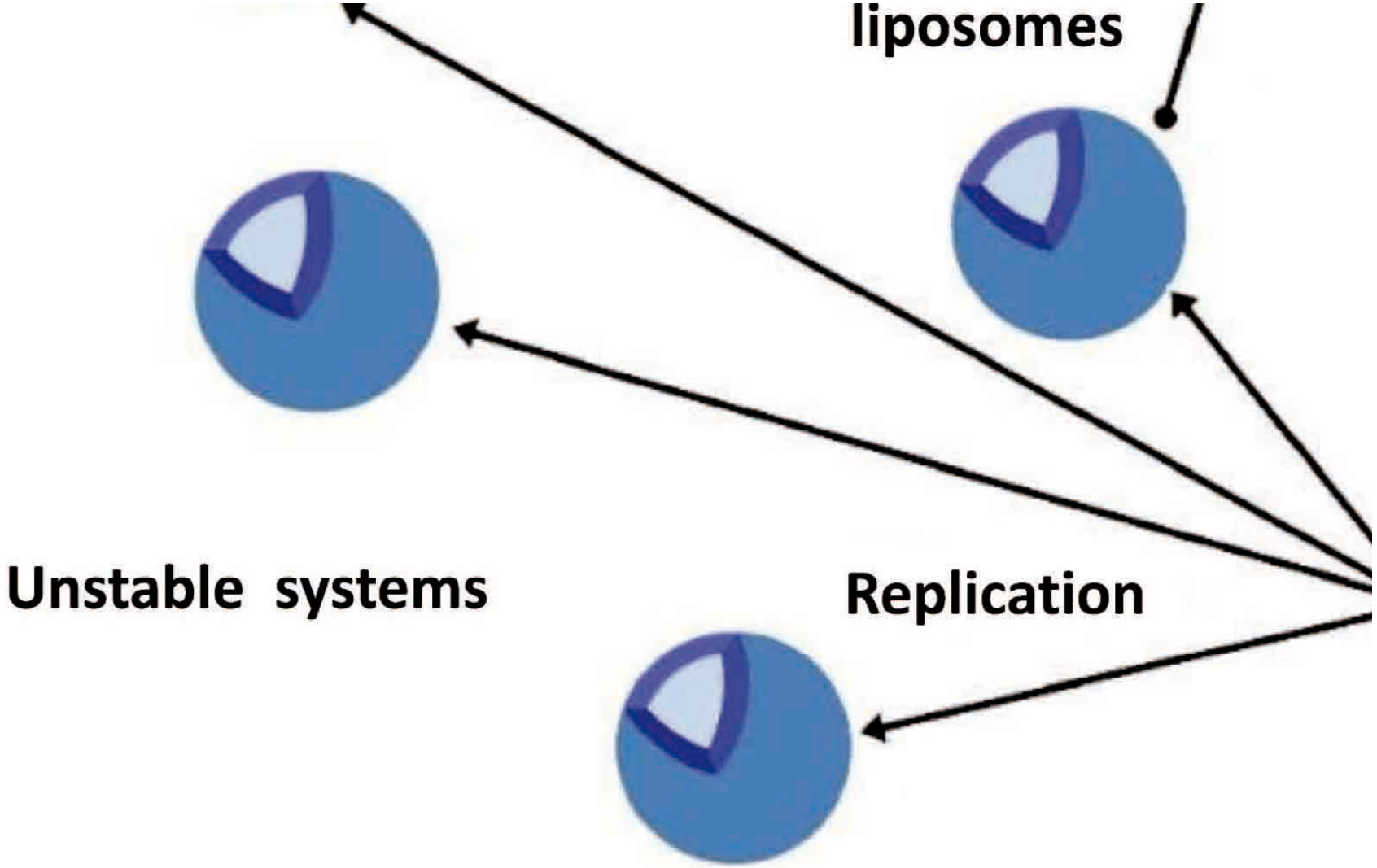
RNA polymerization

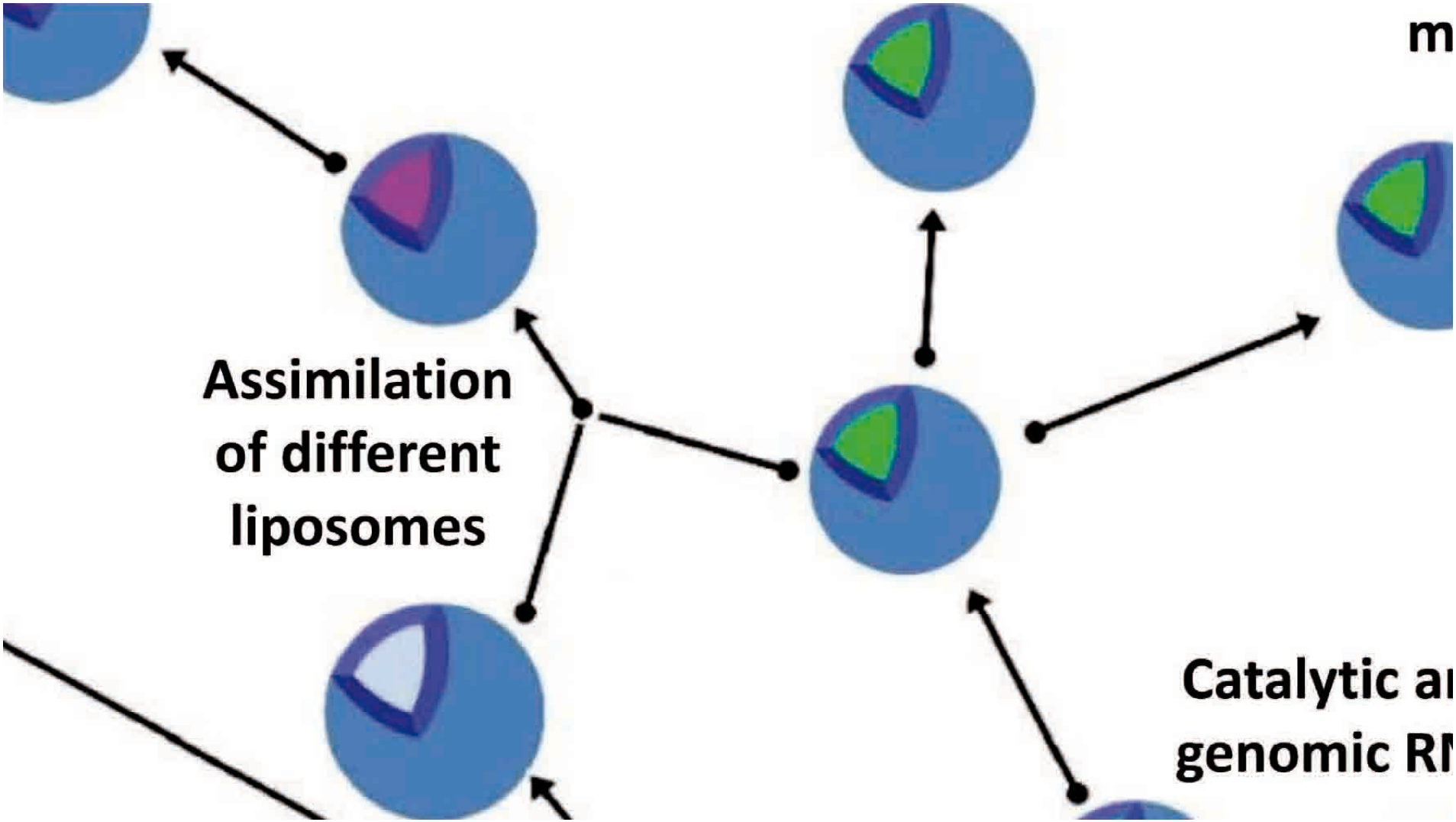
RNA and organocatalyst-based dissipative systems

FERRÉ-D' AMARÉ (2011)
ALTMAN (2011)

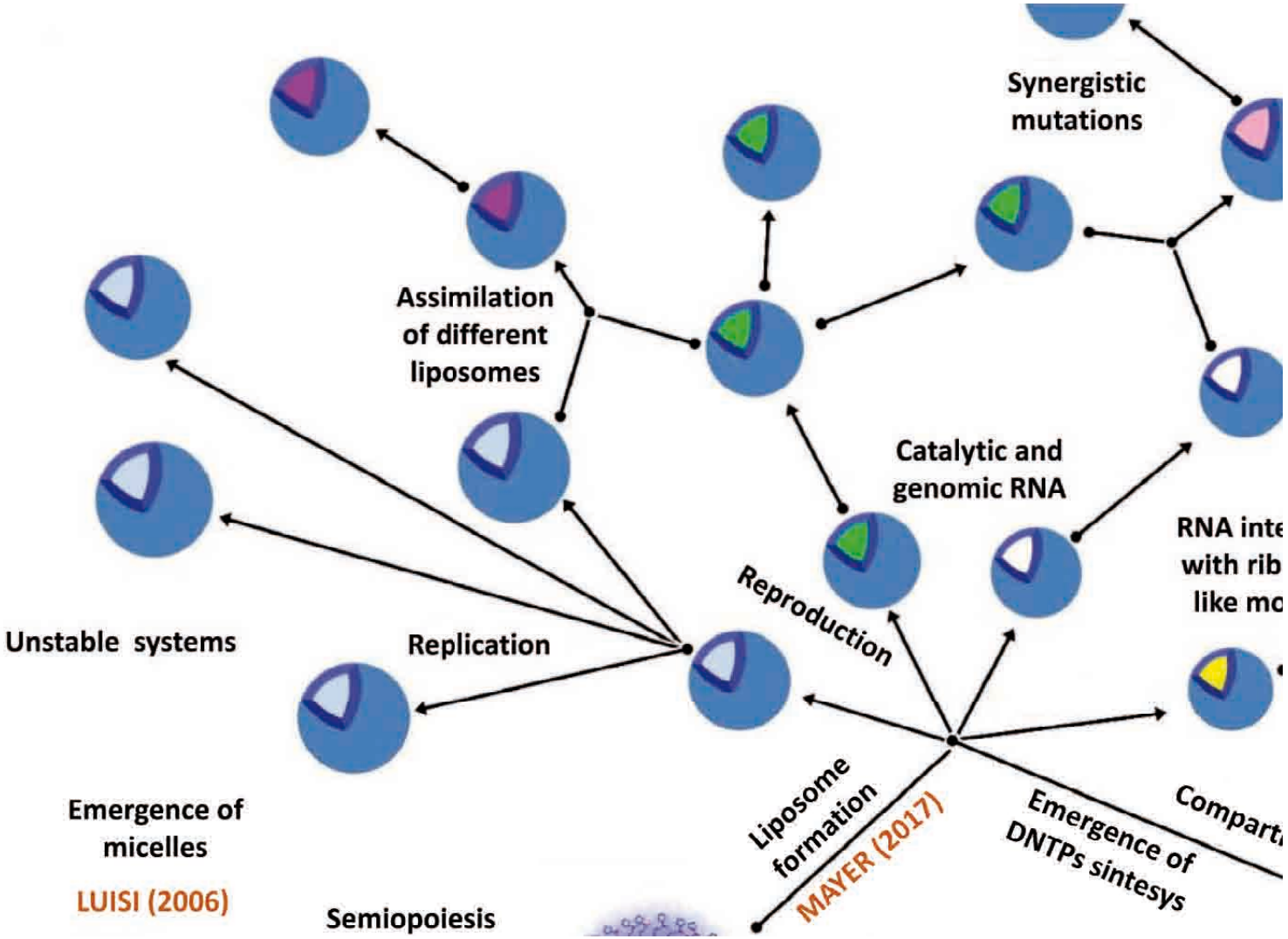

Catalytic and
genomic RNA


Catalytic and
genomic RNA
RNA interactions
with ribozymes-
like molecules
Reproduction
Liposome
formation
MAYER (2017)
Emergence of
DNTPs sintesys
Compartmentalization

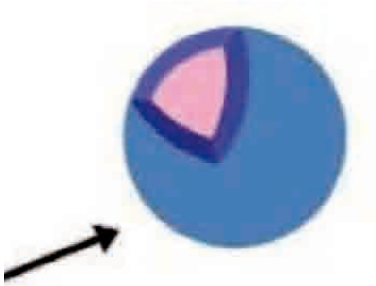

liposomes
Unstable systems
Replication


m
Assimilation
of different
liposomes
Catalytic a
genomic R

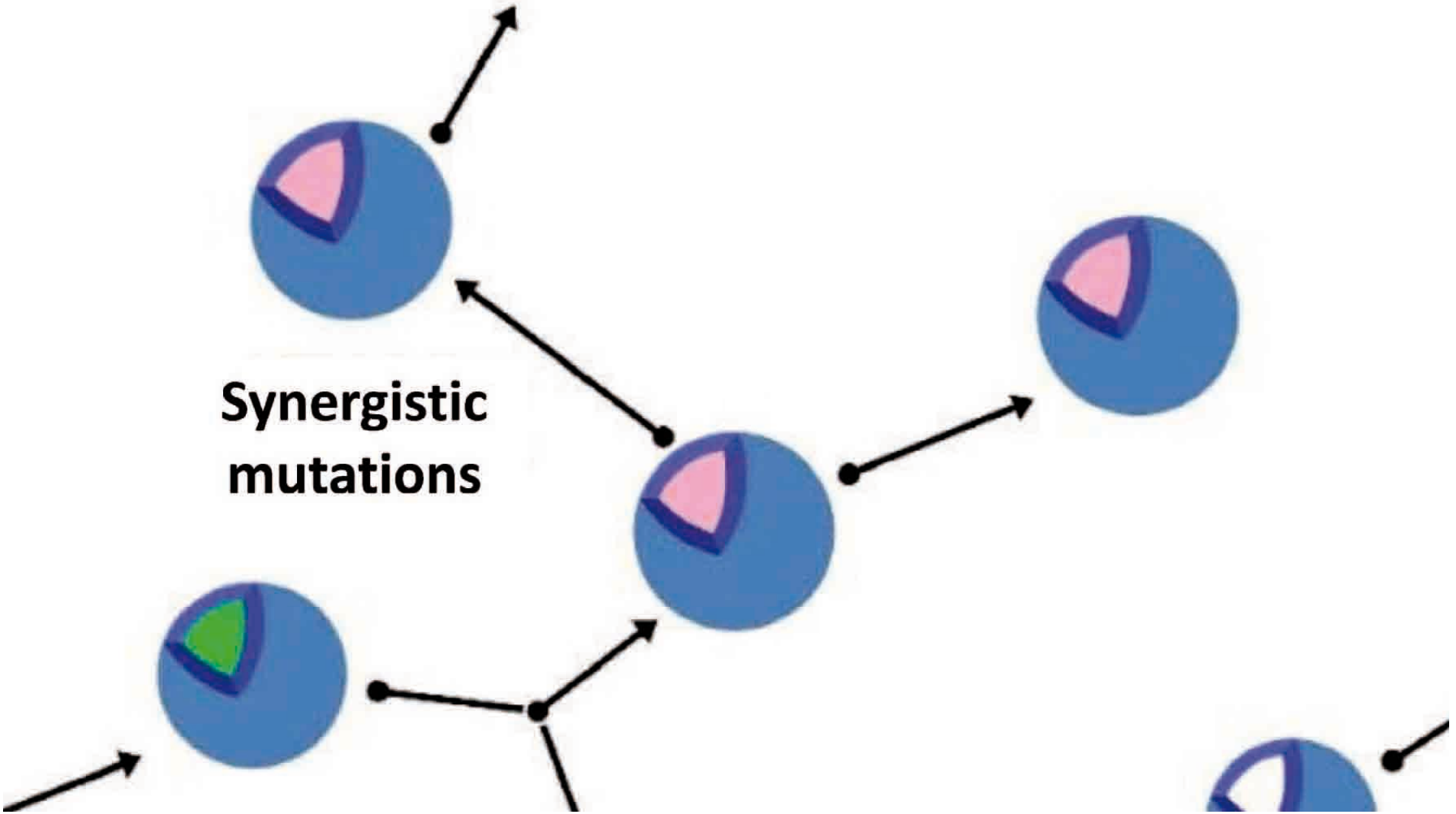
RNAs World


Synergistic
mutations
Assimilation
of different
liposomes
Catalytic and
genomic RNA
RNA inte
with rib
like mo
Reproduction
Unstable systems
Replication
Emergence of
micelles
LUISI (2006)
Semiopoiesis
Liposome
formation
MAYER (2017)
Emergence of
DNTPs sintesys
Compart

Emergence of rRNA and protoribossome



KRUPKIN (2011)
SUGA (2011)

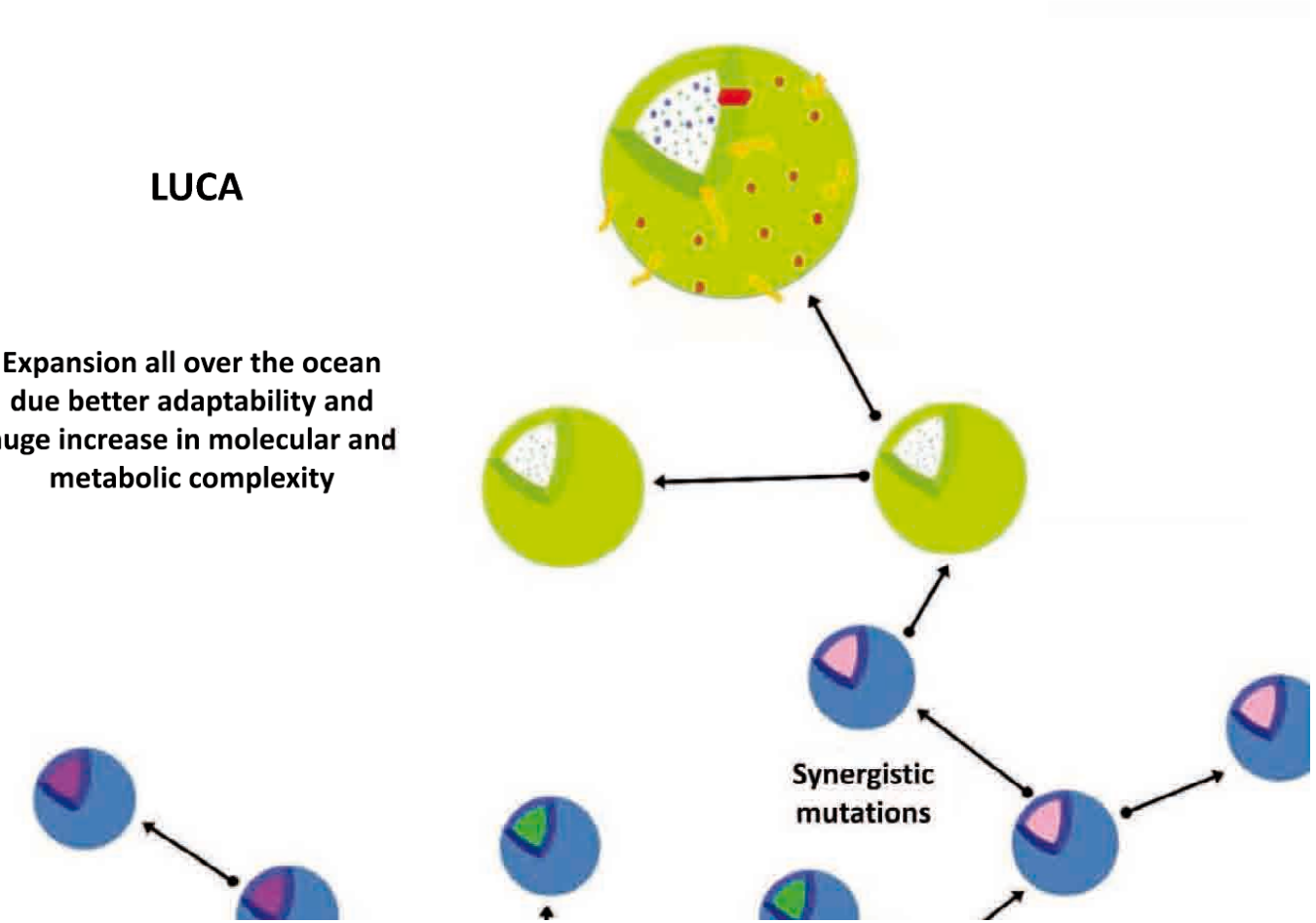

Synergistic
mutations

Emergence of the last universal common ancestor

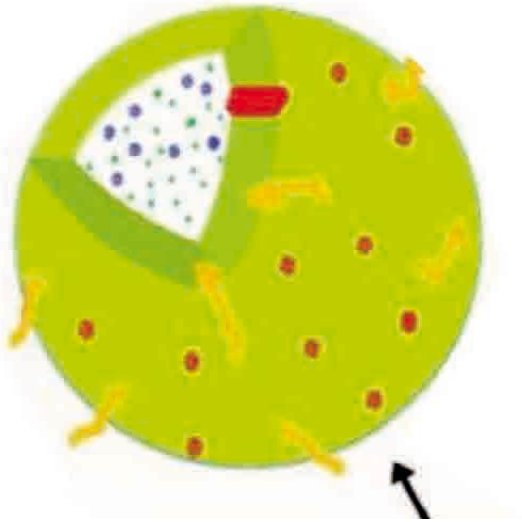
<3,77 Gya

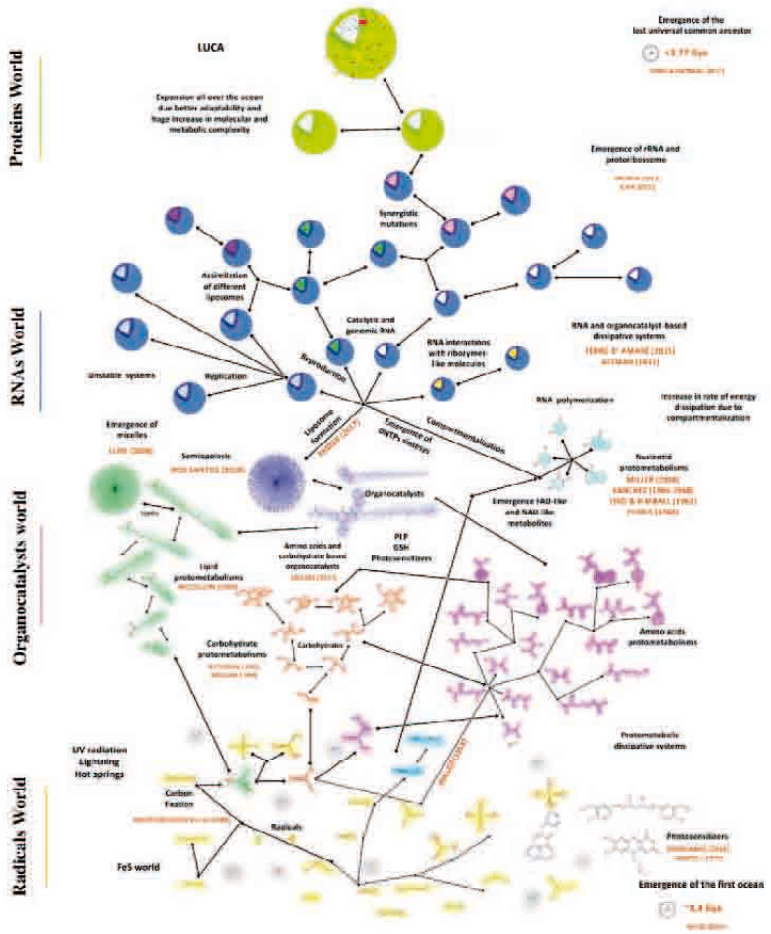
DODD & PAPINEAU (2017)

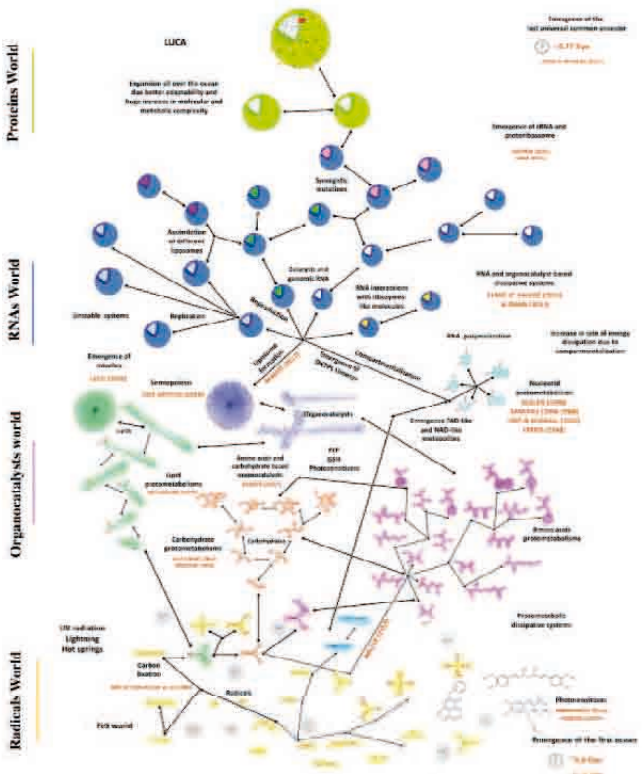
Proteins World

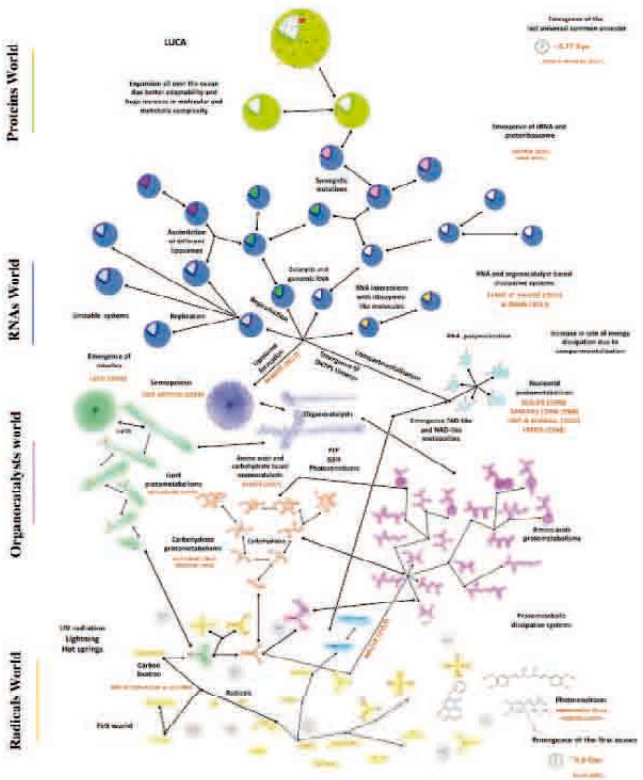


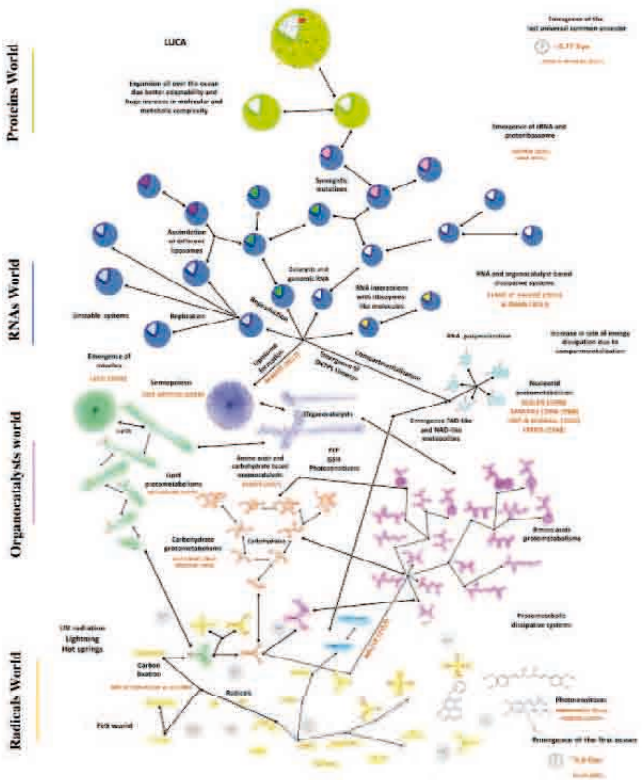
LUCA

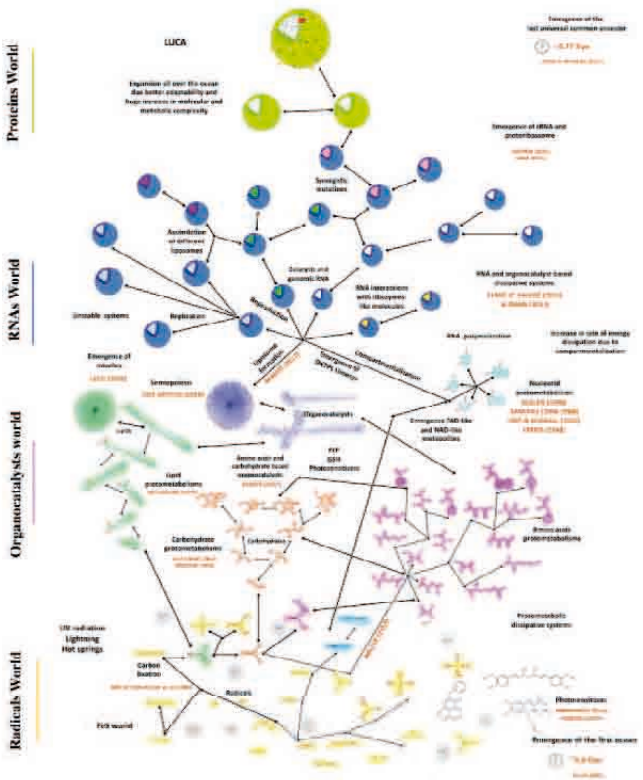



Proteins World
RNAs World
Organocatalysts world
Radicals World
LUCA
Emergence of the last universal common ancestor
Expansion all over the ocean due better adaptability and huge increase in molecular and metabolic complexity
Emergence of rRNA and proto-ribosome
Synergistic mutations
Assimilation of different liposomes
Catalytic and genomic RNA
RNA and organocatalyst based dissipative systems
RNA interactions with ribozymes like molecules
Unstable systems
Replication
Ribonucleotides
Liposome formation
Emergence of QNTPs analogs
Compartmentalization
RNA polymerization
Increase in rate of energy dissipation due to compartmentalization
Emergence of micelles
Semiosynesis
Organocatalysts
Nucleotid protometabolisms
Emergence FAD-like and NAD-like metabolites
PLP
SSH
Photosensitizers
Amino acids and carbohydrates based organocatalysts
Lipid protometabolisms
Carbohydrate protometabolisms
Carbohydrates
Amino acids protometabolisms
Protometabolic dissipative systems
UV radiation
Lightning
Hot springs
Carbon Fixation
Radicals
Fe-S world
Photosensitizers
Emergence of the first ocean


Proteins World
RNAs World
Organocatalysts world
Radicals World
LUCA
Lightning
Hot springs


Proteins World
RNAs World
Organocatalysts world
Radicals World
LUCA
Lightning
Hot springs


Proteins World
RNAs World
Organocatalysts world
Radicals World
LUCA
Lightning
Hot springs


Proteins World
RNAs World
Organocatalysts world
Radicals World
LUCA
Lightning
Hot springs
Carbon
fixation
Radicals
Photosynthesis

UEM

The Roots of the Tree of Life