

Systems CHEMISTRY

Action Overview

Günter von Kiedrowski,
Ruhr University Bochum

ChembioGenesis 2005

COST Action D27
Prebiotic Chemistry and Early Evolution
Midterm evaluation conference

Venice International University, September 28 - October 1, 2005

Keynote & invited speakers:

Albert Eschenmoser, La Jolla
Reza Ghadiri, La Jolla
Peter Schuster, Vienna
Tadashi Sugawara, Tokyo
Sandra Pizzarello, Tempe
Antonio Lazcano, Mexico City
Kenso Soai, Tokyo
Donna Blackmond, London
Christof Biebricher, Göttingen
Martin Hanczyc, Venice
John McCaskill, St. Augustin
Peter Nielsen, Copenhagen

COST Action presenters:

Pier-Luigi Luisi, Rome
Ben Feringa, Groningen
Meir Lahav, Rehovot
Peter F. Stadler, Leipzig
Marie-Christine Maurel, Paris
Vesna Nöthig-Laslo, Zagreb
Auguste Commeyras, Montpellier
John Sutherland, Manchester
Michael Göbel, Frankfurt
Doron Lancet, Rehovot
Peter Walde, Zürich
Constantinos Paleos, Attiki
Jean-Claude Micheau, Toulouse
Mauro Santos, Barcelona
Henryk Ratajczak, Wrocław
Dieter Schinzer, Magdeburg

Contact:
Francesca Bernardi
(bernfran@unive.it)

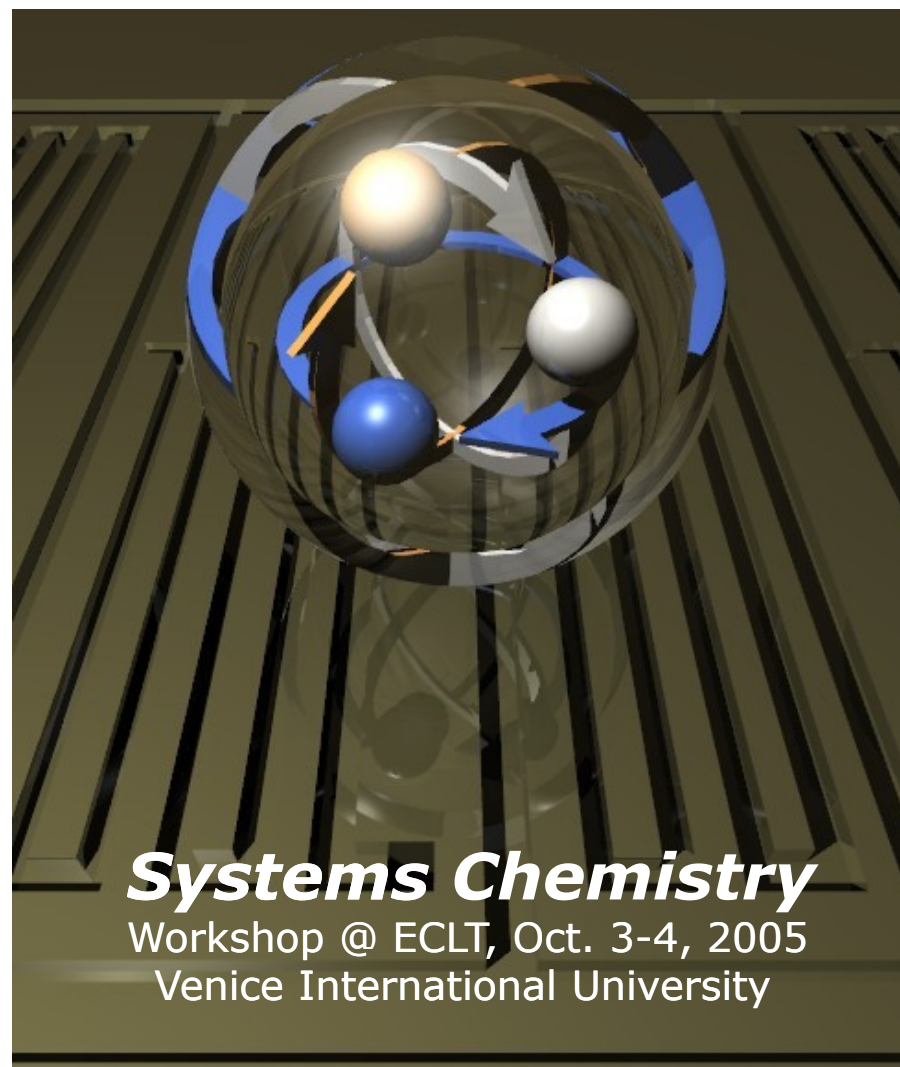
www.costd27.org

Organizers:

Günter von Kiedrowski, Bochum (chair)
Eors Szathmáry, Budapest (vice chair)
Peter Strazewski, Lyon

COST Science Officer:
Denis Neibecker, Brussels

in cooperation with
Venice International University



Systems Chemistry

Workshop @ ECLT, Oct. 3-4, 2005
Venice International University

Accidentally in the same week:
Systems Chemistry: Kinetic and Computational Analysis
of a Nearly Exponential Organic Replicator:
M. Kindermann et al., *ANIE* 2005, 44, 6750-6755.



ESF-COST High-Level
Research Conference
Hotel Villa del Mare
Maratea, Italy
October 3-7, 2008



Speakers:

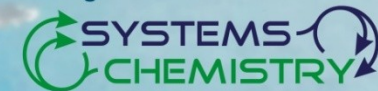
Gonen Ashkenasy, Beer Sheva
Vladik A. Avetisov, Moscow
Carlos F. Barbas III, La Jolla
Steven A. Benner, Gainesville/FL
Donna Blackmond, London
James Cleaves, Washington
George Cody, Washington
Ben Feringa, Groningen
M. Reza Ghadiri, La Jolla
Piet Herdewijn, Leuven
Ludovic Jullien, Paris
Stuart Kauffman, Calgary
Christoph Kuhn, Zurich
Meir Lahav, Rehovot
John S. McCaskill, Bochum
Pierre A. Monnard, Odense
Peter Nielsen, Copenhagen
Douglas Philp, St. Andrews
Addy Pross, Beer Sheva
Peter Schuster, Vienna
Kenso Soai, Tokyo
Pasquale Stano, Rome
Eörs Szathmáry, Budapest
Svetlana B. Tsogoeva, Erlangen
Günter von Kiedrowski, Bochum
Arthur C. Weber, Mountain View/CA

Organizers:

Chair: Günter von Kiedrowski, Bochum
Vice chair: Dieter Schinzer, Magdeburg
Contact: Antje Teegler, ESF, Brussels
Peter Strazewski, Lyon
Zbigniew Zagorski, Warsaw
Josep M. Ribo, Barcelona
John S. McCaskill, Bochum
Eörs Szathmáry, Budapest

Chemiogenesis 2008

Kickoff meeting of COST Action CM0703



Hotel Villa del Mare, Maratea, Italy
October 8-10, 2008

Speakers:

Gonen Ashkenasy, Beer Sheva
Hugues Bersini, Brussels
Donna Blackmond, London
Javier Caldentey, Brussels, COST office
Ludo Diels, Mol
Ben Feringa, Groningen
Christof Flamm, Vienna
Goran Goranovic, Odense
Piet Herdewijn, Leuven
Adam Kun, Budapest
Meir Lahav, Rehovot
Dominik Marx, Bochum
Marie-Christine Maurel, Paris
John McCaskill, Bochum
Wim Noorduin, Nijmegen
Sjibren Otto, Groningen
Robert Pascal, Montpellier
Douglas Philp, St. Andrews
Raphael Plasson, Stockholm
Josep M. Ribo, Barcelona
Clemens Richert, Stuttgart
Raffaele Saladino, Viterbo
Dieter Schinzer, Magdeburg
Kay Severin, Lausanne
Jay Siegel, Zurich
Peter Strazewski, Lyon
Eörs Szathmáry, Budapest, Action vice chair
Günter von Kiedrowski, Bochum, Action chair
Zbigniew Zagorski, Warsaw





Accepting
submissions

Editors-in-Chief

Günter von Kiedrowski, Ruhr-Universität Bochum, Germany
Sijbren Otto, University of Groningen, Netherlands
Piet Herdewijn, Katholieke Universiteit Leuven, Belgium

Editorial Board

Donna Blackmond, UK	John S. McCaskill, Germany
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Meir Lahav, Israel	Svetlana Tsogoeva, Germany
Pier Luigi Luisi, Italy	George M. Whitesides, USA

Journal of Systems Chemistry is a new peer-reviewed open access journal from [Chemistry Central](#) covering all aspects of systems chemistry including (but not limited to):

- o experimental and theoretical studies of complex molecular networks
- o catalytic and autocatalytic systems
- o self-replicating and self-reproducing chemical systems
- o dynamic combinatorial chemistry
- o emergent phenomena in molecular networks
- o information processing by chemical reactions
- o bifurcation and chiral symmetry breaking
- o bottom up approaches to synthetic biology and chemical evolution
- o research on chemical self-organization inspired by the problems of the origin and synthesis of life
- o research from the conjunction of supramolecular, prebiotic and biomimetic chemistry, theoretical biology, complex systems physics, and earth, planetary and space sciences with a center in chemistry

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- „genetic“
- „metabolic“
- „confined“
- „asymmetric“

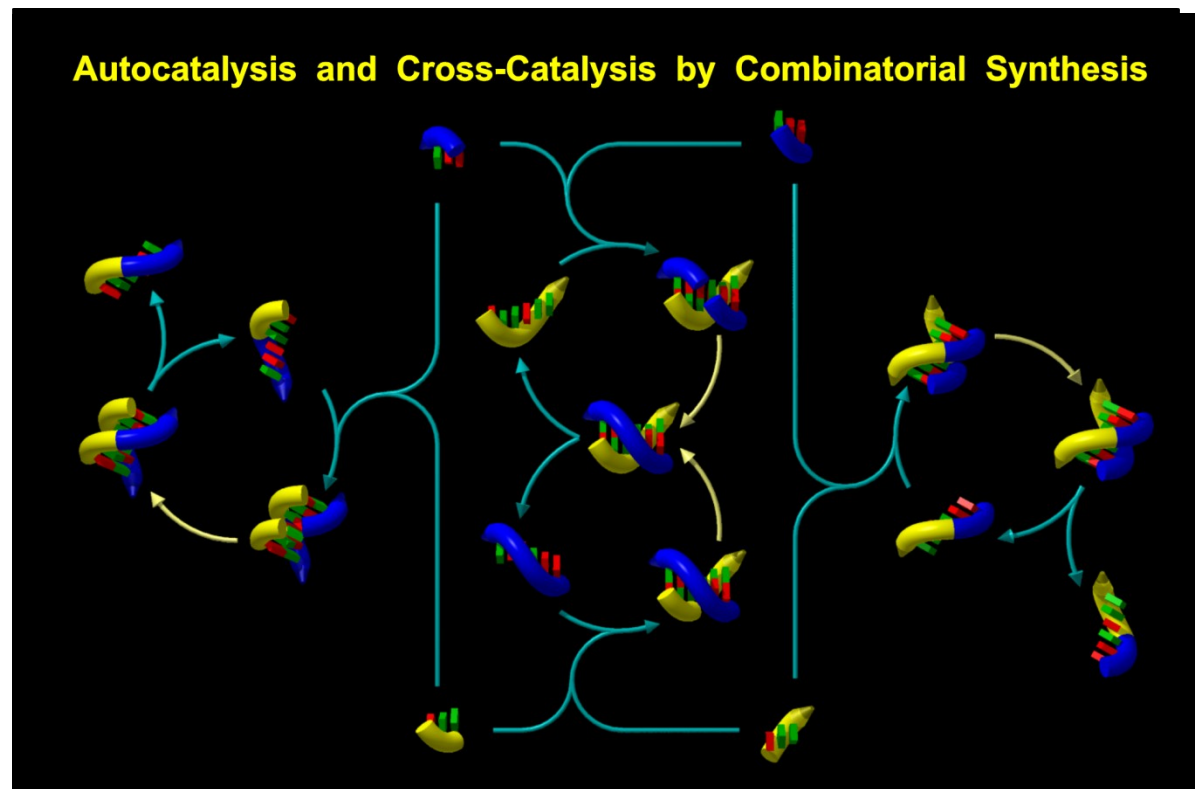


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in terms of dynamics:

...from
autocatalytic replicators
...via
cross-catalytic replicators
...to
replicator networks



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in terms of structure:

- ...from nucleic acids & mimics
- ...via peptide replicators
- ...to small organic replicators



Marie-Christine Maurel, Paris, FR



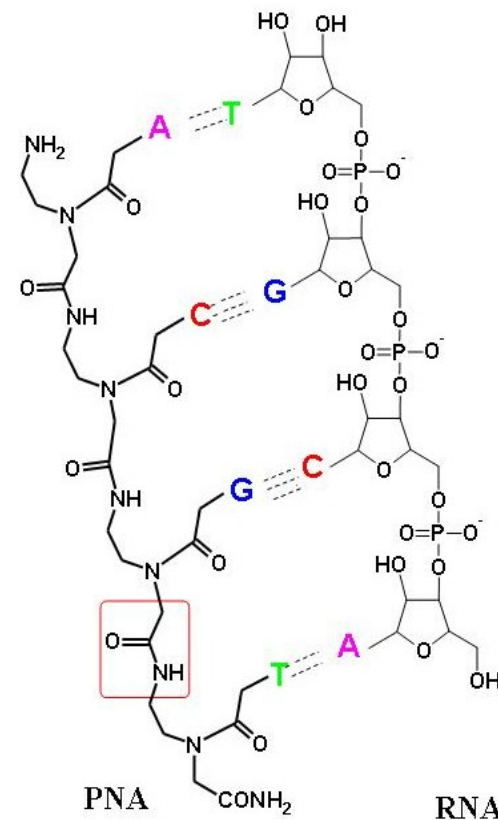
Clemens Richert, Karlsruhe, DE



Piet Herdewijn, Leuven, BE



Peter E. Nielsen, Copenhagen, DK



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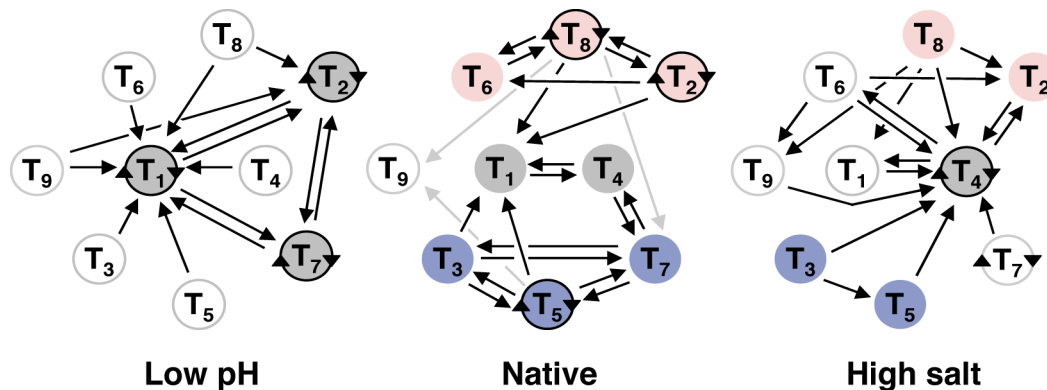
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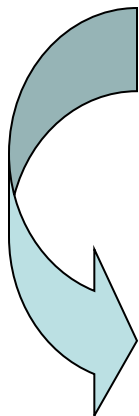
Gonen Ashkenasy,
Ben Gurion Univ., IL

in terms of structure:

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nucleic acids & mimics
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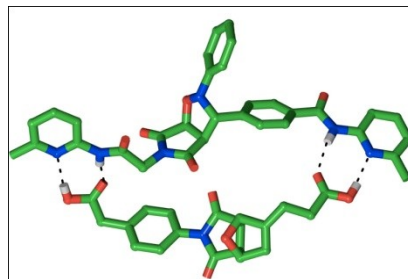
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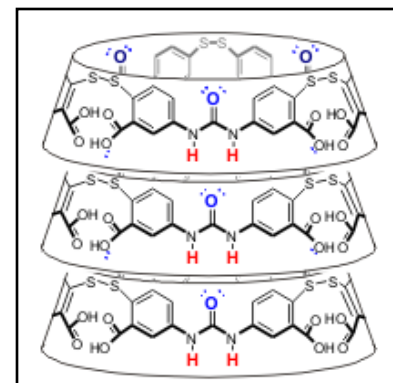
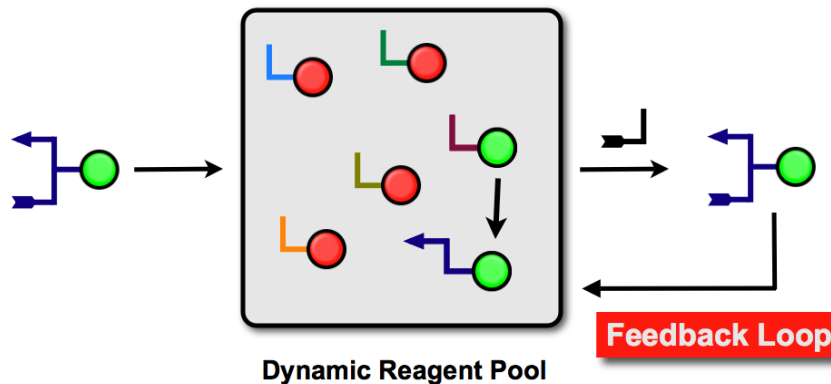
Douglas Philp,
St. Andrews, UK

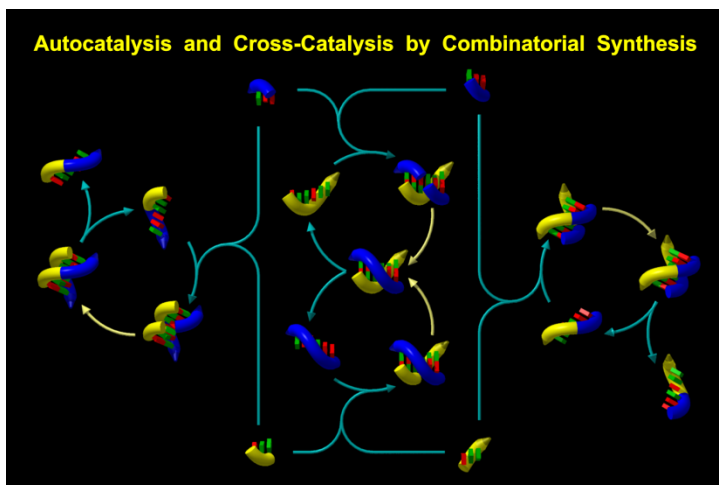


Sijbren Otto
Cambridge, UK

in terms of structure:

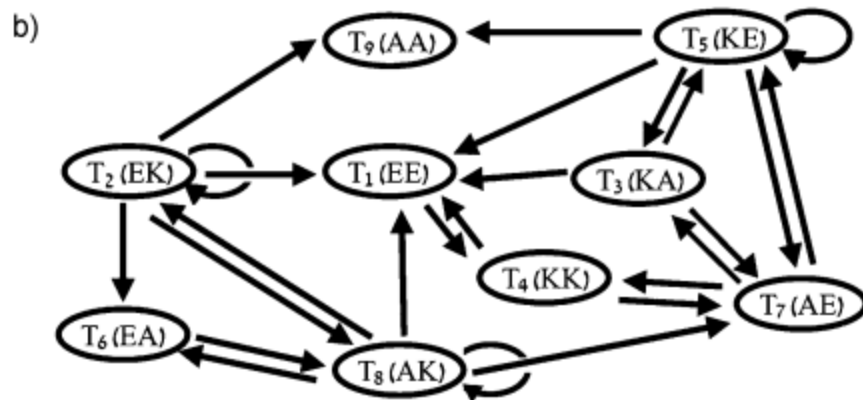
...from
nucleic acids & mimics
...via
peptide replicators
...to
small organic replicators





**Cross-catalytic replication:
Combine more than four precursors...**

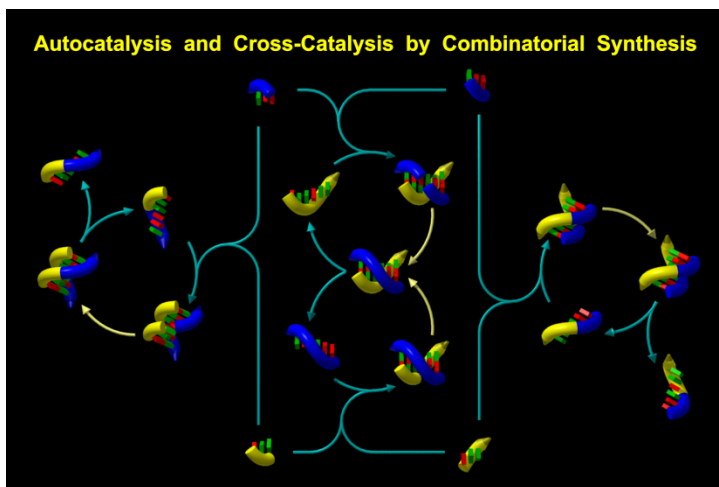
http://www.nature.com/chemistry/looking_back/index.html



...and arrive at Molecular Networks

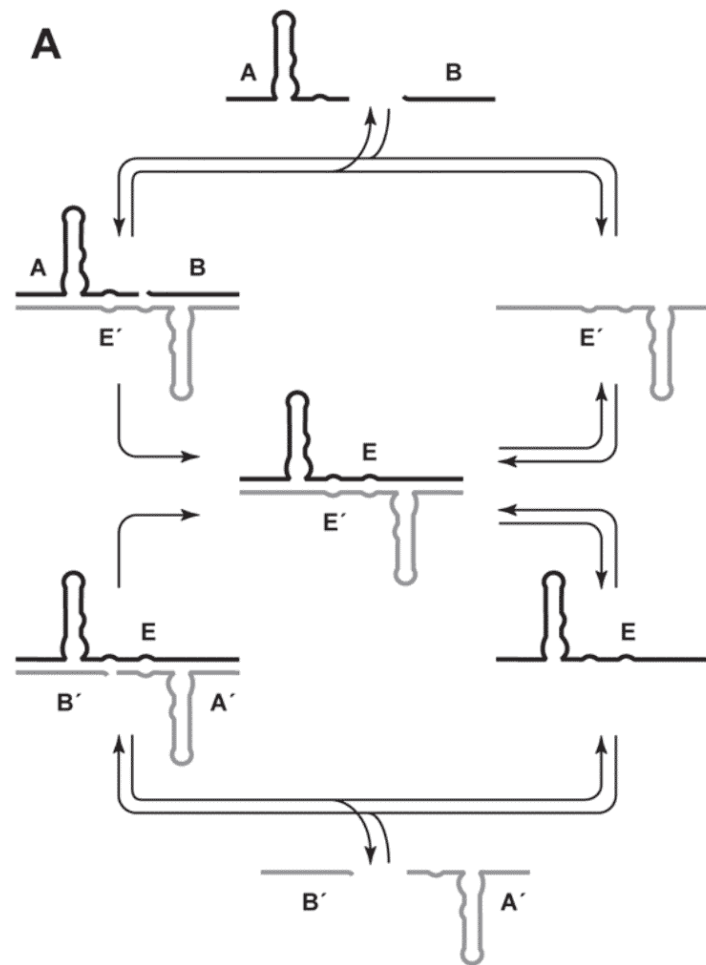
The Road to Nonenzymatic Molecular Networks

Z. Dadon, N. Wagner, G. Ashkenasy,
ANIE **2008**, *47*, 6128-6136



**Cross-catalytic replication:
From parabolic...**

http://www.nature.com/chemistry/looking_back/index.html



...to exponential dynamics

Self-sustained replication of an RNA enzyme
T.A. Lincoln & G.F. Joyce, *Science* **2009**, 323, 1229

Systems Chemistry on Ribozyme Self-Construction: Evidence for Anabolic Autocatalysis in a Recombination Network

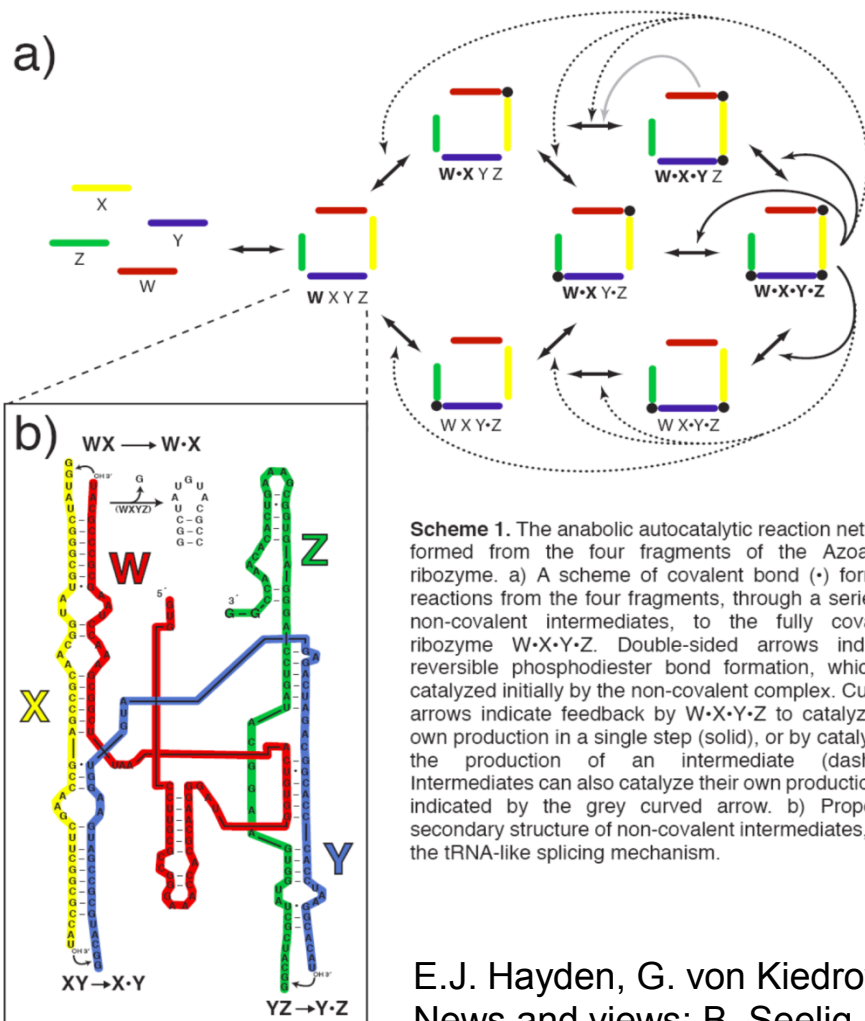
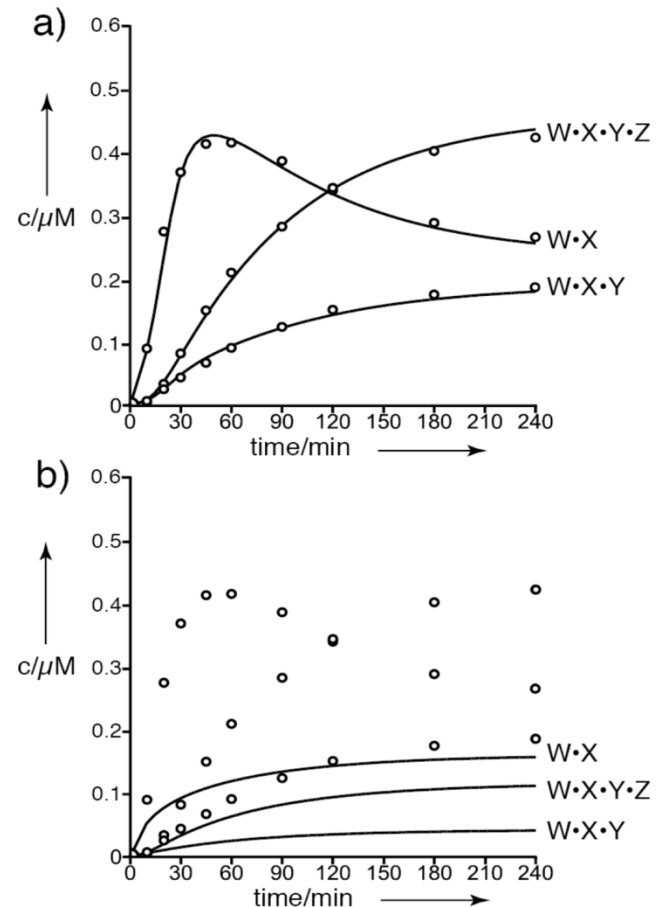
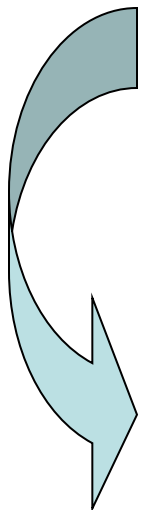


Figure 2. Kinetic modeling of the system. a) Concentrations of observables W•X, W•X•Y and W•X•Y•Z as a function of time. Open circles represent experimental data obtained from denaturing PAGE and autoradiography.^[27] Curves are a best fit of the model to the kinetic data using the program SimFit. c) Result of removing the autocatalytic rate constants from the model after fitting.



E.J. Hayden, G. von Kiedrowski, N. Lehman, *ANIE* **2008**, *47*, 8424-8428
News and views: B. Seelig, *Nature Chem. Biol.* **2008**, *4*, 654-655

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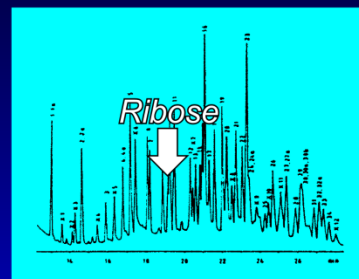
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The Formose Reaction



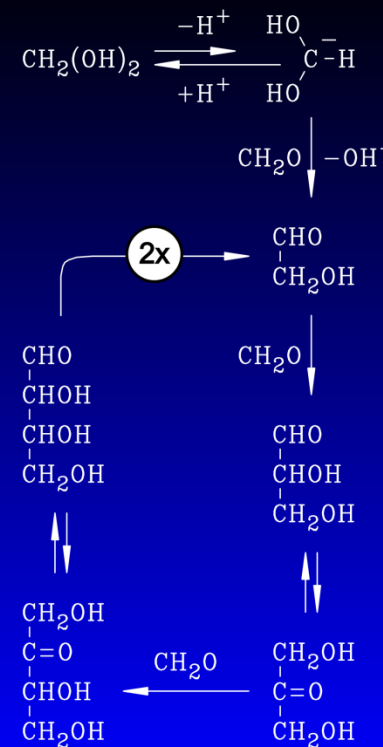
pH 12

glycol aldehyde,
glycerine aldehyde,
+
mixture of isomeric
aldo- and keto-
tetroses, pentoses,
hexoses etc.



GC after derivatisation as *n*-butoxim-trifluoracetates

Butlerow (1861), Decker (1982)

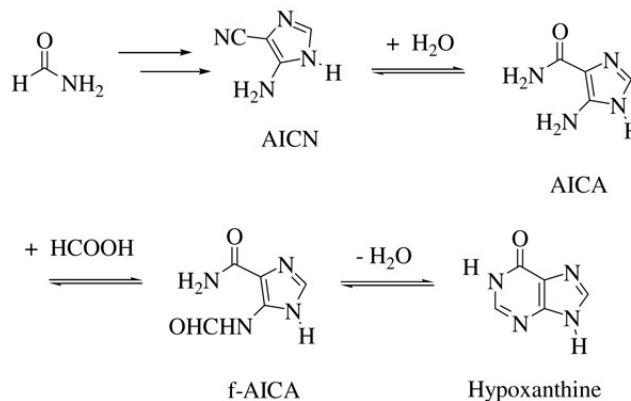


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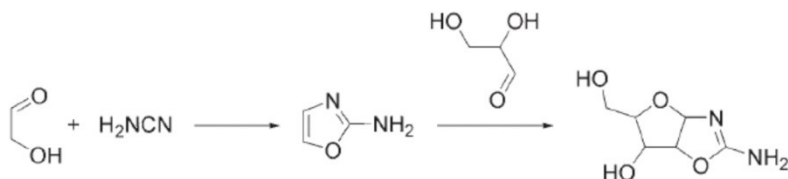
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John Sutherland,
Manchester, UK



Raffaele Saladino,
Tuscia Univ., IT



Süßes Leben: Pentose-Aminooxazoline – Intermediate in einer möglichen präbiotischen Nucleosidsynthese – können in Wasser unter Umgehung des entsprechenden Zuckers hergestellt werden. 2-Aminooxazol, ein Kondensationsprodukt

aus Glycolaldehyd und Cyanamid, reagiert mit Glyceraldehyd unter milden Bedingungen in einem bemerkenswerten und nahezu quantitativen Prozess, der hochstereoselektiv für Ribose- und Arabinose-Aminooxazoline ist.

Präbiotische Chemie

C. Anastasi, M. A. Crowe, M. W. Powner, J. D. Sutherland* _____ **6322 – 6325**

Direct Assembly of Nucleoside Precursors from Two- and Three-Carbon Units

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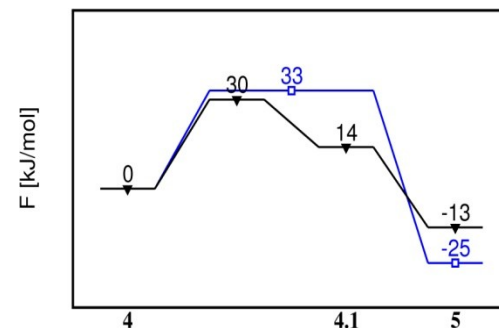
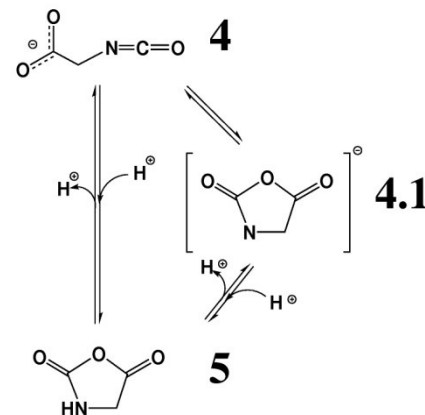
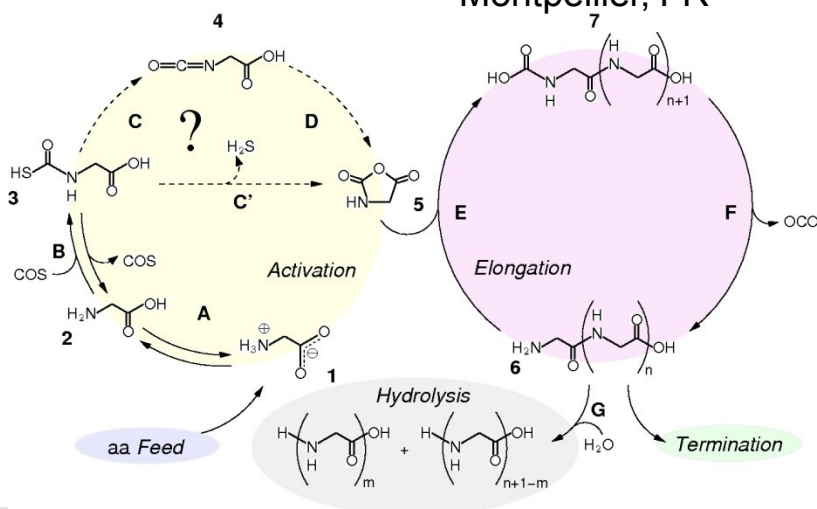
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Robert Pascal,
Montpellier, FR



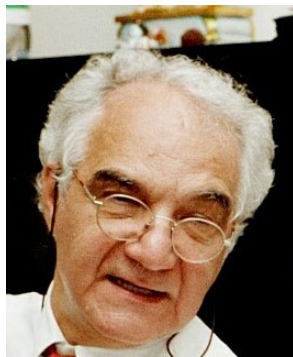
Dominik Marx,
Bochum, DE



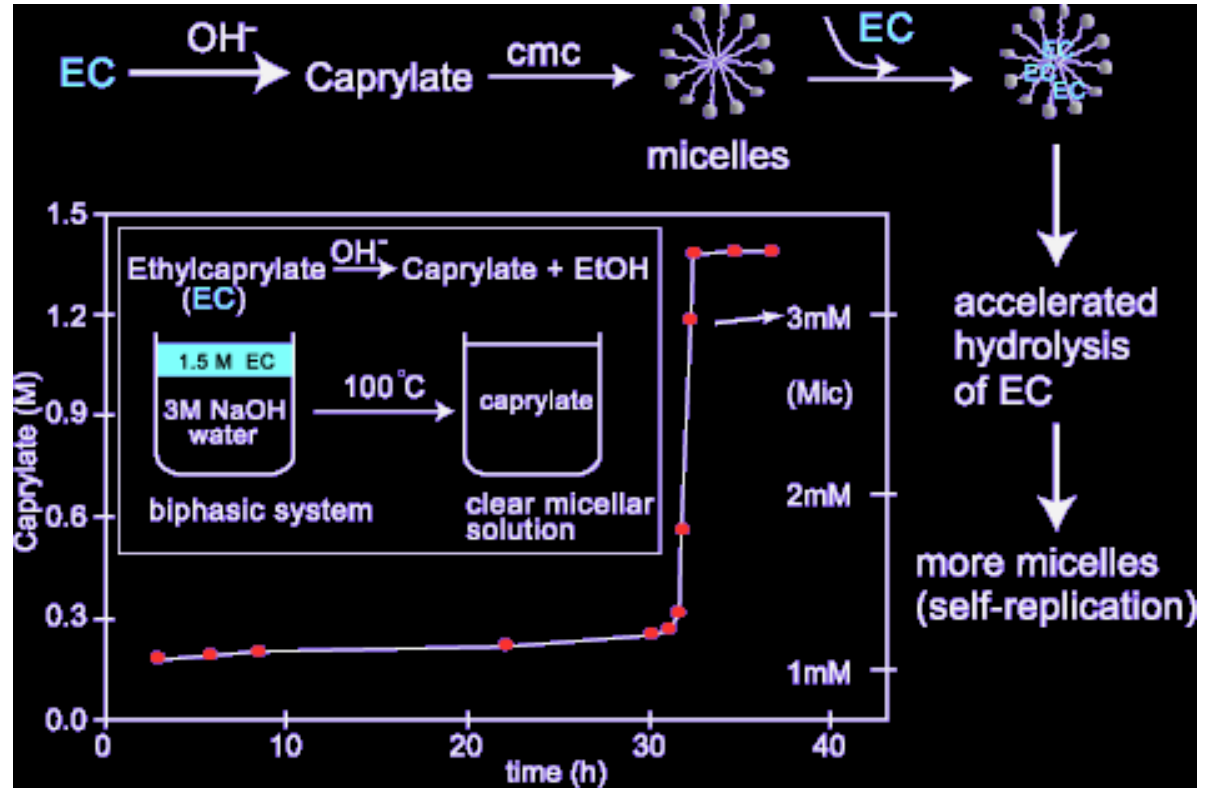
Detailed *ab initio* simulation of various aspects of prebiotic peptide synthesis

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Pier-Luigi Luisi,
Rome, IT



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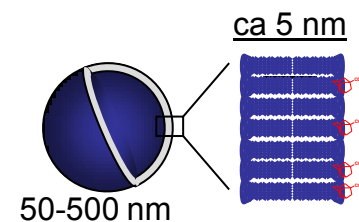
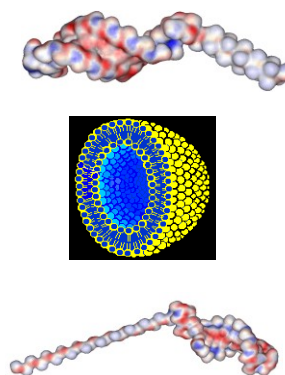
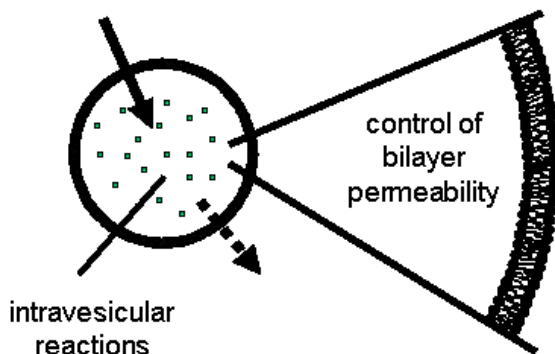
Peter Walde,
ETH Zurich, CH



Peter Strazewski,
Lyon, FR



Jan Bart Ravoo,
Munster, DE



Molecular recognition
at vesicle surfaces
(PNAS 2007, 104, 8986)

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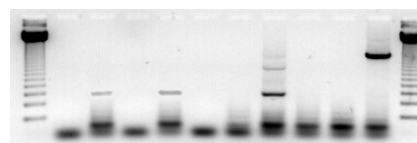
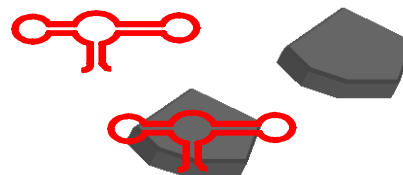
John McCaskill,
Bochum, DE

chemical replicators
@ μ -fluidic electronic cells



Enzo Gallori, Florence, IT

Ribozymes @ minerals




Test for activity changes



Jay Siegel,
Zurich U, SW

pericyclic reactions/
organic replicators
@
cubic lipid phases/
 μ -fluidics/
anti-clays

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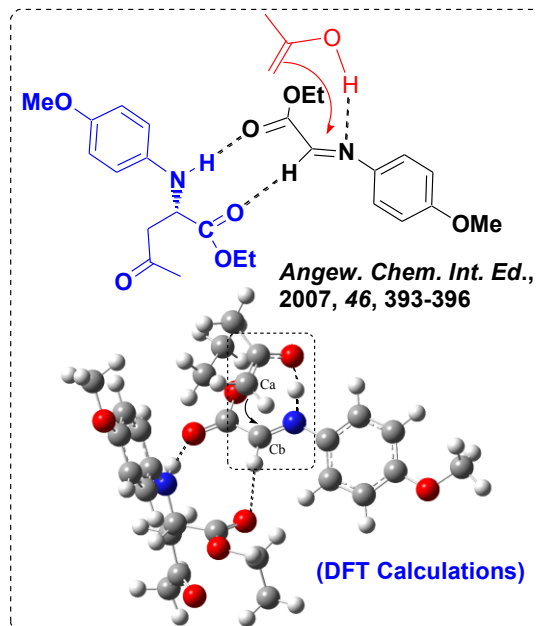
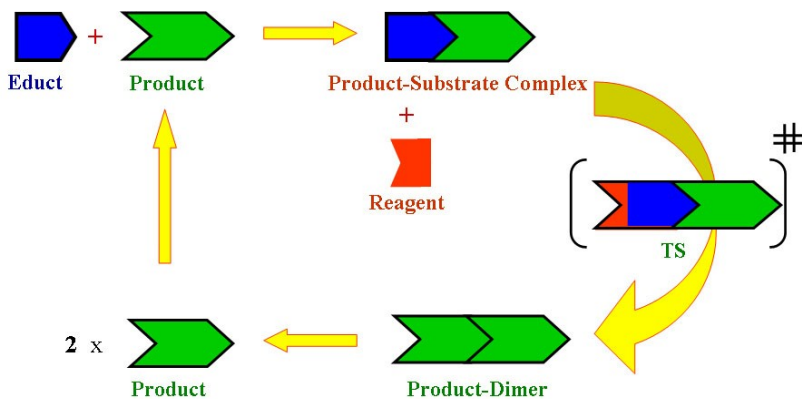


Donna Blackmond,
London, UK

- Mechanism of the Soai reaction
- Chirality amplification by eutectic freezing of scalemic AA mixtures



Svetlana Tsogoeva,
Erlangen, DE



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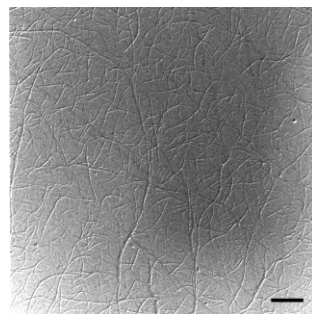
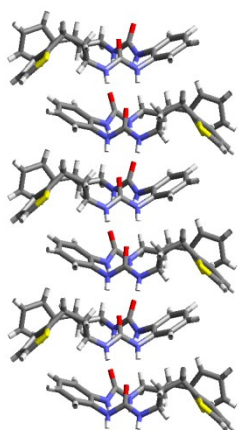
Ben L. Feringa,
Groningen, NL



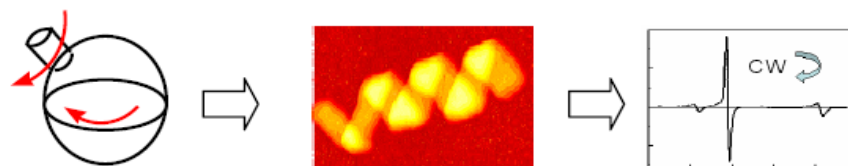
Josep M. Ribó,
Barcelona, SP



Meir Lahav,
Rehovot, IL

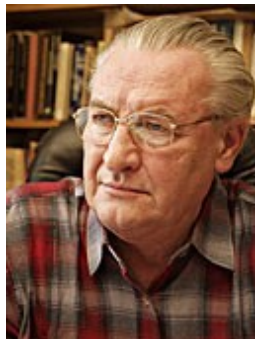


Chiral symmetry breaking by nucleation-growth processes in supramolecular systems: From gels to crystals

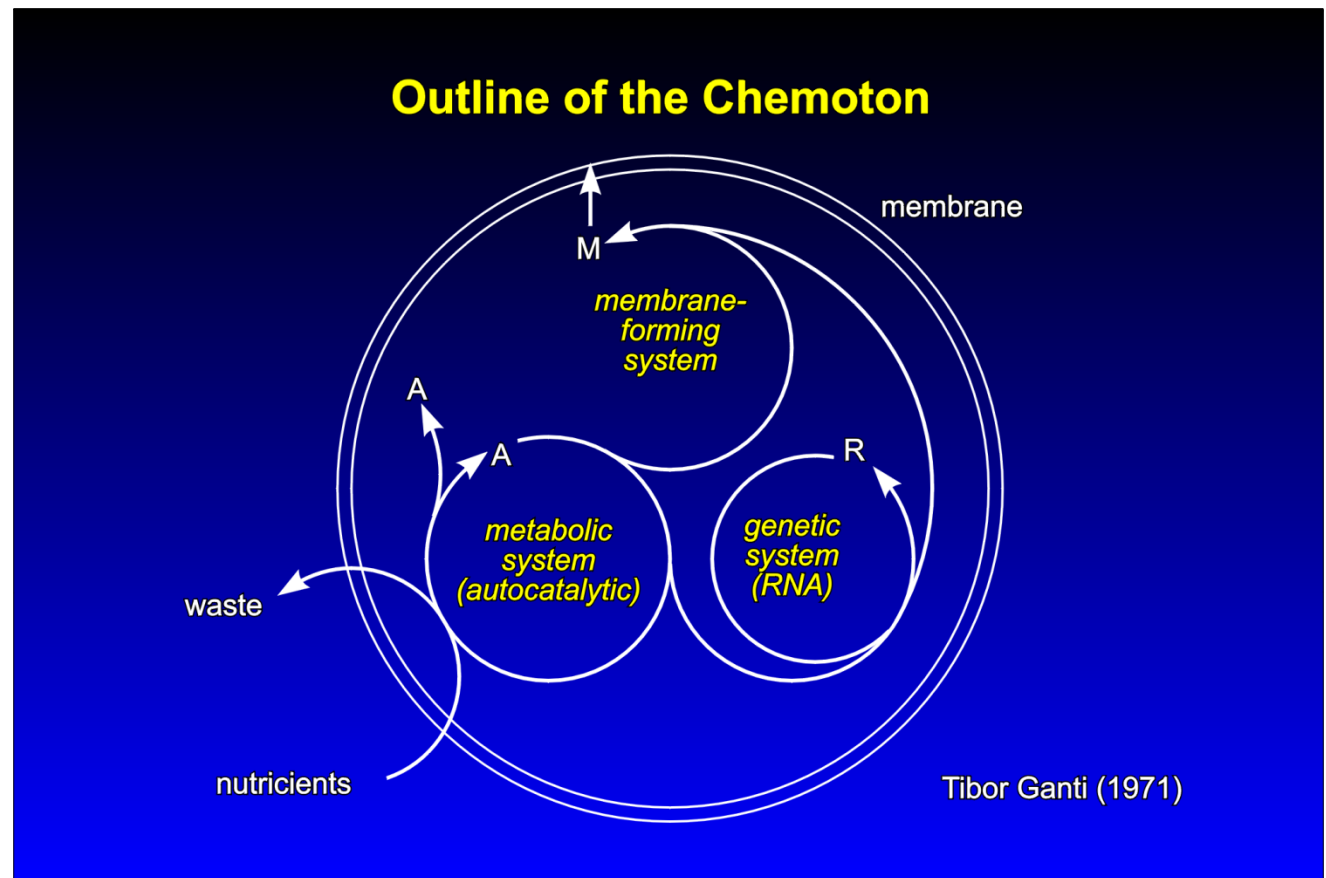


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Tibor Ganti,
Budapest, HU



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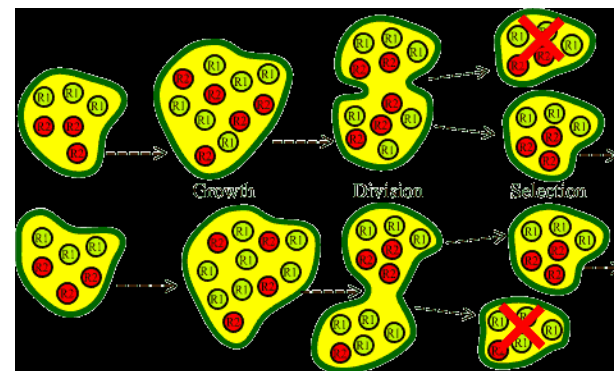
Prof. Kiedrowski achieves phenomenal success with a new self-replicating system



Günter von Kiedrowski,
Bochum, DE



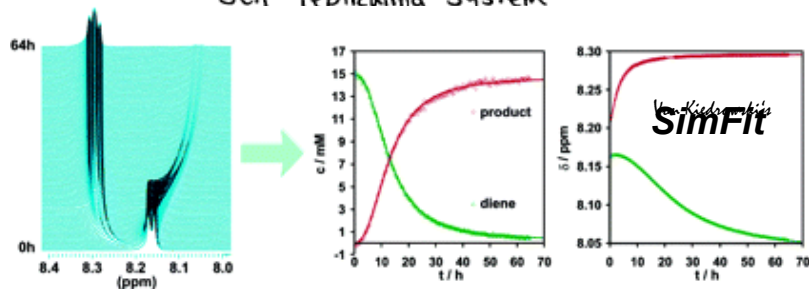
Eörs Szathmáry,
Budapest, HU



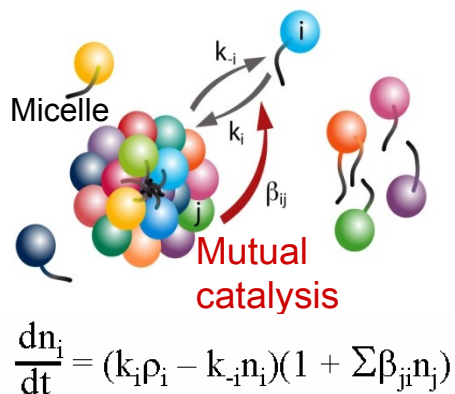
The pragmatic approach toward supersystem construction:
Try pairwise integration before daring triple integration!



GC: The Chromatographed Replicator Model



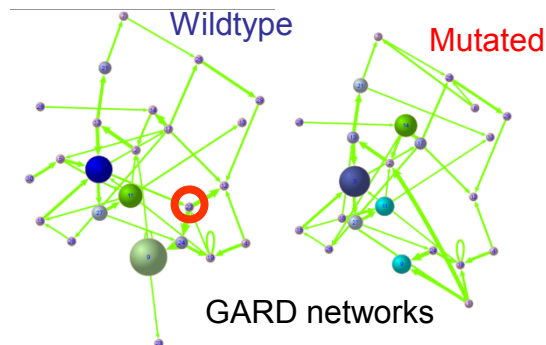
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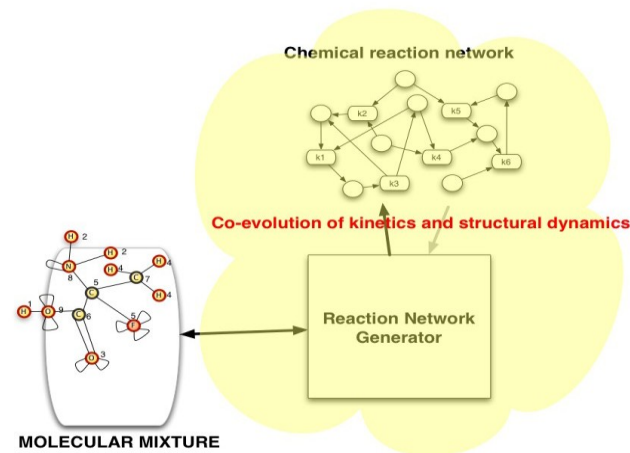
Doron Lancet, Rehovot, IL



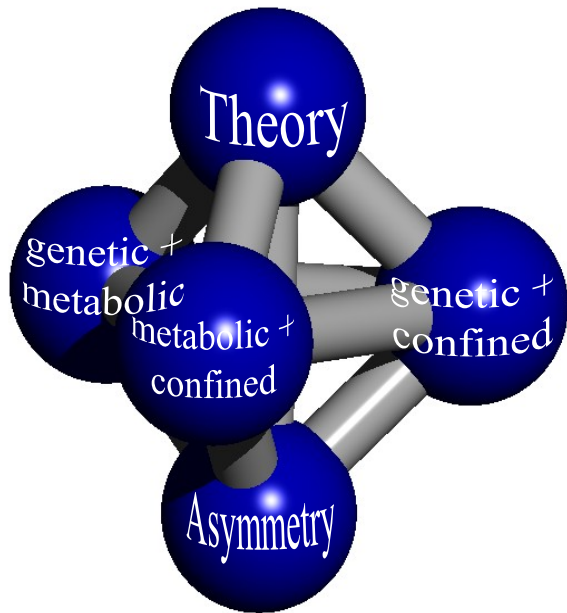
Hugues Bersini, Brussels, BE



The Graded Autocatalysis Replication Domain (GARD) model: mutually catalytic networks in a Lipid World



Action Structure, Organization & Timetable



- MC elected Steering Group with chair, vice, WG heads, STSM manager, dissemination manager, ESR speaker
- STSMs as dedicated instruments for ESR-based knowledge transfer
- Gender issue balance at the level of ESR exchange

Timetable of the proposed COST Action on Systems Chemistry

