

# Self-Creation of Chemical Structures. Experimental Study.

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## Research Article

**Keywords:** Thermodynamics , isolated system, chemical systems , compounds

**Posted Date:** May 11th, 2021

**DOI:** <https://doi.org/10.21203/rs.3.rs-480218/v1>

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ARTICLE

## **SELF-CREATION OF CHEMICAL STRUCTURES. EXPERIMENTAL STUDY.**

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### Abstract

First Law of Thermodynamics states that anything cannot be self-created or destroyed in an isolated system. Chemical systems spontaneously move to steady state. However chemical systems that are open, will create new systems and moving far and far from equilibrium. The simple compounds will spontaneously create unusually complex structures and behaviors. Surprising, general theory of these systems has not been well understanding. Chemical Simplest compounds can spontaneously produce complex arrangements, including chemical structures and dynamical behavior. They are building chemical cells that take chemical compounds from outside, next move to the cell, react, and new compounds move outside. Two other compounds may form more tubes that will create tower and next create metropolis. Machines can switch from one system to another. It can move like a snail. It is basic Law of chemical self-creation. We present simple chemical systems that will spontaneously create very complex structured and machines that may be on level of biology and above. In this paper, simple experiments will show that evolution in Universe is simple and create incredible chemical processes. Universal Chemical Machine can produce an infinite number of entities. Chemical organisms are self-created. It is the most important property of matter.

In this paper we discuss spontaneous development of systems chemistry with complex structures and complex behaviors. They have unusual property: spontaneous creation. The important question: how simple chemical processes are so “intelligent”. They are related to Chemical Garden that was subject of interest at least from 1646. This phenomenon was studied as scientist by French biologist Stephen Leduc in 1911: “Chemical Garden structures are close to living biological systems”. Dynamical research for Chemical Garden started in 20th centuries due to lack of successes in large studies in Origin of Life. Recent research, named System Chemistry, appeared with a large group of scientists. They are between chemistry and biology. It required prebiotic chemistry, complex systems, chemical self-organization, self-replication, physics, mathematics, and engineering<sup>1-20</sup>. Chemical systems have been studied in geological systems<sup>21-23</sup> on the ocean floor related to the origin of life.

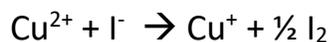
We will discuss experimental chemical systems that are creative chemical systems. How created systems produce themselves, how they continuously change and how their creativity is so incredible. Theoretically they can grow to infinity continuously increasing their intelligence. We will discuss surprising simple inorganic chemical compounds. The question is how small chemical reactions will spontaneously create these incredible entities. Complex chemical systems are already subjecting many chemical technologies like systems for micro- and nanotechnology, self-regeneration in the next work of prebiotic chemistry and technology called Fabrication by Reaction-Diffusion<sup>24-26</sup>.

## Results.

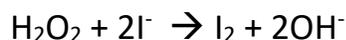
### Self-Creation chemical cells and their functions. $\text{CaCl}_2 - \text{Na}_2\text{CO}_3$ system.

In this reaction we present how few simple inorganic compounds will create spontaneously chemical cell and how inorganic chemicals move to the cell where produce another one that will diffuse outside<sup>27,28</sup>. A pellet of  $\text{CaCl}_2$  was inverted to solution of  $\text{Na}_2\text{CO}_3$  producing a spontaneous formation of a cell surrounded by a semi permeable membrane. Water and small molecules diffuse through the membrane. If the  $\text{CaCl}_2$  is doped with  $\text{CuCl}_2$  and the solution contain  $\text{NaI}$  and  $\text{H}_2\text{O}_2$  the membrane is changing: it become larger and has violet color from the presence of iodine. Iodide and hydrogen  $\text{H}_2\text{O}_2$  diffuse into the cell. They react inside the cell producing iodine and hydroxy ions. The process is catalyzed by  $\text{Cu}$  (II) ions inside the cell. The products diffuse out of the cell and the chemical reaction occurs only inside the cell.

The mechanism of iodine formation appears to follow:



General reaction is:



The detailed chemical mechanism the following: iodide and hydrogen peroxide diffuse into the cell. Iodide ions interact with copper (II) ions producing iodine and copper I ions. Hydroxyl radical reacting with copper(I) recovering copper (II) and producing a hydroxyl radical and hydroxy anion. The hydroxy radical reacts with iodide producing more iodine. Finally, iodine diffuses out of the cell.

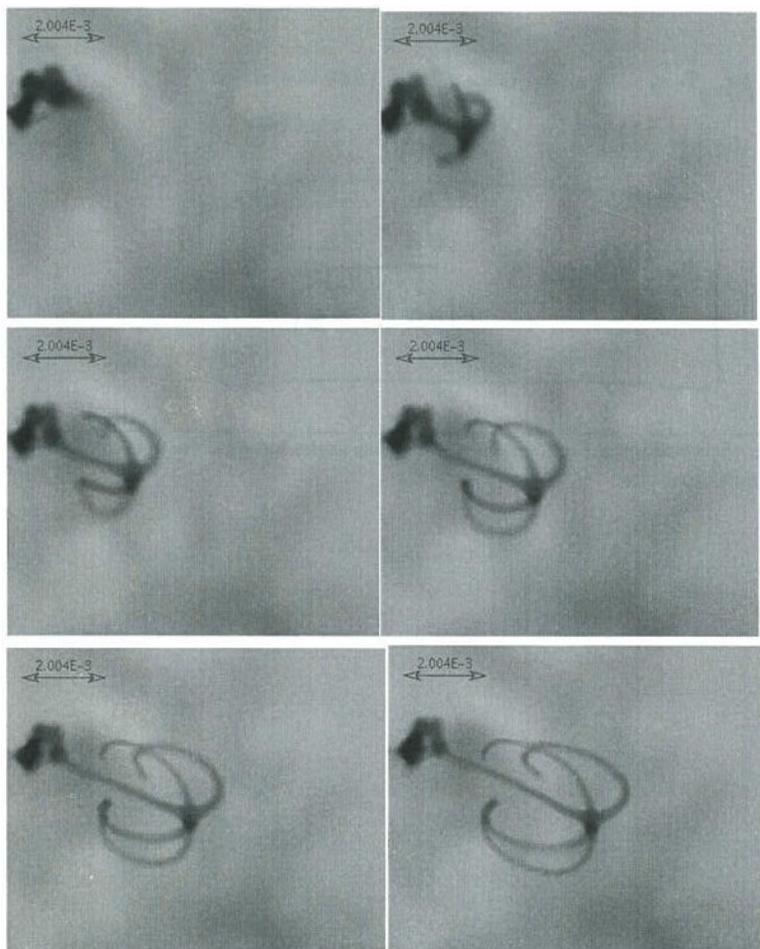
It is an example of complex chemical processes that move chemicals into different places of the cell, forming complex processes and remove produce in adequate

place. Chemical cell is a chemical machine. This sound like an incredible accident but it is the rule in Creation Chemistry. Iodine is essential element of life.

### **Self-controlling unusually complex tube networks: $\text{AlCl}_3$ + NaOH system.**

In this experiment  $\text{AlCl}_3$  was injected into NaOH solution through a needle.

The injection was mostly about 0.01s with 2.5 ml/min, NaOH was 2-4M and  $\text{AlCl}_3$  was saturated. The experiments are presented on Fig 1 are unusual<sup>29</sup>.



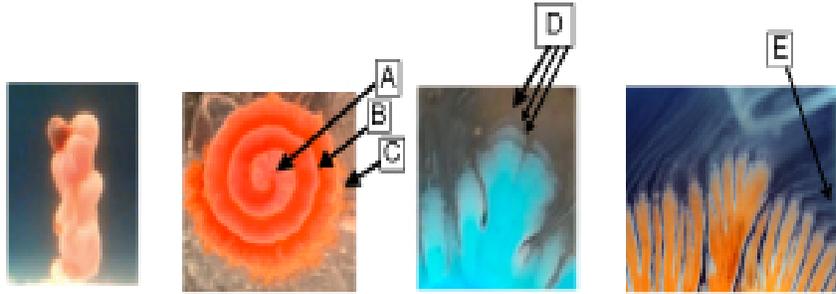
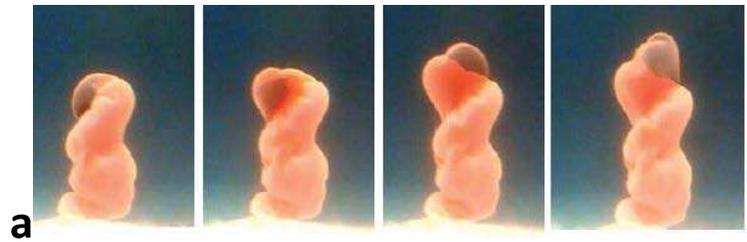
**Fig.1** Growing tuba network. On the top left is a small balloon of saturated  $\text{AlCl}_3$  and NaOH growing from a needle. The stem is a single tube from balloon to branches. Four branches (close to balloon) are growing at the same time. They are moving together with the top of the stem.

The stem is a single tube from balloon to branches. Four branches (close to balloon) are growing at the same time. The branches distribute symmetrically around the stem at the common junction. They are moving together with the top of the stem.

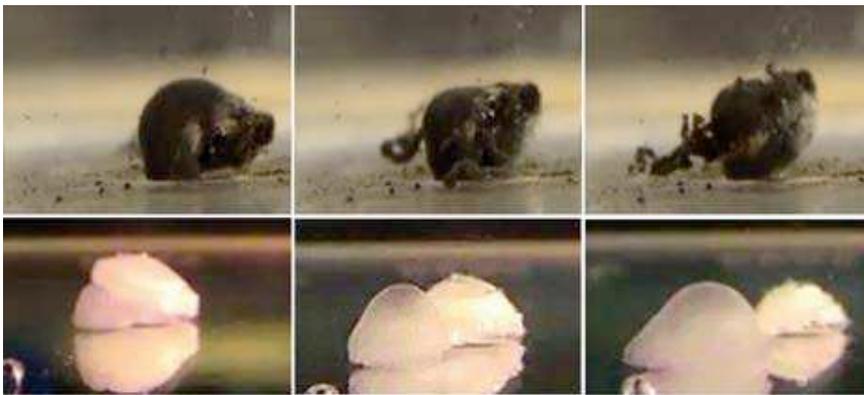
The branches are distributed symmetrically around the stem at the common junction. Branches and stem grow simultaneously, with the same rate and radii. It has never been observed in Chemical Gardens. The stem is smaller close to balloon and bigger in the injection where all are connecting. The number of branches is typically between 2 to 5. A single branch has never been. As single branch has never been observed. Using were high concentration of NaOH (4M) the more unusual tube network has multiple junctions splitting. The circle around the branches is constant all the time. It was observed that multiple tube networks could growth at the time at the same base. Where retraction, the branches and stem did not remain smooth but become bent and crinkly. Jets of one fluid into another usually do not move extremely far. A jet of fluid will only split by an external force transfer to the motion. Incredible that simple structures self-construct a system has only two simplest inorganic compounds. In this case the H<sub>2</sub>O is controlling chemical compounds and chemical compounds is controlling H<sub>2</sub>O. This experiment may have impact on micro and nanotechnology.

**Self-building complex towers, Ca<sup>2+</sup> - silicate and self-constructing different Chemical Machines, Al<sup>3+</sup> - OH<sup>-</sup> - CO<sub>3</sub><sup>2-</sup>**

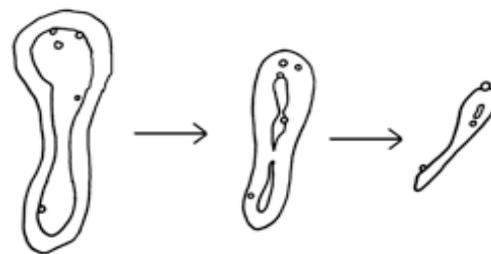
In calcium-silicate this system impulses are switching from one construction to another<sup>30</sup>. Aluminum -carbonate is forming 3 different Chemical Machines<sup>31,33</sup>. It is a beautiful example of chemical entities builder by many stages. Chemical systems may produce different structures and machines that produce different functions.



**b**



**c**



-----> Time ----->

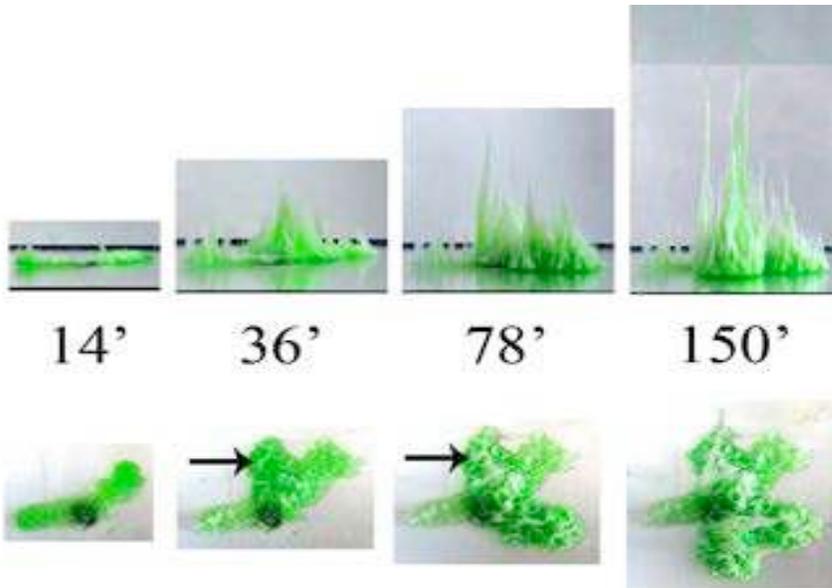
**d**

**Fig 2.** Spirals and Flowers. **a** Top: growth of Solomonic Column. The column climb itself forming spirals upward. **b** Bottom: after reaching surface the structure is forming next three different structures. It is transition from Solomonic structure to two kinds of channels A and B. Next the membrane breaks and internal solution spreads radially producing fingers C and D. The fingers (D) are producing grown from the tip toward the crescent and from crescent toward the tip. This process is repeating. The next new structures are made from small streams (E) with sizes than 0.1 mm and length around a few cm. They are final processes leading to Th. Eq. or producing garbage. **c Top** Cell that grows by itself, looking for legs and using them for movement. On the top is a chemical cell that continuously producing legs. These legs pushing to bottom and cell jump or rotates. **c Bottom.** Cell create a new cell on the bottom that is growing while the Mather cell is disappearing. **d.** Cell membrane with CO<sub>2</sub> bubbles inside. This cell is continuously moving up and down and is continuously shrinking. When the bubble is released, the cell is moving down and if cell is shrinking, it the cell is moving up giving an excellent example of Chemical Machine. (Reproduced from Langmuir, 2014, 30,5727-5731 with the permission of American Chemical Society)

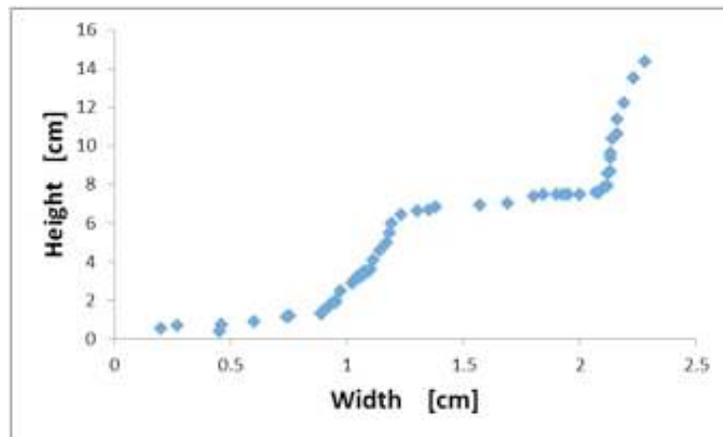
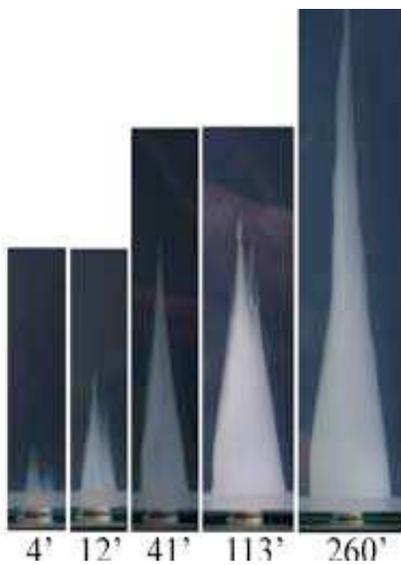
This system spontaneously creates amazing tube, many intricate structures, and a final structure. With small change in chemicals, system will create Chemical Machine with unusual property. Next, this Chemical Machine may switch from one Complex Machine to another with different mechanisms of chemical and physical structures. Chemistry is considered as a science of atoms and molecules where molecules are connected together. However, in self-creations research, the structures become more complex. In all experiments there are very complex structures with tubes, cells and solutions with unusual shapes and behaviors like in **Fig.2**. For example, the white structure (see bottom figure in Fig. 2 **c** grows in the bottom. Next a new cell developed and with first cell they are changing into two connected moving cells/machines. The new cell, in the bottom, begins growing where the bigger on the top is shrinking, thus in the Machine that have Mother and Daughter cell they are continuously attached on the another. The Daughter cell is continuously growing and moving far from the Mother that is still and shrinking. They have different colors as the cell is transparent. As a result, the one cell/Machine was changed into a second Machine.

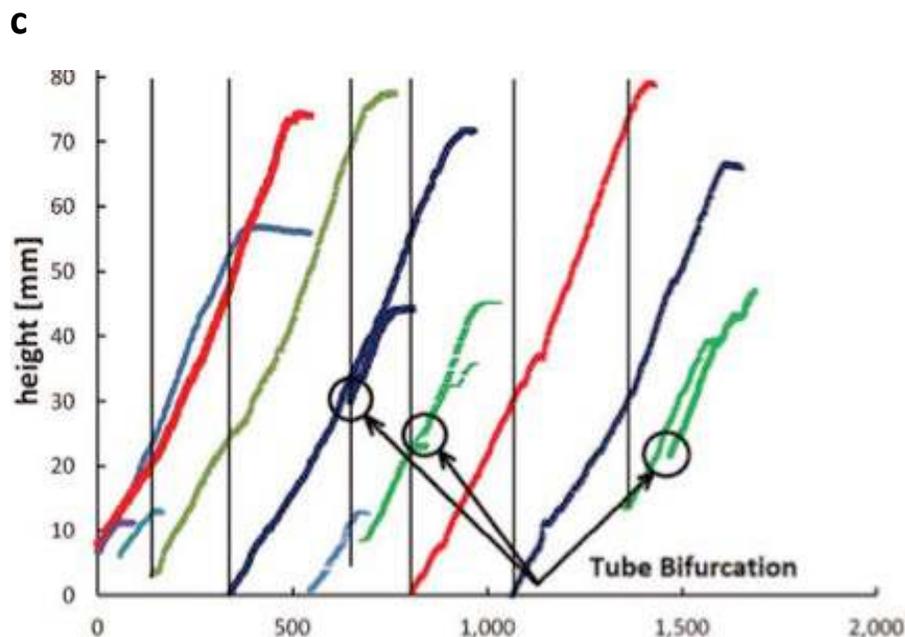
Self-creation of multicellular chemical organisms, behaviors as a whole.  $\text{AlCl}_3 - \text{SiO}_4$

a



b





**Fig. 3** On the top view **a** is the metropolis. On the side and from the top, with many towers. Below towers create building city. One tower stops growing then other tower is building. When city obtains many towers that a new metropolis is building. The youngest tower is always higher. **b** in the right the growth of pyramid is presented. On the beginning the structure is growing horizontally. X axis in seconds. Next the structure is growing only vertically, and this mechanism is repeating. **c** Different vertical tower is indicated by different colors. Cell growth and next terminated when cell reached critical height. Next the new cell starts growing. Sometime new cells do not growth but bifurcate. In this way only a 3 cells growth at the same time. It is beautiful example of cooperation in complex chemical systems.

Reproduction from Journal of Systems Chemistry 6:3 20125 A. Dyonizy, V. Kaminker, J. Wieckowska, T. Krzywicki, P. Nowak, J. Maselko, Cyclic Growth, of Hierarchical Structures in the Aluminum-Silicate Systems, Journal of Systems Chemistry 6:3 20125

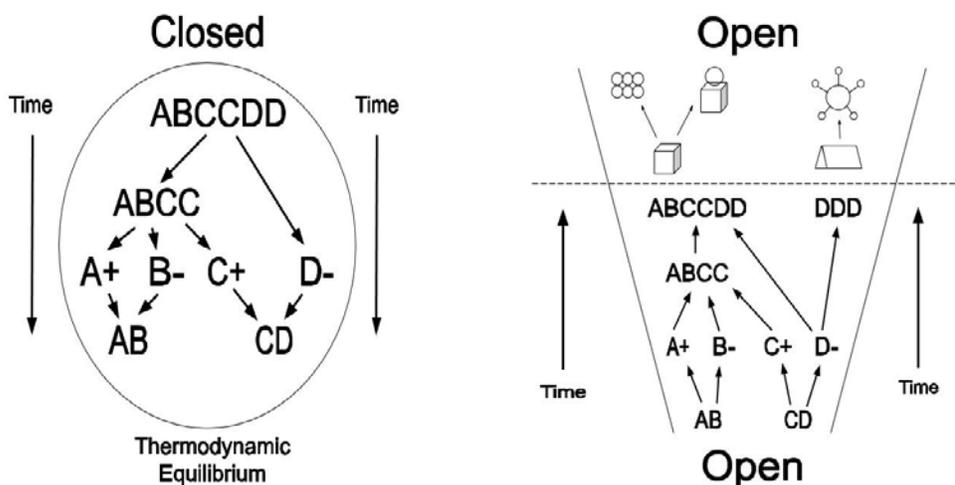
In chemical multicellular organism the cells “communicate” between themselves, as is seen in **Fig. 3**, keeping number of growing cells is constant<sup>32,33</sup>. The behaviors are organized. The important status: When tower is dying than next tower will grow. Structures are growing and switching to vertical and horizontally. Adding or

removing will change structure and behaviors. Creating is the most important property of chemistry.

### Toward chemical self-creation.

The first Law of Thermodynamics states that energy cannot be self-created or destroyed in an isolated system. It was developed by A. Lavoisier 1743-1794. The second Law of Th. states that the entropy of any isolated system always increases. The third Law of Th. states that entropy of a system approaches a constant value as temperature is absolutely zero. Every three cases are in systems that are closed.

In 1960 Ilya Prigogine defined dissipative structures at thermodynamic systems far from equilibrium. It led to self-organizing systems. S. Jorgensen: "If we pump energy into the system, the system will eventually utilize this energy". Sungchul Ji: "Emergence is the creativity of material systems; the creativity is the unpredictable reaction". These comments discussed chemical systems, however, experiments on these systems that continuously far and far from thermodynamical equilibrium (Th. Eq.) were poor. In even much stronger group worked on it from chemical approach. It was in 1646 by John Glauber. Next in 17<sup>th</sup> and 18<sup>th</sup> scientists like R. Boyle and I. Newton studied Chemical Garden. In 1911 St. Leduc carried out important research named them synthetic biology. It was the beginning of thousands of papers.



**a** Th.Eq. closed systems.

**b.** Law of creation. Infinite number of growing structures.

They are technologies for biology and systems chemistry.

**Fig. 4** Difference between chemical systems closed to Th. Eq. and continuously moving far from Th. Eq. **a.** On the left is closed chemical system. Chemicals are spontaneously changing and moving to Th. Eq. **b** on the right is open system with continuously supplied by energy and mass and create infinite number of structures. Structures build itself and next braked and forming another. The same is happening for any entities. This entity continuously bigger and complex more and more.

**Fig. 4** presents on the left Thermodynamic Equilibrium and Law of Creation on the right. On the right-side chemical reactions were formed. They can form chemical cells and multicellular structures. The next are Chemical Machines: device performing functional systems. Another is self-growing cities. In our experiments we have observed: complex structures, chemical cells, multicellular entities, complex behaviors, and complex self-controlling machines. These new chemical complex processes created itself very fast and in simple temperatures.

Open systems may create numbers of complex entities. In experiments the systems were far for thermodynamic equilibrium or was moving continuously far from Th.Eq. Chemical reactions require many processes if are made by humans, however, in the case of self-creation this is done spontaneously, by itself. Creations were studied for many scientists and many years<sup>34-44</sup>.

## Discussion

By nature, Laws are stated facts which have been deduced and derived based on empirical observations. The first law, also known as Law of Conservation of Energy, states that energy cannot be created or destroyed in an isolated system. It means that closed systems will change or create to any smaller system.

However, in open systems, chemicals will use energy and mass from outside, and continuously created very complex structures with behaviors with continuously increasing complexity. More and more. It is the Law self-creation.

The Law of self-creation is controlling development of the Universe.

All our experiments were performed only with simple inorganic systems to show the Law of creation, the incredible systems. The Law of creation will develop of chemistry, system chemistry and biology are controlling creation of Universe.

Self-creation of complex structures will be a new technology since almost everything will be able to produce itself. Structures in Creation are much more complex and shapes that regular human technologies.

Here we have the following creativity that is self: controlling mechanism. First is the creation of a cell, next the creation of the machine following by creation of many different few machines and next the switching from one mechanism to another. Look at Fig. 2. It is mechanisms of the chemical growing and developing forever.

Below are some important points concerning self-creations.

1. Using two simplest compounds, the chemical self-creations can grow to infinity.
2. Origin of Life is one on the most important phenomena in Universe. It is still do not understand. According to Darwinian explanation it was random accident to found chemical cell who may multiply and grow. The presented Low of Self - creation is much more scientific explanation.
3. How our simple chemical processes are so "intelligence"?
4. Without of self-creations the Universe will be a garbage.
5. Self- creation is probably the best technology for everything.
6. If there will be no Law of chemical self-creation, there will no biology.
7. Biology is relatively known. Self-creation is known very little.
8. The Law of self-creation is controlling development of the Universe.
9. Self-creation is the basic phenomena in the Universe.

### **Acknowledgement.**

I thank Prof. Agata Toth, Department of Physical Chemistry and material sciences, University of Szeged, Hungary for important discussions.

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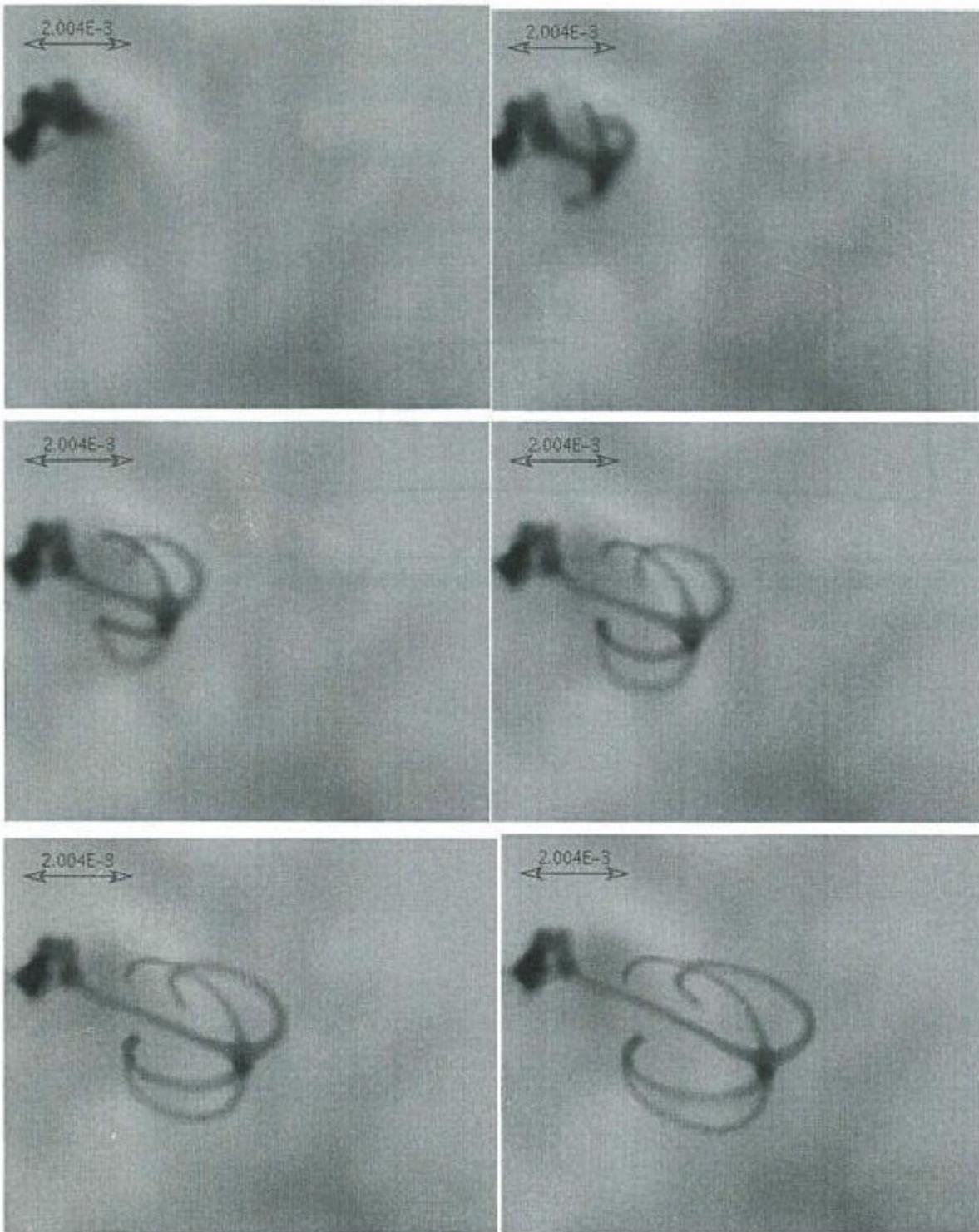
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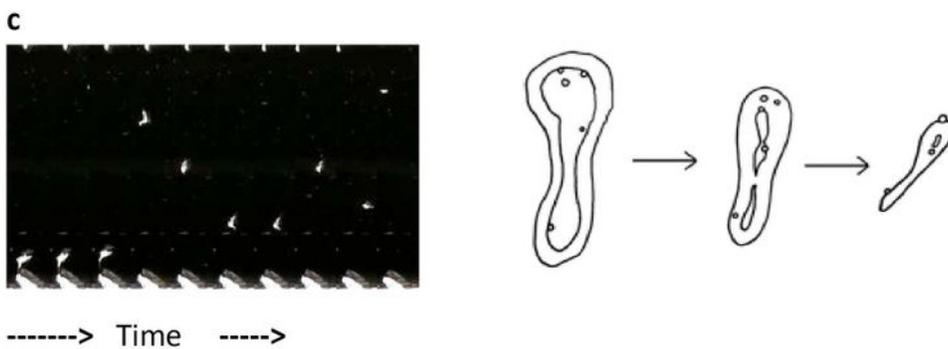
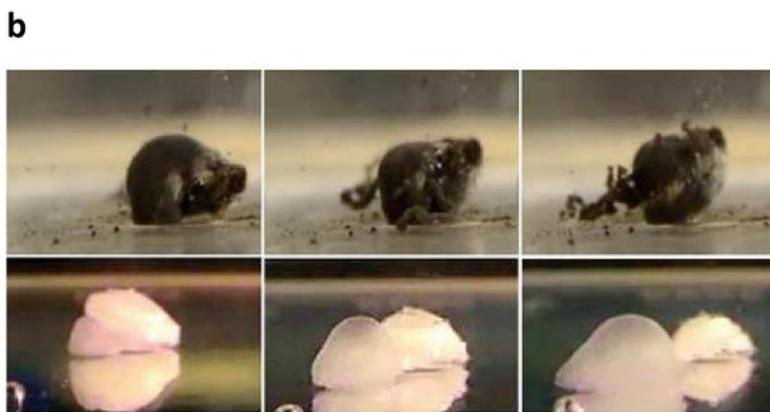
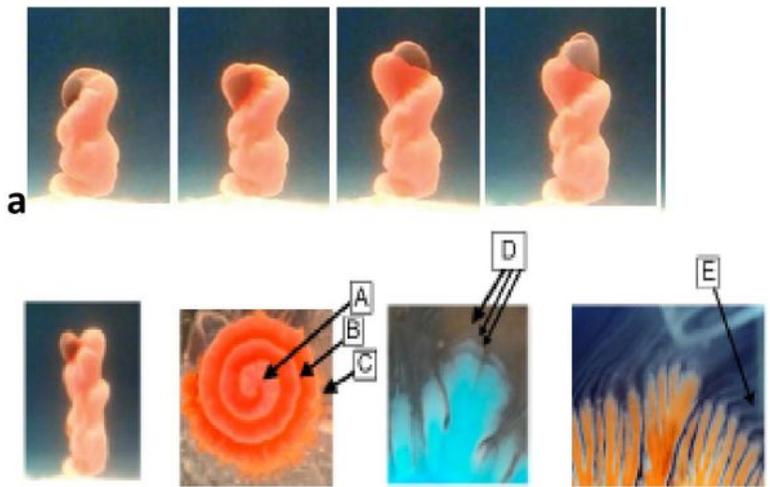


# Figures



**Figure 1**

Growing tuba network. On the top left is a small balloon of saturated  $\text{AlCl}_3$  and  $\text{NaOH}$  growing from a needle. The stem is a single tube from balloon to branches. Four branches (close to balloon) are growing at the same time. They are moving together with the top of the stem.

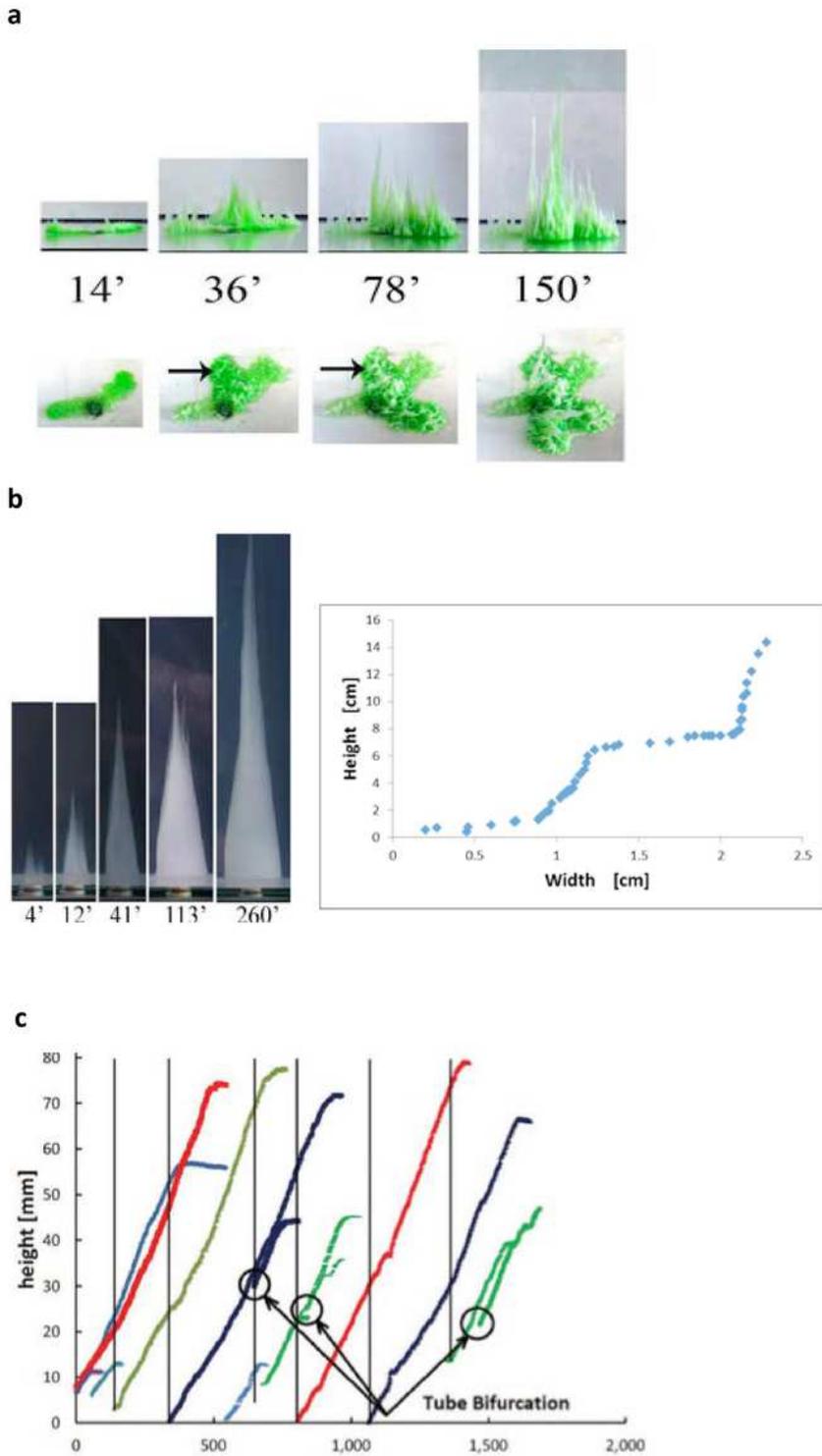


**d**

**Figure 2**

Spirals and Flowers. a Top: growth of Solomonian Column. The column climb itself forming spirals upward. b Bottom: after reaching surface the structure is forming next three different structures. It is transition from Solomonian structure to two kinds of channels A and B. Next the membrane breaks and internal solution spreads radially producing fingers C and D. The fingers (D) are producing grown from the tip toward the crescent and from crescent toward the tip. This process is repeating. The next new

structures are made from small streams (E) with sizes than 0.1 mm and length around a few cm. They are final processes leading to Th. Eq. or producing garbage. c Top Cell that grows by itself, looking for legs and using them for movement. On the top is a chemical cell that continuously producing legs. These legs pushing to bottom and cell jump or rotates. c Bottom. Cell create a new cell on the bottom that is growing while the Mather cell is disappearing. d. Cell membrane with CO<sub>2</sub> bubbles inside. This cell is continuously moving up and down and is continuously shrinking. When the bubble is released, the cell is moving down and if cell is shrinking, it the cell is moving up giving an excellent example of Chemical Machine. (Reproduced from Langmuir, 2014, 30,5727-5731 with the permission of American Chemical Society)



**Figure 3**

On the top view a is the metropolis. On the side and from the top, with many towers. Below towers create building city. One tower stops growing then other tower is building. When city obtains many towers that a new metropolis is building. The youngest tower is always higher. b in the right the growth of pyramid is presented. On the beginning the structure is growing horizontally. X axis in seconds. Next the structure is growing only vertically, and this mechanism is repeating. c Different vertical tower is indicated by

different colors. Cell growth and next terminated when cell reached critical height. Next the new cell starts growing. Sometime new cells do not growth but bifurcate. In this way only a 3 cells growth at the same time. It is beautiful example of cooperation in complex chemical systems.

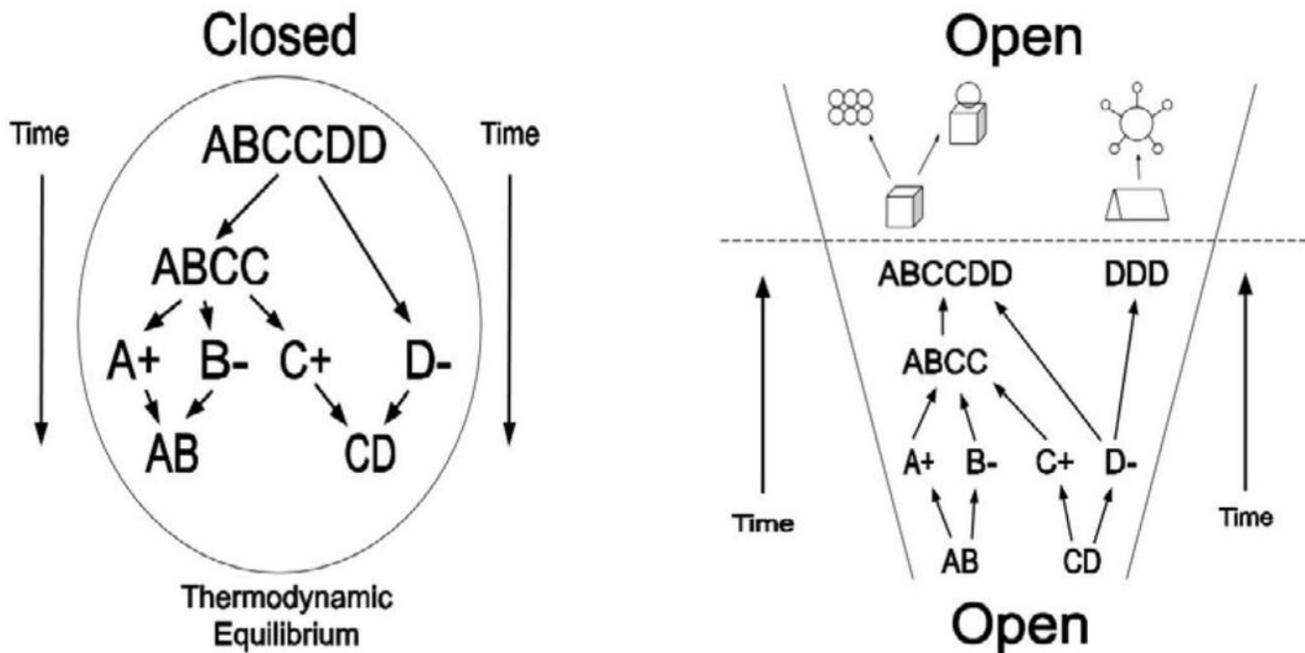


Figure 4

Difference between chemical systems closed to Th. Eq. and continuously moving far from Th. Eq. a. On the left is closed chemical system. Chemicals are spontaneously changing and moving to Th. Eq. b on the right is open system with continuously supplied by energy and mass and create infinite number of structures. Structures build itself and next braked and forming another. The same is happening for any entities. This entity continuously bigger and complex more and more.