The amount of organic compounds.

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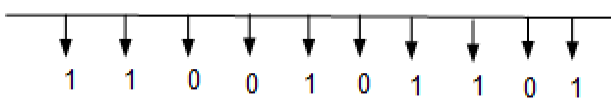
Abstract: It is shown that the amount of organic compounds is uncountable infinite set. Uncountable infinite sets is also the number of substances in one homologous series, the number of homologous series themselves, as well as the number of functional groups. Obviously, the carbon form of life has literally countless organic substances for the origin of life. It can be shown that the probability origin life in the infinite Universe is equal to one. It can also be shown that using the encoding of genetic information on “alkane DNA”, uncountable infinite sets of synthetic artificial biospheres can be obtained.

Keywords: amount of organic compounds, homologous series, isomers, functional group, “alkane DNA”, probability of the origin of life.

INTRODUCTION.

In the study of organic chemistry, as a rule, homologous series of various compounds are studied. The number of compounds in homologous series is assumed to be infinite, but the first 10 to 20 compounds are being studied. The first members in the homologous series are gases or liquids, followed by solids. In this context, the properties of the 100th member of the homologous series and the 1000th member will not differ very much, as these will be solids with similar chemical properties, and the physical properties will gradually change as the relative molecular weight increases. But, if we consider not the properties of molecular crystals, but individual molecules, then everything becomes much more interesting, since each member of the homologous series is a molecule with special properties. And, as the number of atoms increases, for example, to a million (n = 10^6), the properties of such molecules can change very much compared to molecules in which the number of atoms is 1000 or 100. This is especially important when studying the processes of the origin of life and spontaneous “assembly” of DNA.

Briefly consider the encoding of information in DNA. Suppose that the coding of genetic information in DNA is made in the binary system: 1 - purine bases, 0 - pyrimidine bases [1].



Then, using the transformed member of the homologous series of alkanes with n = 10^9, it is possible in principle to encode genetic information in "alkane DNA", and thus obtain a completely different form of encoding of genetic information. We emphasize that “alkane DNA” should lead to other types of viruses, bacteria, plants, animals, etc., that is, to a different form of life, and to a different biosphere. New types of viruses, bacteria and other living things, from "other" biospheres, will be absolutely safe for people and our biosphere. This guarantees the encoding of genetic information on "alkane DNA", since in our biosphere they will be just molecules, and no more. And interestingly, using different homologous series (that is, different types of coding), we can get a certain amount of completely different DNA, and therefore completely different biospheres. To assess the possible number of such biospheres, we need to know the number of molecules in the homologous series, as well as the number of homologous series themselves. Therefore, we need to answer the question: how many organic compounds are in homologous series?

RESULTS AND DISCUSSION.

The answer to the above question is: uncountable infinite set [2]. That is, for numbering all compounds of the homologous series, natural numbers will not be enough. Natural numbers represent a countable infinite set [3].

Let us prove that in any homologous series of organic compounds there is an uncountable set.

Consider the homologous series of alkanes, since this is the simplest series of substances, but using its example, we can show the basic laws and relationships in homological series.

CH_4,	CH_3-CH_3,	CH_3-CH_2-CH_3,	CH_3-CH_2-CH_2-CH_3,	….	CH_3-$(CH_2)_n$-CH_3
methane,	ethane,	propane,	butane	….	C_nH_{2n+2}

If we take into account the fact that in each subsequent term (of the homological series) the homological difference -CH_2- is simply added, then we can easily go to the natural series of numbers.

1, 2, 3, 4, ... n

That is, to each number from the natural series of numbers we can associate an alkane.

CH_4,	CH_3-CH_3,	CH_3-CH_2-CH_3,	CH_3-CH_2-CH_2-CH_3,	….	C_nH_{2n+2}
1,	2,	3,	4,	….	n

In fact, a natural number corresponds to an alkane with the same number of carbon atoms, which is confirmed by the general formula of alkanes C_nH_{2n+2}. A series of natural numbers is a countable set, therefore, alkanes by definition are an infinite set (like any other homological series). But, alkanes will be an uncountable infinite set, since with an increase in the number of carbon atoms the number of isomers sharply increases, and therefore, natural numbers for the numbering of all alkanes (including isomers) will not be enough. That is, alkanes are an uncountable infinite set. This can be generalized to all homological series, since structural isomerism occurs in all homological series without exception.

Thus, the number of substances in one homologous series is an uncountable infinite set.

Consider why structural isomerism, translates a countable set of substances in a homologous series into an uncountable infinite set.

We note that there are many isomers in organic chemistry, and structural is the simplest (atoms bind in different orders, but the number of such substances (isomers) becomes huge, for example, in $C_{100}H_{202}$ the number of isomers becomes 5.921 * 10^39, but the number of carbon atoms can be at least 1000 ($C_{1000}H_{2002}$), even 1 000 000 ($C_{1000000}H_{2000002}$), it is unlimited ..., we note that the number of isomers in C_4H_{10} - 2 isomers). In $C_{400}H_{802}$, taking into account stereoisomers, the number of isomers is 4.776 * 10^199 [4]. There is no simple relationship between the number of carbon atoms in alkanes (n) and the number of isomers, therefore, in 1931 a recursive method was developed to calculate the number of isomers (if we know the number of isomers for n, then we can calculate for n+1) [5]. Compared to the amount of organic substances (even in one homologous series), the number of elementary particles in the visible Universe is just miserable (tends to zero).

We show that the number of homological series themselves is also an uncountable infinite set. Consider the homologous series of alcohols.

$CH_3-(CH_2)_n-CH_2-OH$, $C_nH_{2n+1}-OH$ This is the first homologous series.

$CH_3-(CH_2)_{n-1} — CH(OH) — CH_2-OH$, $C_nH_{2n}(OH)_2$ This is the second homologous series.

$CH_3- (CH_2)_{n-2} – CH(OH) – CH(OH) – CH_2-OH$, $C_nH_{2n-1}(OH)_3$ This is the third homologous series.

…..............

$C_nH_{2n-k}(OH)_{2+k}$ This is 2+k homological series.

n and k are natural numbers.

Therefore, if we continue to replace hydrogen atoms with the alcohol group —OH in a similar way, then we get a countable infinite set of such “alcohol” homologous series. But, in each such homologous series, we can also replace hydrogen with other functional groups ($-NH_2$, -COOH, -SH, $-C_6H_5$, $-NR_2$, -OR, etc.), and then we get “additional” homologous series. Then the number of all such homological series will be an uncountable infinite set. In this case, the introduction of functional groups and the production of "additional" homological series is an "analogue" (so to speak) of the structural isomerism, which translates countable sets into uncountable sets.

It can also be shown that the number of functional groups is also an uncountable infinite set. To do this, consider what a functional group is.

A functional group is a grouping of atoms that is connected in a certain way and forms a new quality, that is, the functional group itself. It is very important that the functional group has unique chemical properties that differ from the chemical properties of its parts. This applies to "composite" functional groups such as amide, carboxyl, etc. The introduction of a functional group into any organic molecule will lead to the formation of a new molecule, which will also have the chemical properties of the functional group.

A functional group is chemistry in its "pure" form, since a chemical reaction in organic chemistry is the interaction of functional groups with each other, or with simpler reagents. Organic chemistry can be studied by studying only the chemical properties of functional groups. Such an approach, despite its simplicity, will ultimately lead to the study of homologous series, reaction mechanisms, and stereoisomerism, etc. of things, that is, to the study of organic chemistry in a classical form (by studying homological series with different functional groups).

We show that the number of functional groups also represents an uncountable infinite set.

Consider the phenyl radical C6H5-, this is an aromatic functional group. Now consider a series of condensed aromatic substances, starting with benzene:

benzene,

naphthalene (two condensed benzene nuclei),

anthracene (three condensed benzene nuclei),

tetracene (four condensed benzene nuclei),

pentacene (five condensed benzene nuclei).

Obviously, all these substances can easily be "converted" to radicals (in the theoretical sense) if the hydrogen atom is removed in the first position and the corresponding radical is obtained. Each such radical will be a functional group, and the number of such functional groups will be a countable infinite set, like a natural series of numbers (by the number of condensed benzene nuclei). But, as the number of condensed nuclei increases, isomerism is also possible (starting from n = 3), and therefore, the set of such functional groups will also be an uncountable infinite set.

In addition, we will be able to "get" radicals by "removing" hydrogen from other positions, and not just from the first, and we will always receive an uncountable set of such functional groups.

Why, we attribute condensed aromatic nuclei to functional groups requires an explanation.

A functional group is a group of atoms that has specific chemical properties. Moreover, if the functional group consists of two functional groups (for example, -CO-OH consists of -CO- and -OH, and -CO-NH2 consists of -CO- and -NH2), then its own chemical properties must differ from chemical properties of the functional groups of which it consists. Therefore, the chemical properties of the functional group are specific and characterize precisely this functional group. It is clear that in the general case, a functional group can consist of any number of functional groups.

The question may arise: why does a functional group have specific properties different from those of the groups of its constituents?

Because two groups (or more) in the formation of a new functional group actually interact with each other. This "interaction" occurs through the chemical bonds of these functional groups. After such an "interaction", the electron distribution is unique and different from what was in the original functional groups, and naturally, new chemical bonds are formed. From here unique and specific chemical properties of this functional group appear. For example, in the carboxyl group —COOH, the acid properties of the alcohol group —OH increased millions and billions of times, and therefore the —COOH group is a typical acid group. And in the amide group —CONH2, the basic properties of the amino group —NH2 have decreased millions and billions of times, and therefore the amide group has no basic properties. This is the essence of understanding what a functional group is.

Similarly, in a series of condensed aromatic nuclei, chemical properties are special for each member of such a series. And this is precisely due to the interaction of individual aromatic nuclei with each other, that is, as in composite functional groups. Therefore, each such member can be attributed to a functional group. And this is theoretically rigorous, since if in such a functional group hydrogen is replaced by alkyl radicals, then we get a typical homologous series of substances.

For the above reasons, heterocyclic systems (such as pyrrole, thiophene, imidazole, pyridine, pyrimidine, etc., are also functional groups. Moreover, they can be condensed both among themselves and with aromatic compounds. From this it is clear that the number of such functional groups will also be an uncountable infinite set. Replacing in any such group of a hydrogen atom with alkyl substituents we obtain a typical homologous series.

We have shown that the set of functional groups is an uncountable infinite set on the example of condensed aromatic systems, as it is simple and clear. Similarly, it can be shown by the example of condensed heterocyclic systems. Moreover, it is the chemistry of heterocyclic

compounds that is the most diverse and numerous. The chemistry of hydrocarbons compared with heterocyclic chemistry is much more “poor” and less diverse. But, precisely using the chemistry of hydrocarbons, we have shown that both the number of substances in the homologous series, and the number of series, and the number of functional groups are uncountable infinite sets. It’s hard to imagine how big the countless endless sets of heterocyclic substances will be ...
Obviously, only such an unimaginable amount of organic matters can provide the origin of life.

CONCLUSION.

It turns out that the amount of organic matters is an uncountable infinite set. Moreover, uncountable infinite sets are the number of substances in one homologous series, the number of homologous series themselves, as well as the number of functional groups. Obviously, only such an unimaginable amount of organic matters can provide the origin of life.

We can show, that the probability origin life in the infinite Universe is equal to one. The probability origin life tending to zero P(life) → 0. This follows from the fact that the probability of spontaneous “assembly” of DNA (RNA) tends to zero. The probability of spontaneous “assembly” of the cell (if there is already ready DNA) also tends to zero.

Let's move from the probability P(life) → 0 to a number, that is, P(life) = X. The idea is simple. The set of rational numbers on the segment [0, 1] is infinite, and countable (we include both 0 and 1). That is, near zero there will be a minimum rational number, by value it will be practically zero, but still it will be a rational number. We call this number a rational zero, and denote 0(R). But, our rational zero will not be the smallest number.

Even closer to zero will be an irrational number. This follows from the fact that between two irrational numbers there will always be a rational number. Zero is an integer, that is, a rational number, since it can be specified as a fraction, for example, such 0/1. In addition, the set of irrational numbers is infinite, and uncountable, and therefore, between zero and 1 (0, 1), there is an infinite set of irrational numbers, and it is uncountable (0, and 1 are no longer included in the set). Since the set of irrational numbers between zero and 1 is "greater" than the set of rational numbers, it follows that the "closer" to zero will be an irrational number. We call this smallest number imaginary zero and denote 0(i).

Our probability of the appearance of life is P(life) → 0, that is, the probability of the appearance of a cell will be just the imaginary zero P(life) = 0(i). And the probability of a self-consistent “assembly” of DNA (RNA) will be rational zero P(DNA) = 0(R). Now these probabilities are very small numbers that you can work with. Naturally, integrating them at infinity gives 1. This is clear if we recall that any number to the power of zero is one: a^0 = 1.

All of the above applies to the spontaneous origin of life in the Universe. If we encode genetic information on “alkane DNA” synthetically, that is, manually, then we can get uncountable infinite sets of synthetic artificial biospheres.

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