

A New Explanation of Homeopathy

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Abstract

This article covers the basics of a new model of homeopathy that is grounded in chemical thermodynamics. The equivalence between the disease-causing compound in a healthy person and the disease-causing compound in an ill person, which led to this interpretation of the new model of homeopathy, is well considered. The mechanism of curing, the Law of Similars, and the Law of Infinitesimals were considered. This article also discusses the basics of the dilution mechanism and its influence on the final concentration of remedy molecules in homeopathic solutions. The maximum number of succession steps involving vigorous grinding and dilution where the existence of a therapeutic concentration is still possible was considered.

Keywords: Homeopathy; Simillimum; Biochemical Equilibrium; Law of Similars; Law of Infinitesimals; Law of Mass Action; Le Chatelier Principle

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Introduction

Homeopathy, a form of natural medicine, is based on the idea of 'let like be cured by like', which is known as the "Law of Similars". This law states that a disease can be cured by a substance that produces alike symptoms in healthy people. It was proposed by Samuel Hahnemann and published in his well-known work *The Organon of the Healing Art*.

There are many clinical research presentations showing that homeopathy goes beyond a simple placebo effect [2,3], and despite a long history of scientific disagreement [4], homeopathy is a successful approach that is now widespread [5].

The principle of homeopathy is preserved in the "Law of Similars." This has always been a part of human history, and continues to this day. We now believe that this phenomenon is natural, and that it must have a basis in science, as is the case with many other phenomena that we have eventually been able to explain. Homeopathy is practiced today, despite being criticized in terms of medically validated results and the idea that it is based on unconfirmed findings that have no scientific evidence.

The basis of a homeopathic treatment is often discussed in the literature, although its origin, the mechanism of its action and the confirmation of its effectiveness in scientific terms were never clearly expressed. Homeopathy is also covered in books, such as those by Clarke [6], Vitthoulkas [7] and Bellavite [8]. Recently, researchers have proposed various theories about the properties and working of homeopathy. In general, current investigations proceeding to explain the homeopathic mechanism extend to interdisciplinary areas of science. Several models have been published: the quantum macro-entanglement model [9], the silica crystals and structures glass-derived concept [10], electromagnetic activities [11], biological signaling [12], the nonlinear dynamics of complex systems [13,14], stressor effects and

hormesis [15-17] and the biopsychosocial model [18].

Recently, chemical thermodynamics has been introduced to homeopathy [19]. The basic elements of chemical thermodynamics were included in homeopathy after considering the definition of disease presented by Samuel Hahnemann, where he associated the healthy state with the tuned state and the state of illness with the detuned state. Accordingly, healing is the return from the altered biochemical equilibrium (the detuned state) to the initial chemical equilibrium (the tuned state) to promote health and well-being [20]. During the explanation of the Law of Similars (LS), the Law of mass action (LMA) was applied [21].

Further studies have highlighted the importance of kinetics in the relatively small space of a human cell, where the equilibrium is limited by the reaction kinetics of successful collisions. This leads to the paradox that by decreasing the concentration of the remedy will upsurge the healing through the establishment of the starting equilibrium [22].

The comprehensive aspect of homeopathy [23] highlighted one of its most important properties, i.e., that the disease-causing compound in a healthy person must have the same chemical composition as the compound causing this disease in ill person.

The present article discusses the basic features of homeopathy, including the concentration limit, where we can use a thermodynamic model to explain homeopathy and achieve successful treatments.

The principle of healing in homeopathy

To cure a person, we must start with a chemical equilibrium that maintains this disease. Here, the biochemical equilibrium between the healthy state, representing with vital molecules $[A] = \sum_{na} A_n$ (which determines the status of the healthy patient), and the unhealthy condition, dependent on molecules $[B] = \sum_{nb} B_n$ (which determines the



status of the ill patient), are in equilibrium. Here, v_{na} represents the number of vital molecules A_n stabilizing the healthy state in the human body before the start of the illness, while v_{nb} represents the number of molecules of the B_n reaction products formed during the disease's development. We can present the biochemical equilibrium for the time when it is considered in the condensed form:

Vital molecules \leftrightarrow reaction products $[A] \leftrightarrow [B]$ and the corresponding equilibrium constant: $K = [B]/[A]$.

Here, $[A]$ represents the vital molecules stabilizing the healthy state and $[B]$ the disease-causing compound. The biochemical equilibrium governs the status of the sick person when visible signs of human behavior and appearance indicate that the expected patient status is a deviation from the normal and/or healthy state. The patient's appearance is a consequence of the compound $[B]$ causing this disease.

When a healthy person ingests an active substance that develops in the body the same symptoms as a sick person, we usually label this substance a remedy. In addition to the same medical symptoms, the remedy also develops in the human body the same chemical composition and resonance spectra as the disease-causing compound $[B]$ [23,24]. The remedy causes the disease and thus gives the healthy person the status of a sick person. In the human body, the remedy develops the reaction product Simillimum (compound) $\equiv [Bs]$ highlighted by Vithoukias; "In this way, gradually we acquire a sense of the essence or soul of the remedy" [7]. The $[Bs]$ is equal to $[B]$ in all parameters, so that $[Bs] = [B]$, and is actually the compound for homeopathic treatment. Here, the index indicates the reaction product of the remedy.

However, we cannot exclude the possibility that in some cases the remedy and the Simillimum might show a biochemical equality already prior entering the remedy in the human body.

When we recognize the equivalence $[Bs] = [B]$ we can start curing the ill person by applying the Le Chatelier principle governed by the LMA and the kinetic equilibrium.

The starting point in curing is the equilibrium composition $[A] + [B]$ of the diseased-state equilibrium $[A] \leftrightarrow [B]$ and the application of the Le Chatelier principle assisted by LMA, which states that "If a chemical system at equilibrium experiences a change in concentration, temperature or total pressure, the equilibrium will spontaneously shift to minimize that change". So, we add to this equilibrium $[Bs]$ and treat the person by making possible a thermodynamically grounded shift of the equilibrium towards the healthy state.

The formalism associated with curing in homeopathy is shown below and is connected with the addition of the remedy to the ill person, i.e., to the equilibrium composition of the diseased state $[A] + [B]$.

To a sick person we add for instance medicine $2[Bs]$ and obtain in the ill person's body the composition $[A] + 3[B]$. An increase in $[B]$ induces homeopathic aggravation. The aggravation of the disease will disappear when the total concentration of $[B]$ in the body decreases after the operation of the Law of Mass Action (LMA). During the operation of the LMA the composition in the system changes. Here, one $[B]$ changes to $[A]$, on account of the equilibrium constant $K = [B]/[A]=1$, and in the system (the human body) we obtain the chemical composition $2[A] + 2[B]$. Thus, $[A]$ in the human body increases by 100% relative to $[A] \rightarrow 2[A]$, while $[B]$ decreases by 60% $3[B] \rightarrow 2[B]$. Here, the LMA has increased the concentration of the vital molecules

$[A]$ at the expense of the added $[Bs]$ and consequently reduces the total concentration of $[B]$, removing the homeopathic aggravation and healing the patient.

The above presentation displays the very mechanism of shifting the equilibrium and the increasing the vital molecules on the bases of homeopathic medicine (Bs). with the assistance of LMA. The actual concentration of (Bs) that heals is due to kinetically reasons in fact extremely small.

The LMA assisted by the kinetic equilibrium in homeopathy is the reason that the disturbing condition (illness) caused by $[B]$ can be reversed by the addition of $[Bs]$ and increases the concentration of vital molecules.

Here, the negative approach/action (disease) caused by $[B]$ is changed to a positive approach (treatment) with the addition of $[Bs]$. In other words, homeopathy is a medical system that relies on the concept that a medicine $[Bs]$ whose pathogenesis is similar to the pathological symptoms of a particular disease will cure the disease if delivered in small quantities, which literally means '*let like be cured by like*'.

It is clear that the above derivation of the equilibrium is actually a thermodynamic interpretation of the Le Chatelier principle using the LMA. In the considered equilibrium the added $[Bs]$ induces a change in the concentration, and thus the equilibrium will spontaneously shift to minimize that change by increasing the quantity of vital molecules $[A]$ and decreasing the concentration of the disease-causing compound $[B]$.

The basics of the concentration paradox in homeopathy

In a human cell, which is large compared to the macromolecule itself, there is a relatively high concentration of macro-molecules located in micro-environments, within which each macro-molecule will operate. They are densely packed and occupy up to 40 % of the total cellular volume. This packing is referred to as macro-molecular crowding and contains different molecules (proteins, nucleic acids, and/or polysaccharides) of various sizes and shapes. Crowding reduces the volume of solvent that is available for other molecules in the solution [25]. The interactions between individual macromolecules and their immediate surroundings can strongly influence the equilibrium and rate of reactions in which these molecules participate. These are mainly macromolecular over-crowding, confinement and adsorption [26].

We believe that the chemical equilibrium is mainly affected by macromolecular over-crowding and the relative sluggishness of biochemical reactions because of the relatively lower rates caused due to the increased mass of most participating molecules and the viscosity of the protoplasm containing about 70% water and therefore the accumulation of reaction products on site. The environment is described as crowded and not highly concentrated or overcrowded when no individual molecule types are present in the cells.

The ingested remedy responds in the cell to form the reaction product $[Bs]$ by means of the same mechanism as it performs in a healthy person, as was identified when testing a large number of different substances. After making $[Bs]$ the restoration of the equilibrium of the organism to the healthy state takes place. Here, the increased concentration of individual molecules, due to the equilibrium processing after remedy uptake in the cell, induces a high concentration (over-crowding) and can be, in principle, disruptive to the subsequent process, so that the corresponding reactions can be steric/kinetic hindered and the equilibrium might be strongly delayed



or even not take place. By reducing the concentration of remedy uptake, we eliminate or decrease the molecular over-crowding and release the kinetic processes, thereby allowing the restoration of equilibrium and healing at a lower remedy concentration. This is the paradox of concentration in homeopathy, governed by the Law of Infinitesimal. On the other hand, by intensive mixing we produce more active molecules, without physical bonds between them, so the breaking of existing bonds and the formation of new bonds during the successful collision of constituents will be more effective and the intensity of the chemical reactions in the cells will increase, i.e., the number of failed reaction collisions will be reduced and the number of suitable reaction products per unit time will increase. Thus, the mixing-dilution (known as succession) can reduce the critical equilibrium concentration and consequently the healing will proceed at a lower remedy and or $[B_s]$ concentration. In over-crowding, the collisions cannot occur in the predicted time due to steric/kinetic hindrance. On the other hand, the lower concentration also successfully prevents the collisions of targeting molecules in the predicted time since there are not enough targeting molecules available. There must be optimal conditions where the practitioners observe an increasing therapeutic effect with respect to the dilution.

In principle, further dilution enables the healing of patients if there are molecules of remedy in the medical solution and/or molecules $[B_s]$ in the cells available. In that case the status of the medical solution can be taken as "infinity diluted", as that will determine the lowest concentration in the concentration range covered by the "Law of Infinitesimals", i.e., the "infinitesimal dose" [22].

In the case when the dilution is very high and the cells lack the $[B_s]$ molecules, the chemical equilibrium cannot take place and the treatment of the disease will be unsuccessful. Thus, it is important to know to what concentration limit and/or to what degree of succession the thermodynamic model can predict the positive treatment of diseases in homeopathy.

Remedy concentration limit and healing

When Hahnemann tested the remedies that caused disease responses in healthy people that were similar to the diseases he studied, he discovered an important phenomenon that had been experimentally proven and confirmed in others, i.e., that diluting and vigorously mixing the remedy decreases the initial homeopathic aggravation and improves the effectiveness of the treatment. Practice has confirmed that the degree of dilution of the remedy in homeopathic therapy can be very high.

When estimating the extent of the dilution (known as the dilution steps) and the corresponding residual number of remedy molecules in the medical solution, we will use the established Hahnemann approach, where in each step of the dilution process the original mixture is divided by 100. He introduced the hundredth dilution, i.e., CD, scale.

The starting point of the dilution process is 1 g of remedy that is recognized as causing the same disease symptoms in a healthy human body as the disease being studied. This 1g of remedy is mixed with 99 g of lactose and the mixture is carefully ground in a ball mill. The mixture is labelled 1CD (centesimal dilution). After intensive grinding 1g of this pulverized mixture is separated and the process is repeated twice, 99 g of lactose is added to 1 gram of the mixture and the mixture is ground. Accordingly, the three-times-ground-and-diluted mixture is labeled as 3CD.

Strong grinding reduces the particles of insoluble matter to nano

dimensions. This reduces their radius and the atoms on the surface have a large free-space angle where they have no neighboring atoms. The atoms are therefore much less bound and are released from the surface during intensive milling and bind by physical bonds to the lactose molecules.

In particular, when dealing with compounds with a compact structure and strong bonds can take a lot of time and energy to acquire a suitable amount of atoms/molecules in the medical solution.

In this way, even completely insoluble substances are converted into liquid preparations when they are dissolved in a mixture of alcohol and water and can then be considered as typical medical solutions.

In the wet part of the process, 100 milliliters of a solution of water and alcohol are added to one gram of 3CD mixture, and the mixture is stirred vigorously for a long time. This medical solution is designated 4CD. The procedure can be repeated several times and after dilution and vigorously mixing we obtain NCD labels. Here, N means the number of dilution steps. Lactose-related remedy molecules and or atoms are released in the human cells after the lactose metabolism. The released molecules then actively participate in chemical reactions that lead to the formation of the corresponding reaction product $[B_s]$ and equilibrium restoration.

As the dilution proceeds, the number of remedy molecules/atoms in the medical solution is reduced at each dilution step by 10^2 . To estimate the number of molecules/atoms in the selected medical solution (NCD) we need to know the remedy's molecular weight, because the number of molecules in one mole is defined by the Avogadro number A_n . For a very rough estimate, we assume that the molecular weight of the remedy is 100g/mol. The deviation is about $\pm 10^1$, (M can be about 10 to 1000 g / mol), which for an approximate estimate, when operating with numbers with twenty powers of 10^{23} , represents a deviation of 1/23 100 % or 4.3%.

When the medical solution is diluted to the point where there are no more remedy molecules / atoms in it and there are no $[B_s]$ molecules in the human cells, then there will be no biochemical reactions and no equilibrium restoration and healing. When we want to reach the Avogadro limit, where "no" remedy molecules are present in the medication solution, we must use a more than 11-step dilution, i.e., $N = 11$ CD (10^{22}). This will practically exhaust the remedy molecules from the medical solution and reach the Avogadro limit, i.e., $6.023 \cdot 10^{23} / 10^{22} = 60.23$ molecules. Here, we anticipate that the number of remedy molecules is proportional to the $[B_s]$ molecules formed.

An assessment shows that 10^5 to 60 molecules of remedy and the corresponding $[B_s]$ molecules can remain in the cells at dilutions up to 8-11CD. The lowest therapeutic concentration required to perform a treatment is not known; however, we can be sure that below the Avogadro limit the thermodynamic model does not predict any healing.

It should be noted that above estimate is justified if the number of molecules and/or atoms does not increase during mixing-grinding and dilution (succession). However, during succession there can be release of atoms/molecules from the nanoparticles surface. In the extreme case, the number of atoms or molecules released during succession can, in principle, be able to compensate for dilution maintaining constant concentration of species up to their disintegration. In exceptional cases, the solution may still contain a certain number of species after intensive dilution (succession) when reaching Avogadro's limit by serial dilution. In this case, their therapeutic effect should be not considered as a placebo effect. According to statistics, there are



about 25% of homeopathic medicines (on sale) that supposedly do not contain molecules of the starting material. However, there is no experimental evidence for this hypothesis, so we will not consider this possibility and ponder that during succession comes not to a notable increase of the absolute number of species.

The thermodynamic model can explain the strong dilution and treatment in homeopathy if the molecules of [Bs] are present in the cells. Or, in other words, by vigorous mixing and dilution, we reduce the molecular overcrowding and increase the reactivity of the remedy molecules, leading to a lower critical concentration of the remedy and or the reaction product [Bs] required to establish the equilibrium and healing. This dilution process can take place as long as the [B_s] molecules are available in the cells.

On the other hand, the process of extreme dilution by potentization (above 11 CD) without the presence of remedy molecules in the medical solution transforms the medical solution into a “dematerialized spiritual force” where the possible effect of treatment can be addressed by a “vital energy” model [27,28]. In this case, the cell’s constitution remains unchanged as there are no [B_s] molecules in it. They are dominated by [B] molecules, whose concentration alone cannot contribute to restoring the equilibrium of the organism of the healthy person, but maintain the original disease state.

Very high dilutions >11CD are not supported by all homeopaths. Most homeopaths who were initially physicians use a less-diluted medical solution that rarely exceeds 11 CD. In that case we have [B_s] molecules present in the cell, so that we can explain the most important phenomena of homeopathy on the basis of chemical thermodynamics: the Law of Similars [21] the Law of Infinitesimals [22] and the homeopathic aggravation [23].

The separation between the lower dilution steps (potencies) <11 CD (molecule [B_s] present in the human body and cells) and the higher dilution steps (potencies) > 11 CD (no [B_s] molecules) followed the conceptual strategies.

Those who favor low dilutions emphasized the strong association with conventional medicine, while those who favored high dilutions emphasized the “vital energy” model and the nonphysical interpretation of the disease, or in other words, for mental health issues at high potencies > 11CD and lower potencies <11 CD for physical illnesses.

Conclusions

Homeopathy is a natural phenomenon dependent on the Le Chatelier principle governed by the LMA and kinetic equilibrium taking place in the confined space of human cells, which dictates the course of the mechanism in which the molecular density and viscosity of the protoplasm play an important role, manifested in low critical concentrations of remedy in a medical solution and [B_s] in the cells needed to successfully achieve equilibrium and appropriate treatment. The thermodynamic model can explain the strong dilution and treatment in homeopathy if the remedy molecules are present in a medical solution.

By succession we reduce the molecular overcrowding and increase the reactivity of the remedy molecules, leading to a lower critical concentration required to establish the equilibrium and healing. This dilution process can take place as long as the remedy molecules are present in the medical solution.

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