

Ali je homeopatija povezana s kemijsko termodinamiko?

Is Homeopathy related to Chemical Thermodynamics?

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Izvleček

V članku je biokemično ravnotežje uporabljeno kot izhodišče za uporabo Le Chatelier–Brounovega principa za razlago mehanizma homeopatskega zdravljenja. Uporaba kemijske termodinamike pri glavnih načelih homeopatije osvetljuje znan homeopatski izrek Zakon podobnosti. Poleg tega je podan razlog intenzivnega razredčenja homeopatskih učinkovin.

Abstract

In the present article, biochemical equilibrium is used as a starting point for the application of the Le Chatelier–Broun principle in order to clarify mechanisms of homeopathic treatment. The application of chemical thermodynamics to the main homeopathic principles elucidates the well-known "Law of Similars". In addition, the theory of intensive dilution of homeopathic remedies is discussed.

INTRODUCTION

Homeopathy is a treatment method introduced into Germany at the end of the 18th century by Hahnemann and has remained popular ever since. This routine is currently very widespread, in spite of it being criticized with respect to actual medically proven results and a belief that it is based on unproven assertions lacking scientific evidence. The basic principle behind homeopathy is the so-called "Law of Similars," which is sometimes explained by the axiom "like cures like."

Homeopathic remedies aim to stimulate the body's innate curative mechanisms, as it is believed that any physical disease also has perceptual and emotional components. Thus, a homeopathic assessment encompasses physical indicators, current emotive and psychosomatic states, and the patient's constitution. The most appropriate remedy, therefore, must take into account all of these aspects, so that each diagnosis and therapy is individualized.

A tentative approach to homeopathic treatment

Herein, an attempt is made to draw interest to the thought that homeopathy might be considered as a thermodynamically backed, chemical phenomenon and, as such, is interrelated with science, irrespective of whether or not its methods are useful therapeutically. In the literature, the foundation of homeopathic healing was, and still is, often discussed; however, the origin and/or support for its effectiveness in light of scientific declarations, has not been explicitly considered. Generally, explanations are implicit, in spite of the fact that thermodynamic principles (e.g., the Le Chatelier–Broun principle) are only briefly mentioned in parallel with other natural principles (1). However, explanations for the healing effects of homeopathy are often proposed mostly on a semi-quantitative basis (2). Recently, a bio-psychosocial model was introduced which is believed to offer sufficient insight to introduce novel homeopathic theories (3).

One of the main weaknesses of homeopathy is that it cannot be explicitly supported by medical science

or other scientific disciplines. On the other hand, homeopathy is closely associated with the "Law of Similars," which is seen as a particular rule that has been used by homeopathic practitioners since the inception of homeopathy. In addition, homeopathy is criticized as there is no homeopathic remedy confirmed to yield clinical effects that are credibly different from those of placebos and that the best clinical verification for homeopathy to date does not endorse its use in clinical practice.

Nonetheless, homeopathy is used to a large extent in daily life and the number of users and members of the homeopathic community continues to grow and their influence on society at large is, in spite of the lack of clinical evidence, relatively extensive. So, one cannot simply ignore the methodology of homeopathy and must wonder whether there could be something more scientific than simply the "Law of Similars". The "Law of Similars" can be understood as an axiom linked to thermodynamics, governing the earliest homeopathic observations during the use of such remedies in healing.

As a starting point we will assume that a great majority of physical diseases of the human body are connected with biochemical reactions that are in a dynamic equilibrium. An adult human body consists of, in terms of weight, about two-thirds water, most of which is located within cells, while the remaining water is extracellular, generally in the blood plasma and interstitial fluid that bathes the cells. The extracellular water amounting to about 5% of body weight, serves as a supporting fluid for the blood cells and acts as a means of transporting chemicals between the cells and external environment. It is basically a 0.15 M solution of salt (NaCl) containing smaller amounts of other electrolytes, of which the most important are bicarbonate (HCO_3^-) and anionic proteins. Thus, biochemical reactions take place in a closely linked system. The response time of biochemical reactions to maintain equilibrium is longer than in the case of ionic reactions; however, they are always relatively quickly

synchronized with the body's state of health. Hence, the human body can, in this context, be treated as a homeostatic "reaction vessel," in which the temperature and pH are maintained at constant values to facilitate individual biochemical reactions. These reactions are linked to one another via equilibrium constants, where the rate-limiting mechanisms (i.e., the slowest reaction) determine the final complex biochemical equilibrium.

Let us define the biochemical equilibrium in the body of a healthy patient as the starting point for further consideration. In an ill patient, the whole biochemical equilibrium complex deviates from a healthy state. This new equilibrium state then governs the status of an ill patient; however, in such cases, visible signs of the patient's behavior and appearance indicate that the anticipated medicine is a deviation from the norm and/or healthy state. Therefore, the patient's behavior is implicitly linked to essential biochemical reactions of the new equilibrium state.

A basic thermodynamic principle for all dynamic chemical equilibria, to which the biochemical reactions in the human body are certainly subjected, the Le Chatelier–Broun principle, known in chemistry for nearly a century and thermodynamically well grounded: If a chemical system at equilibrium experiences a change in concentration, temperature, or total pressure, the equilibrium will shift in order to minimize that change. This qualitative law makes it possible to envisage equilibrium displacement in a chemical reaction. However, this law is much more general and can be extended to all processes in which dynamic equilibria are essential. In that light, one must consider the thermodynamic principle that biochemical reactions in a dynamic equilibrium will alleviate any disturbance by shifting the equilibrium in the direction that will mitigate it. So, when a disruption exhibits similar symptoms to the original disruption and shifts the equilibrium from the original basic equilibrium state to a new one inducing illness to the human body then, in light of the Le Chatelier–Broun principle, this new chemical

equilibrium will alleviate this disturbance and shift the equilibrium in the direction of the original equilibrium associated with a healthy state. This is actually the basic thermodynamically grounded mechanism of the healing principle of homeopathy and encompasses the axiom "like cures like".

Thus, on this basis, one has to find suitable substances (i.e., remedies), which will cause similar symptoms as the targeted disease to boost the body's immune response to the disease. So, a homeopathic practitioner searches for a substance that produces, in a healthy person, those same symptoms that a patient experiences in an ill state. However, the selection or acquisition of such a substance, for this argument, is not germane.

To illustrate this point, we can cite the most outstanding example of homeopathy, the influence of *Atropa belladonna* (common name, deadly nightshade), which induces fever in healthy patients and is a homeopathic substance used to heal the fever of sick patients. Indeed, there are many other substances that exhibit a similar curative effect. With the unique axiom "like cures like," one can make an assertion that the biochemical reactions in the human body that causes, in this case, a high fever induced by consumption of *A. belladonna*, that according to the general thermodynamic principles, the body will force the targeted biochemical equilibrium in a direction to mitigate the disturbing influence of the homeopathic substance that decreased the body temperature, which is, in effect, healing the fever using homeopathic substances. Thus, homeopathic healing is a phenomenon based on chemical and thermodynamic principles and should be, in theory, also valid for similar homeopathic remedies. In healthy patients, homeopathic substances will cause symptoms of the illness for which it was introduced in the patient. Therefore, the difference between homeopathic healing and classical medicine is in the fact that in the former case, healing is implicit since one does not know which biochemical reaction is essential, but the human body, assisted by chemical thermodynamics, spontaneously selects

the proper mechanism, while classical medicine is targeting the reaction that is believed to be the key biochemical reaction.

Homeopathy is combined with the technique of the so-called “dilution of homeopathic remedies” and was introduced in the early stages of homeopathy, as homeopathic remedies were themselves substances that caused similar symptoms as the actual diseases and were, in many cases, simply toxic to the body.

In homeopathic reports, there are large differences in the amounts of administered ingredients, the methods by which data are recorded, and the lengths of studies. In addition, a substance with a certain activity with a positive pharmacological effect might, with another dose, stimulate the human body in a completely different way. Consequently, the concentration of a remedy must be precisely optimized. Since the effective concentration of a substance that governs biochemical equilibrium is often extremely low, the concentration must be optimized by trial and error, which demands extensive dilution. This dilution technique was criticized using the argument that the concentration of most homeopathic remedies that have a healing effect cannot be chemically analyzed due to very low concentrations. However, due to the very large number of atoms or molecules that make up Avogadro's number (N_A), the concentration and/or its mole fraction that show a healing effect can be incredibly small due to the enormity of N_A and can effectively govern the biochemical equilibrium.

Very weak concentrations of chemicals can yield an enormous number of molecular species, which then operate in the body and might effectively govern the biochemical equilibrium linked to the targeted disease. So, a very low concentration of any solute, for example, parts per billion, can yield 10^{14} molecular species, which may be sufficient to influence biochemical equilibria. However, the extremely weak concentrations applied means that the amount of the solute cannot usually be determined by analytical means and must be in the N_A range, otherwise the entirety of homeopathic principles covered by chemical thermodynamics or any other current scientific knowledge is meaningless.

On the other hand, the healing effect of extremely diluted (i.e. ultra diluted) aqueous solutions, in which the solute can be treated as being absent, is not connected with the subject of this contribution. Here, the belief regarding the so-called “memory effect” of water published by Jacques Benveniste in *Nature* in 1988 (4) failed; however, there is certain evidence that water maintains some structure, depending on its origin (i.e., the solute originally in solution) with regard to the distribution of clusters of water molecules bound by hydrogen bonds (5), in spite of the fact that the formation and disruption of hydrogen bonds in water was found to occur over very short times (6). However, this issue was not the aim of the present contribution and should be considered elsewhere.

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