Decrease of the variability in the impact of UHD on plant models

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The creation of form, in the context of life, appears as a language. The descriptions and explanations furnished by the natural sciences concerning life attempt to relate the events which take place at a reductionist level, using complex algorithms which should be suitable for formalizing biological processes. For example, some authors, such as S.N. Salthe (Evolving Hierarchical Systems, 1985) and G. A. Chauvet (Hierarchical functional organization of formal biological systems: a dynamical approach, 1993), have tried to formalize the functional structure and the morphological structure of living organisms, observing it them as an organizational hierarchy." "Chauvet's method consists essentially in connecting the dynamic description with the topological description. The dynamic description describes functional interactions, while the topological descriptions define the spatial-temporal changes in the processes associated with these interactions. Regarding the second description, a principle is sought, by means of a "variational" approach, to explain the topological stability of the system, like Hamilton's principle for the mechanics of conservation systems. Thus, an attempt is made to compare biological systems with physical systems. The topological structure of the biological system which emerges from this approach, is a hierarchical system whose 'principle of stability' for temporal evolution is deduced from a function of a state called 'organizational potential'. This principle of stability, due to the non-symmetry of the functional interactions, can be considered as 'a principle of the increase of functional order by means of hierarchy', and tends to bring the system to a stable state where specialization is at a maximum.. Instead, for the dynamic description of processes associated with functional interactions, Chauvet proposes a 'field' theory, in which physiological processes are construed in terms of the transport of a field variable, subject to the action of a specific field operator. A consequence of the hierarchy is that the field theory is based on a concept of non-locality, including a non-local and nonsymmetric interaction operator. The type of formulations used in this work give rise to a consistent definition of self-organization. A formal biological system (FBS) is found to be self-organized if it evolves from a given stable state to another stable state, on the basis of its dynamic characteristics (D-FBS), influenced by certain modifications in its topology (O-FBS). The properties 'deduced' from this formalism reveal the relationships between geometry and topology in a 'formal biological system'. This work outlines a programme of theoretical biology which brings to mind the transition from Newton's experimental mechanics to Lagrange's analytical mechanics. In both cases the formal/deductive aspect is predominant and the organic world is idealized to a certain extent. (D. Nani, Mathematics and morphology: essential points in the theory of knowledge, in Under the ashes of science, 1995.) All the algorithms used in these works can be seen to be "surrogates" with respect to the visible form of living organisms. Research into the effect of ultra high dilutions (UHD) (ultra high dilutions of substances which are biologically active) on in vivo and in vitro models of germination and growth of wheat seeds, carried out in the Department of Science and Agricultural Technology at Bologna University, highlighted the presence of a systematic decrease in variability. As can be seen from the abstract: "A series of experiments, performed on plant models with ultra high dilutions (UHD) of arsenic trioxide at 45th decimal potency, has been reviewed with a particular focus on variability. The working variables considered are: the number of germinating seeds out of a fixed set of 33, the stem length of wheat seedlings and the number of necrotic lesions in tobacco leaf disks inoculated with tobacco mosaic virus (TMV). A thorough comparison between treatment and control group has been proposed, considering the two main sources of variability in each series of experiments: variability within and between experiments. In treated groups , a systematic decrease in variability between-experiments, as well as a general decrease, with very few exceptions, in variability within experiments has been observed with respect to control. Variability is traditionally considered as control parameter of model systems. Our hypothesis, based on experimental evidences, proposes a new role of variability as a target of UHD action". (D. Nani, M. Brizzi, L. Lazzarato, L. Betti, The role of variability in evaluating ultra high dilution effects: considerations based on plant model experiments, 2007). The experimental demonstration of a systemic tendency in a biological process

highlights, therefore, the activity of the life characteristic which we have called totality. These experiments, together with other experiments , (L. Betti, G. Trebbi, M. Brizzi, G.L.Calzoni, F. Borghini, D. Nani, Effects of homeopathic arsenic on tobacco plant resistance to tobacco mosaic virus.Theoretical suggestions about system variability, based on a large experimental data set, 2003), have shown that the plants used for the research, subjected to the action of arsenic trioxide, using different ultra high dilutions, react in the way structures which are capable of non-local behavior react. It is not a question of parts of plants, or focal points - such as receptors - following the theory based on the molecular/receptor model, which respond to the stimuli. Rather, it seems that the plant responds as a whole. Within the remit of this text, we can say that the ultra high dilutions do not seem to act either on specific loci in parts of each of the little plants, or on each individual plant as a separate entity, hence as an independent plant. On the contrary, a principle of supra-individual equilibrium seems to come to the fore, such that the plants behave like units of a multiplicity which tend to react as a system. This principle of equilibrium seems to oblige each little plant to grow, or stop growing, within limits imposed by a specific constraint which governs the whole system. This gives changes in the plant the appearance of a wave in continuous fluctuation. It is interesting to note that systematic reduction in variability emerges as a probabilistic concept, hence, formalizing experimental data can only be based on statistical algorithms.

The research group of University of Bern, in the work Reproducibility of effects of homeopathically potentised gibberellic acid on the growth of Lemna gibba L. in a randomised and blinded bioassay, 2014, did state "Apart from mean growth rates we also investigated the variability (SD) of the growth rate. We observed the consistent phenomenon that potency series exhibited a lower within-group variability than the allocated SNC series, though the magnitude of the reduction of SD in the four se- ries differed to some extent (5%e22%). This may suggest an effect of the homeopathic treatment also in potency series 2 and 3, where we did not find significant effects in mean growth rate. Baumgartner et al. observed a similar phenomenon after treating dwarf peas with potentised GA3: the substantial dose 4x of GA3 induced a more het- erogeneous growth, whilst 17x increased homogeneity of shoot length.52 Nani et al.53 investigated the hypothesis that homeopathic potencies might induce a systemic reduction of variability, or an equilibrating effect. Nani et al. observed a decrease in variability induced by the treatment with Arsenicum album 45x in several experimental systems: in a wheat germination and wheat growth model with or without preliminary intoxication with sublethal doses of As2O3, and in a phytopathological model, where tobacco leaves were inoculated with tobacco mosaic virus (TMV). Hahnemann's theory of homeopathic action was that the primary action of homeopathic treatment provokes a sec- ondary action or counteraction of treated organism to restore the normal condition (x63, 66, 112, 114).54 If we use Hahnemann's theory, a possible equilibrating effect in the PE could be produced by a secondary action or coun- teraction of test organism to the homeopathic treatment. The more homogeneous growth in all PE could be an indi- cation of the restored normal condition after a homeopathic treatment." From this point of view decrease of variability could be considered the target for a theory of homeopathy.