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Geometrische Kristallmorphologie auf projektiver Grundlage

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Crystals fascinate us with their clear shapes and with their sensual attributes such as colour, luster, hardness, etc. and by their variety of substances. Each of these aspects corresponds to a field of study within scientific crystallography: crystal morphology studies possible and actual shapes, crystal physics their physical attributes, and crystal chemistry studies the elements they are composed of and their influence on colour, shape, etc.

Conventional crystallography 'explains' most of the phenomena by the way in which small particles join to form lattice-like structures. How does this relate to Rudolf Steiner's emphasis on the role of cosmic/spiritual configurations of forces in the forming of crystals?

Crystal morphology and physics study attributes which correspond to singular directions within the crystals: flat crystal surfaces are situated at well-proportioned angles to each other (law of the constancy of interfacial angles); the level of hardness and the optical attributes (in double refraction, for example) are not the same for all directions, etc. This means that the study of the *inside* of crystals leads to qualities that are connected to the outer shape but point far *beyond* its finite limits. Each crystal has a *bundle of singular directions* which span all of space. Suitable, idealised crystal shapes prove to be symmetrical, that is, they can be brought into self-coincidence by rotating them about axes with 60, 90, 120 or 180 degrees. They can also often be mirrored on the planes which join two axes.

Conventional crystallography interprets these directions as a consequence of the lattice-structure. The building blocks of these lattices are atoms, ions or molecules. This concept enables crystallographers to develop a subtle picture of how the macroscopic attributes relate to the micro-structure. However, for these studies to be precisely (mathematically) applied, one must assume that the various crystal lattices are infinitely large – that they span the whole of space. As a consequence of this, it appears that only one aspect of crystal formation is grasped by the infinite lattice. Its *other*, necessarily complementary aspect needs to be sought in projectively enhanced morphology. The latter enables one to think the idea of a formative force which spans the whole of space to its logical conclusion. In addition, it will be shown that projective concepts may be relevant for the interpretation of X-ray diagrams of crystals. In this sense, the two main ways of studying crystals – structure theory and morphology – prove to be complementary. Structure theory expresses variations of substance and local principles, whereas morphology expresses forming and global principles. The two fields thus form a solid fundament for crystallography and mineralogy permeated by an anthroposophic approach.

Trockene Wärmeprozesse und Pflanzensubstanz

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Pharmaceutical processes are for transforming plant substances into pharmaceuticals. The heating effects in pharmaceutical processes should change the substances in such a way that their healing properties for particular human illnesses are enhanced. The variety of plant types manifests through different formative processes. Accordingly, the characteristics perceptible to the senses vary in the developmental process. Similar differences are revealed when observing the properties of dried substances when heated.

Using the examples of stinging nettle (*Urtica dioica*), dandelion (*Taraxacum officinale*) and horsetail (*Equisetum arvense*) it is shown how with dry heat processes (roasting, carbonising, ashing) the properties of the plant substances change as the temperature is increased in stages.

A relationship is demonstrated between the heating process, decomposition of substance and the life process of the plant with a view to the question as to what similarities and differences are shown. A further step involves comparing the three example healing plants as regards their corresponding changes during stepwise heating of the plant substance in order to distinguish the species-specific differences in relation to the process-specific differences of dry heating.

This investigation can be regarded as a contribution to questions as to the essence of substances and processes and the boundary between the living and the non-living. It can contribute to a more precise choice of temperature ranges in pharmaceutical processes – something which is too little considered in modern pharmaceutical practice.

Die Aufgabe der pharmazeutischen Prozesse ist es, Pflanzensubstanzen in Heilmittel zu verwandeln. Die Wärmewirkung im pharmazeutischen Prozess soll die Substanz so verändern, dass sie für bestimmte Krankheiten Heilungsprozesse im Menschen unterstützt. Die Vielfalt der Pflanzenarten erscheint durch unterschiedliche Bildungsprozesse. Dementsprechend sind die der Sinneswahrnehmung zugänglichen Eigenschaften im Entwicklungsprozess verschieden. Ähnliche Unterschiede offenbaren sich auch bei der Beobachtung der Eigenschaften von trocken erhitzter Substanz.

Am Beispiel von Brennnessel, Ackerschachtelhalm und Löwenzahn wird gezeigt, wie sich unter der trockenen Wärmewirkung (Rösten, Verkohlen, Veraschen) die beobachtbaren Eigenschaften der Pflanzensubstanz ändern, wenn man die Temperatur stufenweise steigert. Es wird eine Beziehung zwischen dem Substanz abbauenden Wärmeprozess und dem Lebensprozess der Pflanze hergestellt im Hinblick auf die Frage, welche Gemeinsamkeiten und Unterschiede sich darin zeigen. In einem weiteren Schritt werden die entsprechenden Veränderungen bei der schrittweisen Erhitzung der Pflanzensubstanz der drei genannten Heilpflanzen verglichen, um das Prozessspezifische der trockenen Erwärmung gegenüber artspezifischen Unterschieden abzugrenzen.

Die Untersuchung kann als Beitrag zur Frage nach dem Wesen von Stoffen und Prozessen, nach der Grenze zwischen dem Lebendigen und dem Unbelebten verstanden werden. Sie kann einen Beitrag zu einer feiner abgestimmten Wahl der Temperaturbereiche in den pharmazeutischen Prozessen leisten, die in der heutigen Praxis zu wenig beachtet werden.