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EDITORIAL

On the Scope of the Science of Biorheology and the Aims of BIORHEOLOGY

In a Plenary Lecture ("The Future of the Science of Biorheology", BIORHEOLOGY 19, 47-69, 1982) at our Congress in Tokyo five years ago it has been emphasized by one of us (ALC) that biorheology is the missing link in the life sciences. It was then stressed that "We all as practicing biorheologists, regardless of whether our activities and contributions concern theoretical, experimental or applied (including clinical) pursuits, will have to exercise the mission of disseminating biorheology as the important link, missing thus far in most life sciences toward their advancement." Indeed, the science of biorheology is more than just a branch of rheology. Technically, of course, it deals with biological materials in deformation and flow, i.e., their rheology, both extra vivum and in the biological context. Unlike straight rheology, however, biorheology is concerned not only with the "how" but also and predominantly with the "why" biological materials behave as they do.

The rheological properties of biological materials and their cellular and molecular level interpretations are thus not studied purely as material attributes. They are inextricably linked to the transport and motility requirements and thus to the molecular, structural and thermodynamic description of the biological system. The existence of mechanical stresses, other than a hydrostatic pressure at an appropriate level is responsible not only for the establishment of pressure gradients, but also for the creation of the requisite chemical potential, including electrochemical potential gradients which feed and clear the living system. Mechanical energy losses, of the frictional type, which occur in biological materials, are predominantly the results of the relative flow of components and the viscous dissipation which this entails. Much of biorheological investigation is, therefore, concerned with the interpretation of observations in terms of structural, molecular morphology and a relative component flow. Although our Journal is not meant to serve teleological philosophical concerns, there are fundamental tasks facing biorheology asking it to provide the understanding for why Nature built in the way it did, particularly why certain structures and organisations, using certain materials and dimensions, have evolved.

Since movement and the accompanying transfer of energy is the essence of life processes, problems of deformation including flow lie particularly close to the center of things insofar as living matter is concerned. Clearly biorheology is not meant to be all encompassing, but much more feeds into its study than the rheological characterization of a biologically derived material. Indeed, it is not our policy to publish data on the rheological behavior of such a material if the results only serve to characterize its function in a strictly non-biological context. For example, we are not interested in the technological properties of animal hides in the making of leather, nor of such aspects of other materials derived from living organisms, such as butter, silk, coal or oil. Only if the study is related to the elucidation of structure and provided data, which are of extensive use in the elucidation of the original biological context, would such a communication be considered to fit our Journal. On the other hand the description and characterization of the physico-chemical state of biological materials, particularly of the factors which contribute to the establishment of gradients and thus to the transport of matter, are important subjects of study, since such gradients will be mirrored and coupled to mechanical stresses in the structured matrix of matter in the biological context.

Metabolic processes, molecular turnover of structured matrices provide additional important mechanisms for the relaxation of induced stress. This is particularly important in the biological context. Stored energy of deformation can relax through a chemical reaction in any material, but in inanimate systems this is generally prevented by chemical stabilization.

The essence of a living system requires it to be out of equilibrium with respect to at least some of its components. Chemical regeneration, growth and decay are thus inevitably phenomena accompanying purely mechanical energy loss in a biological material.

Much of the fluid dynamics of Newtonian liquids is, by convention, though not by logic, excluded from rheology. However, it is not necessarily excluded from the science of biorheology.

For the purposes of communications acceptable to BIORHEOLOGY we have some years ago excluded clinical hemorheology from its scope. This was due to the tremendous upspurt of interest in clinical hemorheology and the correspondingly large increase in communications published in this field. Our companion Journal CLINICAL HEMORHEOLOGY was hence set up. BIORHEOLOGY continues to publish communications in all fields of clinical biorheology other than clinical hemorheology.

Recently we have heard of problems concerned with the aims of BIORHEOLOGY. What should or should not be published in our Journal? This Editorial is, therefore, intended to establish the guidelines not only for our Editors, but also for the potentially interested Authors and certainly for our Readers. Far too many communications of central relevance to biorheology are often, quite in contradiction to their real message, written up to fit in elsewhere. We see the purpose of BIORHEOLOGY not just to be another Journal, or to be a Journal which "fills a gap", but to be an active leader with a mission. This mission we take to be the proper understanding of biorheology as a link between most life sciences and other basic sciences.

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