modern atomic theory. He also assumed that atoms are surrounded by spherical envelopes of heat, like atoms repel and unlike atoms attract, elementary gases are monatomic, binary compounds are formed by preference because of the repulsion of like atoms, equal volumes of gases contain unequal numbers of particles, etc. These assumptions had been abandoned by 1860. I am not conscious of having contradicted myself.

The similarity between the functions of phlogiston and caloric (a name introduced in 1788, not in the nineteenth century) was mentioned in my "Short History of Chemistry" (1937) and is fully described in a paper by Dr. McKie and myself, referred to in my first letter and published ten years before Prof. Soddy's book.

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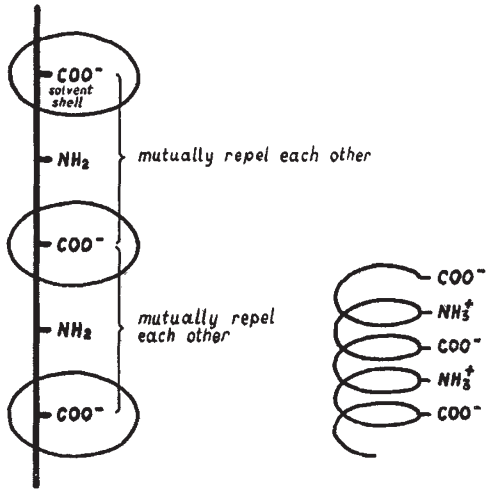
Biological Significance of Folding and Unfolding of Protein Molecules

In an interesting paper which appeared recently in *Nature*, Goldacre and Lorch[1] put forward the hypothesis that folding and unfolding of protein chains plays a decisive part in amœboid movement and cytoplasmic streaming. The same hypothesis was put forward more than twenty years ago by us in connexion with a new theory of muscular contraction[2]. This theory said that the contraction is due to a folding of unfolded protein chains under the influence of chemical reactions, and as one of the possibilities a variation of *p*H was considered; this was illustrated in 1929 by the accompanying diagram.



Protein chains in an alkaline medium (left) and at the isoelectric point (right). From Meyer, K. H., *Biochem. Z.*, **214**, 253 (1929)

Summarizing this hypothesis in our monograph[3], we wrote: "Beim Muskel war es verhältnismässig deutlich zu erkennen, dass die Formänderung von Eiweissketten eine wichtige Rolle spielt. Es liegen nun Anzeichen für ähnliche Vorgänge auch bei Protoplasmabewegungen vor. Hier sind es besonders die Erscheinungen der Doppelbrechung, wie man sie bei Pseudopodien beobachten kann, die darauf hinweisen, dass auch hier Hauptvalenzketten bald zur Streckung und Parallelrichtung, bald zur Kontraktion gebracht werden. Es ist nicht daran zu zweifeln, dass ein weiteres Studium der Form und des Wasserbindungsvermögens der Eiweiss- und Pektinstoffe in ihrer Abhängigkeit vom Medium auch andere physiologische Fragen neu beleuchten wird. Der Turgor der Gewebe, die Resorptions- und Sekretionsvorgänge werden sich dann wohl in ähnliche Beziehungen zum molekularen Geschehen bringen lassen, wie es hier für die Bewegungsvorgänge versucht worden ist."

All these conclusions originated in our work on the molecular structure of silk[4], tendon[2] and muscle[2]. In contrast to the compact 'globular' proteins investigated shortly before by Svedberg[5], we showed for the first time in the substances mentioned the existence of 'fibrillar'-proteins. We were also the first to demonstrate the reversible folding and unfolding of these protein chains[2] provoked by physical or chemical influences, and emphasized that the decrease of viscosity of gelatin which is observed when approaching the isoelectric point is due to a coiling or folding of chains which previously were extended by the repelling force of their electrically charged groups[3].

Although the accompanying diagram is certainly much too simple to account for the phenomena of muscular contraction, we believe that the main principle of our theory, namely, folding and unfolding of myosin chains governed by chemical reactions, will form the basis of any future theory.

Concluding their paper, Goldacre and Lorch say: "The protein molecule is unique in that its chemical and physical properties are greatly altered by changes in the degree of folding of the polypeptide chain. That this property might be exploited in living cells and be the basis of many vital phenomena has been suggested, especially by Astbury and Szent-Györgyi." The work of these authors is, however, of much later date than ours.

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Feb. 13.

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In a necessarily short article the mention of one or two of the more recent summaries was not intended to be exclusive; but we naturally regret it if we failed to do proper justice to the early and important contributions to the subject made by Prof. Meyer and Prof. Mark.

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