**This Week's Citation Classic**


[General Electric Research Laboratory, Schenectady, NY]

The equations of motion of a model of a chain molecule diffusing in a viscous fluid under the influence of external forces are solved exactly. Hydrodynamic interaction between parts of the chain is included in approximate form. The evolution with time of macroscopic observables is then calculated. [The SCI® indicates that this paper has been cited over 600 times since 1961.]

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“I got into this field in 1949 when C.T. O’Konski and I found that the relaxation of electrically induced birefringence was a very sensitive tool for studying the size and structure of rigid macromolecules, notably tobacco mosaic virus particles, in solution. I was seized with the desire to extend relaxation methods to my main interest, flexible chain polymers. Beginning in late 1951, I spent some time reading the older literature on the theory of orientational relaxation of rigid molecules by Browninan motion, and at-tempted to transfer these ideas to the much more complicated case of flexible molecules. There were already several approaches to this in the literature, but the theories gave me no confidence that they could produce reliable quantitative results. Therefore I worked for some time to put together a simple-minded but quantitatively reasonable theory based on an elastic-dumbbell model (two beads connected by a spring with a vibration damper). I had just finished doing this when P.E. Rouse’s important 1953 paper appeared in the *Journal of Chemical Physics.* I found this paper very impressive, but failed to understand it fully on first reading; I thought that Rouse had considered only the internal motions of the polymer chain and had ignored the rotations of the molecule with respect to external axes. Fortunately, I wrote to Rouse about this, and he quickly straightened out my error.

“I then abandoned my dumbbell model and tried to extend Rouse’s calculation by including hydrodynamic interaction between the parts of the chain, which was the main omission in his otherwise excellent theory. At first I simply did numerical calculations in chains with a small number of segments, i.e., four or five. I was pleasantly surprised to find that the equations of motion of these small molecules, even with hydrodynamic interaction, were exactly soluble by a normal-coordinate transformation. I was thus encouraged (in the summer of 1954) to try to con-struct a formal theory. The paper herein cited was the result.”