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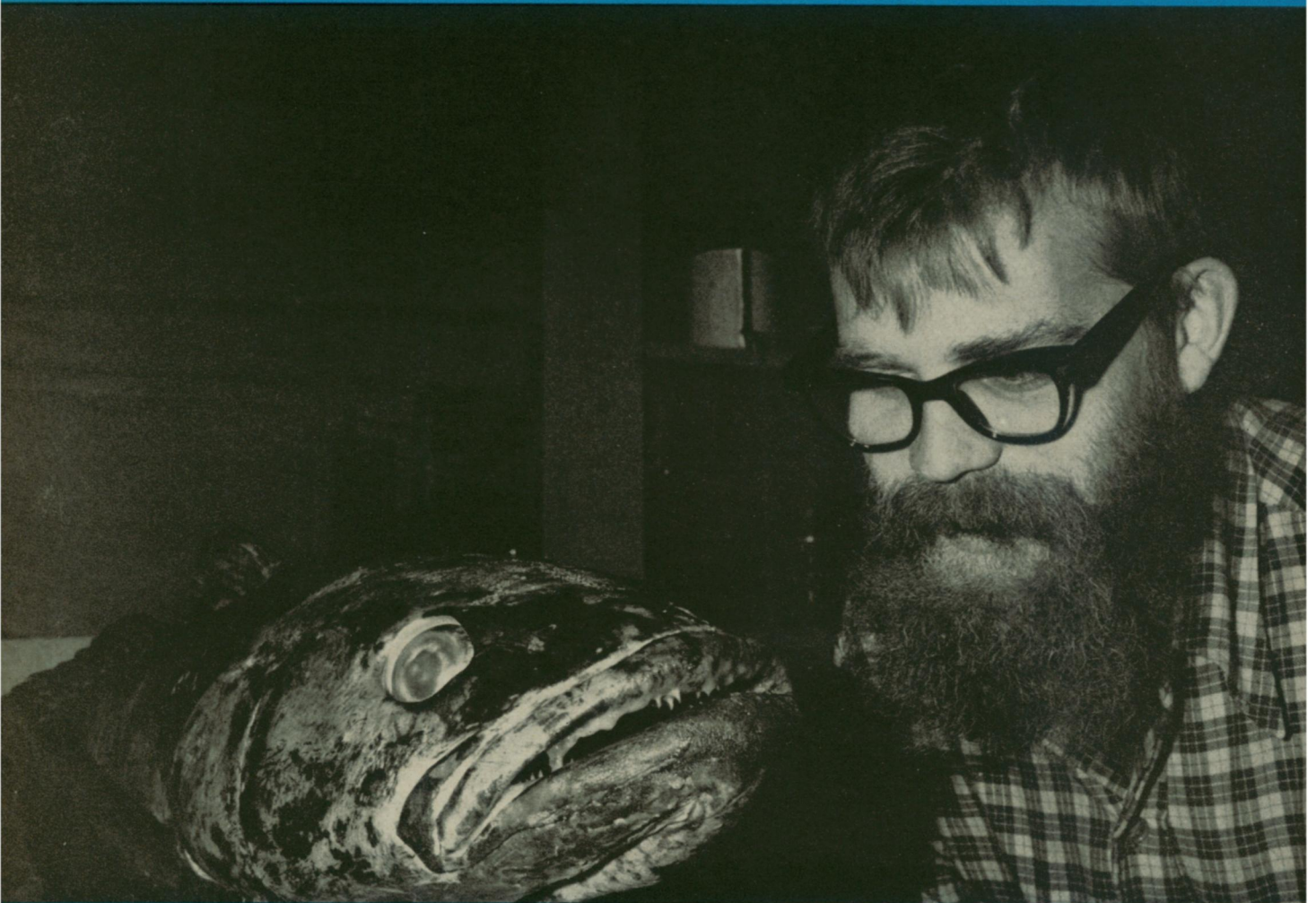
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# SCIENCE NEWS LETTER

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THE WEEKLY SUMMARY OF CURRENT SCIENCE



National Science Foundation

**Antarctic Fish**

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A SCIENCE SERVICE PUBLICATION

## Tales of Restless Nuclei

The molecules in a solid may be tumbling, rotating, or jumping. Or just quietly vibrating. What they do can affect the characteristics of bulk matter. This is not news . . . but the way we can relate specific motions to physical properties *is*.

Physicists at GM Research are using Nuclear Magnetic Resonance (NMR) to study molecular motion as temperature or composition is changed. This new branch of spectroscopy uses magnetic nuclei to probe many phenomena on a molecular scale. From it, for example, our NMR physicists are developing new knowledge of electron densities, molecular configurations, and the basic nature of that strange squishy state of matter—the plastic crystal.

In addition, they are associating specific molecular motions with the macroscopic properties of polymers. And they're learning to predict properties for the engineer.

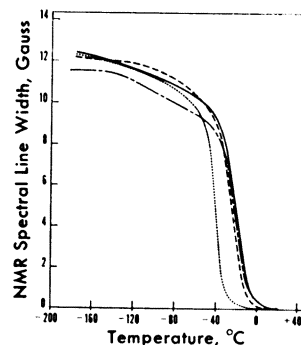
Take neoprene, for instance. Engineers wanted to know what plasticizers might keep it flexible at low temperatures . . . without having to run physical tests on a number of samples.

NMR found out. How? By detecting changes in molecular motion. A hard, solid polymer allows molecules only limited movement. Addition of a plasticizer, or an increase in temperature, allows more complex motions as the rigid structure relaxes. The increased motions cause narrowing of the NMR spectral line which can be correlated with flexibility.

The motions of the nuclei tell the tale . . . and help General Motors find a better way.

## General Motors Research Laboratories

Warren, Michigan



Effects of plasticizers on NMR spectrum of neoprene. The best plasticizer produces spectral line narrowing (due to increased molecular motion) at lowest temperature.

—From a recently published GMR paper.

