This Week's Citation Classic

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Drost-Hansen W. Structure of water near solid interfaces.
Ind. Eng. Chem. **61**(11): 10-47, 1969.

Evidence **is presented for the** existence **of structurally modified water adjacent to a 'solid' interface. This vicinal water may ex-tend over large distances and exhibits anom-alies in its thermal properties. A 'three-layer model' for vicinal water is proposed, some-what akin to the Frank-Wen model of ion hydration. [The** *SCI®* indicates **that this paper has been cited over 125 times since 1969.]**

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"This paper, 'Structure of water near solid interfaces,' is the third in a series of five papers on interfacial water. This paper, as well as the first paper,[1,2] was the result of invitations from Sidney Ross to contribute to the state-of-the-art Symposia on Interfaces. The paper was initially presented orally at the Second Symposium in Washington, DC, June 11-12, 1968. The first paper in this series had served to describe some general aspects of aqueous interfaces (particularly the air/water and the immiscible li-quid/water interface), while the second paper[3] in the series dealt with the ice/water interface. (The fourth and fifth papers are far more detailed accounts which include and stress structural aspects of water at biological interfaces.[4,5])

"The paper on the structure of water near solid interfaces served to review the evidence for unusual properties of water adjacent to a solid. In part, the usefulness of the paper may be due to the bringing together of a variety of apparently unrelated examples of anomalous, unexpected properties of water at interfaces, but the stress was particularly on the geometric extent of such

modified water. In this paper, for the first time, I stressed the use of the phrase 'vicinal water.' The intent was to denote water proximate to an interface but without any commitment as to the mode by which the structural properties were affected by the presence of the interface.

"The paper was in preparation for a long time, stretching from about the beginning of 1968, through the summer at the time of the oral presentation and until late in the spring of 1969. Part of the actual writing of the paper took place in the mid-Atlantic while on oceanographic cruises from the Institute of Marine Science of the University of Miami. These cruises included one into the Sargasso Sea (the 'Cruise of the Virgins' from Bermuda to Miami) on which the infamous Mackel kidnapping case was planned, one of the perpetrators being a new graduate student of mine.[6] In general, the paper was created under somewhat stressful circumstances particularly due to administrative problems at the Institute. The chairman of the division of physical sciences, Fritz Koczy, had suddenly died, and, as a result, I served for several years as acting chairman of the division.

"In summary, the paper was an attempt to present evidence to show that water does not necessarily possess its bulk characteristics up to the immediate vicinity of a solid surface but rather exhibits unusual properties over some (considerable) distance from the interface. I still do not consider this paper to be my most important contribution. Instead, I hope that the application of these ideas regarding vicinal water to cellular systems may prove to be highly useful for cell biology. However, the paper in question may possibly have set the stage for this development.

"The idea of long-range structural effects at interfaces has not been part of the traditionally accepted paradigms of surface and colloid chemistry. Hence, relatively few authors have attempted to present a con-ceptually integrated view of the subject. Thus the article may have filled a real need for such a synthesis and this may account for the frequency of citation of the paper."

1. **Drost-Hansen W.** Aqueous interfaces—methods of study and structural properties. Part 1. *Ind. Eng. Chem.* **57**(3):38-44, 1965.
2. ....., Aqueous interfaces—methods of study and structural properties. Part II. *Ind. Eng. Chem.* **57**(4): 18-37, 1965.
3. ....., The water-ice interface as seen from the liquid side. *J. Colloid Interface Sci.* **25**:131-60. 1967.
4 ....., Structure and properties of water at biological interfaces. (Brown H D. ed.) *Chemistry of the cell interface.* New York: Academic Press, 1971. Part B. p. 1-184.
5 ....., Water at biological interfaces—structural and functional aspects. *Phys. Chem. Liq.* **7:**243-348. 1978.
6. **Miller** G. *83 hours till dawn.* Garden City. NY: Doubleday. 1971. 404 p.