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This Week's Citation Classic

Bonner J T. Evidence for the formation of cell aggregates by chemotaxis in the development of the slime mold *Dictyoslelium discoideum. J. Exper. Zool.* **106**:1-26, 1947. (With an appendix by L J Savage.) [Harvard University, Cambridge, MA]

The amoebae of cellular slime molds first undergo growth as separate cells and then aggregate to form cell masses that become differentiated multicellular organisms. This paper gave evidence that aggregation occurred by chemotaxis, and the chemical attractant was given the name *acrasin*. [The *SCI*® indicates that this paper has been cited over 185 times since 1961.]

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"It is difficult to believe today that it was once necessary to prove that cellular slime molds aggregated by chemotaxis. In the 1940s it was thought that most morphogenetic processes, which often had been assumed to be chemotactic, were probably not so, and could be explained by other mechanisms such as 'contact guidance.' Chemotaxis had first been postulated for cellular slime molds by G. Potts[1] in 1902, but it was not until the earlier work of Ernest Runyon[2] and this paper that the idea became accepted. My research was done at Harvard after I left the Army to finish my graduate studies; the paper was my Ph.D. thesis.

"Since 1947, there has been an enormous increase in the interest in the development of the cellular slime molds. At that time there were a mere handful of workers; today there are probably two hundred scattered over the world. It is conceivable that this paper played some part in bringing slime molds to the attention of developmental biologists, especially those who had been trained as molecular biologists on *E. coli* and were looking for a eukaryote that had an uncomplicated development. But there are many other papers that also contributed, especially those of Kenneth Raper[3] in the early 1940s; his certainly were the ones that trapped me.

"If my paper has any importance, this may be the reason, but unfortunately it has nothing to do with why it is cited so often. The explanation for its popularity is that in the 'methods' section I devised a physiological salt solution (based on S.O. Mast's work[4] on *Amoeba proteus)* which has been used by many workers in the field. It is a simple mixture of NaCl, KCl, and CaCl2 which apparently keeps the amoebae in a particularly happy and healthy state in most (but not all) circumstances. When it first was used by others, I was greatly elated by the fact that they referred to it as 'Bonner's solution.' What could be more impressive than having a 'solution' bearing one's name? Unfortunately, this dignified label has quite disappeared and now it is often called 'Bonner's salts,' which raises a different picture in my mind, something one might need a 'dose of.' To compound this unhappy trend, I occasionally find bottles in our laboratory refrigerator labeled 'BS;' it gives me a feeling that one of my graduate students is sending me a message. But, on the whole, and despite these problems, I do not mind assuming the role of the Fanny Farmer for slime molds; there are worse fates."

1. **Potts G.** Zur physiologie des *Dictyoslelium mucnroidcs.* (Toward the physiology of *Dictvostelium mucoroides.*) *Flora (Jena)* **21**:281-347. 1902.
2. **Runyon E H.** Aggregation of separate cells of *Dictvostelium* to form a multicellular body. *Collecting Net.* **17**:88, 1942.
3. **Raper K.** Pseudoplasmodium formation and organization in *Dictyostelium discoideum. J. Elisha Mitchell Scientific Soc.* **56**:241-82, 1940.
4. **Mast S O.** Mechanism of locomotion in *Amoeba proteus* with special reference to the factors involved in attachment to the substratum. *Protoplasma* **8**:344-77, 1929.