

This Week's Citation Classic

CC/NUMBER 19
MAY 11, 1981

Porath J & Flodin P. Gel filtration: a method for desalting and group separation. *Nature* **183**:1657-9, 1959.
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The introduction of cross-linked dextran (Sephadex) provided for the first time a practical and inexpensive chromatographic method for the separation of solutes according to their molecular dimensions. [The SC® indicates that this paper has been cited over 640 times since 1961.]

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April 15, 1981

"One day in the early 1950s we observed that certain low-molecular weight substances in a mixture were separated from each other upon elution from an electrophoresis column packed with starch grains—despite the fact that, by a mistake, no electric current had been applied. My assistant and I studied the phenomenon systematically and found that the test substances chiefly grouped together in two main classes: a rapidly migrating, high-molecular and a more slow-moving, low-molecular class. Polypeptides were found to occupy an intermediate position. I had no doubt about the mechanism: differential exclusion according to molecular size. In addition I observed that several dyes migrated—often with strong retardation—as well-defined zones. Unfortunately the starch had defects as a sieving medium that we could not eliminate. However, I thought I had made a genuine discovery of an unknown phenomenon. That was not the case, but I believe I was the first to recognize its potentialities. I hoped for a better gel-medium.

"Some years later Per Flodin and I discussed the possibility of synthesizing an ideal convection medium for zone electrophoresis. Flodin remembered that there was a bottle of cross-linked dextran on one of the laboratory shelves at Pharmacia pharmaceutical company. Perhaps that gelforming substance might be suitable? Eventually I got the bottle in my hand. A column was packed and the adsorption properties we tested as we used to do routinely. We never ran an electrophoresis experiment (Stellan Hjertén did somewhat later). The test substances travelled in a way that strongly reminded me of the experiments on starch: perhaps the ideal molecular sieve had been discovered?

"When I announced the method for the first time at a conference in Bruges (1959) there was no response. Within the first years the publication in *Nature*, which is now considered as a *Citation Classic*, evoked little interest.

"We proposed that gels should be tailor-made for different molecular size ranges. In the beginning, I often encountered critics telling me that it was ridiculous to believe in the future of a method that had such a limited separation interval ($R_F = 0.5-1.0$).

"The 'gel filtration' method directly gave the impetus to 'gel permeation chromatography' of non-polar substances on polystyrene gels. This very simple technique for fractionation of biomaterials and synthetic polymers can be applied to sample quantities from microliters to hundreds of liters and from a fraction of a microgram to hundreds of grams or more. It has also turned out to be a useful tool for estimation of molecular size and for the study of association-dissociation phenomena. More recent work in the field has been reported by H. Determann¹ and T. Kremmer and L. Boross.²

1. **Determann H.** *Gel chromatography*. Berlin: Springer-Verlag, 1968. 195 p.
2. **Kremmer T & Boross L.** *Gel chromatography*. Chichester, England: Wiley, 1979. 300 p.