

# This Week's Citation Classic

CC/NUMBER 39  
SEPTEMBER 26, 1983

Elton G A H & Ewart J A D. Starch-gel electrophoresis of cereal proteins.  
*J. Sci. Food Agr.* 13:62-72, 1962.  
[British Baking Industries Research Association, Chorleywood, Rickmansworth,  
Hertfordshire, England]

Starch-gel electrophoretic patterns were obtained for protein fractions from cereal flour. Globulins, albumins, and gliadins of wheat corresponded to the fast, medium-speed, and slow bands respectively, but were mutually contaminated. The electrophoretic pattern of gluten protein changed with variety. [The SCJ<sup>®</sup> indicates that this paper has been cited in over 100 publications since 1962, making this the 8th most-cited paper published in this journal.]

G.A.H. Elton  
Ministry of Agriculture, Fisheries and Food  
Great Westminster House  
London SW1P 2AE  
England

August 18, 1983

"I became director of the then British Baking Industries Research Association at Chorleywood in May 1958 and soon became engaged with colleagues in developing the Chorleywood Bread Process, a system based on intense mechanical working of dough to achieve optimum rheological properties. This process, which won the Queen's Award to Industry in 1966 (the first laboratory ever to receive one), now produces over 80 per cent of British bread and is used in over 40 countries around the world. I recognised the urgent need for more fundamental information on the structure of wheat proteins and determined to appoint a first-rate chemist to lead this work. J.A.D. Ewart, a physical chemist from Oxford, started work on wheat flour proteins in June 1959 with no more knowledge of the subject than he had gained from reading.<sup>1</sup>

"To understand dough rheology, which is so important industrially, the protein was the obvious point to start since it is the only constituent of flour that is viscoelastic. Not much success attended attempts to dissolve the protein complex, gluten, or to separate it electrophoretically on paper or cellulose acetate. I suggested trying the recently in-

vented technique of starch-gel electrophoresis and, after a demonstration by Winifred Wright at Messrs. J. Lyons Ltd., this was adopted. After some months of trials, encouraging electrophoretic bands were seen and this was reported,<sup>2</sup> but a baffling problem remained in that half the pattern lacked any resolution.

"It seemed a long time before the possibility eventually dawned that an enzyme might be at work. A series of experiments then established beyond doubt that beta-amylase caused the loss of resolution. The way was then open to show that the classic Osborne fractions, globulins, albumins, and gliadins, although mutually contaminated, corresponded respectively to the fast, medium, and slow regions of the electrophoretic pattern. Further, the gliadins showed varietal differences, and there were variations among genera of the Gramineae. The present paper was written up and submitted to *Biochimica et Biophysica Acta*, which rejected it; it was later accepted by the *Journal of the Science of Food and Agriculture*.

"The unprecedented resolution provided by the technique enabled workers all over the world to examine the composition of their protein fractions and to follow the progress of fractionation, which ultimately led to the isolation of pure wheat proteins. A number of these were separated for the first time at Chorleywood. The discovery of varietal differences was the foundation of the now widely used method for identifying varieties of wheat (and other cereals) by their electrophoretic patterns. Perhaps the greatest effect of this paper was the stimulus to research provided by the knowledge that at least half the gluten complex, which had remained an enigma despite the efforts of generations of scientists, was composed of discrete proteins and that the possibility of studying these was now real.

"Since those days, I have moved on to other things, but Ewart has remained in the field, and is now recognised as a world authority on wheat proteins. An excellent review of later work in the field is by Kasarda *et al.*"<sup>3</sup>

1. Fox S W & Foster J F. *Introduction to protein chemistry*. New York: Wiley, 1957. 459 p.
2. Elton G A H & Ewart J A D. Starch-gel electrophoresis of wheat proteins. *Nature* 187:600-1, 1960.
3. Kasarda D D, Bernardin J E & Nisimmo C C. Wheat proteins. *Advan. Cereal Sci. Technol.* 1:158-236, 1976.