

This Week's Citation Classic

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Thompson M P, Kiddy C A, Johnston J O & Weinberg R M. Genetic polymorphism in caseins of cow's milk. II. Confirmation of the genetic control of β -casein variation. *J. Dairy Sci.* 47:378-81, 1964.
[Eastern Regional Research Center, Philadelphia, PA]

This paper contains the results of phenotyping of β -caseins from the milk of 1,349 individual cows from five breeds and three crossbreeds. The results confirm the discovery of β -casein polymorphism by Aschaffenburg¹ and support his conclusion that the variation has a genetic basis. [The *SCJ*[®] indicates that this paper has been cited in over 115 publications since 1964, making it the 8th most-cited paper published in this journal.]

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"By the time I had learned what a protein polymorph was, R. Aschaffenburg, then at the National Institute for Research in Dairying, Reading, England, had established himself as the father of milk protein polymorphism. His early discovery of genetic variation in β -lactoglobulin² (the principal whey protein) and β -casein¹ had earned him an international reputation.

"Our paths crossed when I observed genetic variation in the major milk protein, α _{s1}-casein. Despite the use of crude electrophoretic methods, Aschaffenburg noted polymorphisms in both α _{s1}- and β -caseins, which my more sophisticated methods failed to reveal. The problem was that I didn't know what to look for. But having been shown by my mentor, I proceeded with my colleagues, who knew more about cows than I did, to substantiate Aschaffenburg's work.

"With this training, the verification of his results became relatively easy

because we began to understand proteins, genetics, and cows. This delighted Aschaffenburg because he knew that eventually all the amino acid sequences of the milk proteins would be reported and that sites of mutations would be pinpointed. That happened within ten years of the date of his discovery.

"I do not imply that we didn't have research problems. Some milks were shipped which contained preservatives that totally obliterated the electrophoretic patterns, and others did not arrive. We also had to sift through records to determine accurate parentage for daughter-dam comparisons.

"This paper was probably cited frequently because much of the study of genetic variants was still in the early stages. Perhaps more important were the speculation and suggestions made. We encouraged others to determine the total amino acid sequence of the proteins, and further suggested that milk protein variants might be factors in determining the stability of individual milks to heat.³ These amino acid sequences were completed and, indeed, milks containing certain casein variants were found to be less stable to heat.

"Partly as a result of this and subsequent research on genetic polymorphism, I was cited for achievement in protein chemistry. Among the citations were the Arthur S. Flemming Award, the Borden Award, the USDA's Superior Service Award, two distinguished alumnus awards, and a professorship at a leading university.

"Although Aschaffenburg began a new career in crystallography at Oxford University, his interest in milk protein variations in all mammalian species never diminished. He died in 1982 at age 76."

1. Aschaffenburg R. Inherited casein variants in cow's milk. *Nature* 192:431-2, 1961.
2. Aschaffenburg R & Drewry M. Genetics of the β -lactoglobulins of cow's milk. *Nature* 180:376-8, 1957.
3. Farrell H M & Thompson M P. Physical equilibria: proteins. (Webb B H, Johnson A H & Alford J A, eds.) *Fundamentals of dairy chemistry*. Westport, CT: Avi Publishing Co., 1974. p. 442-73.