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This Week's Citation Classic

Butler J E. Bovine immunoglobulins: a review. *J. Dairy Sci.* 52:1895-909, 1969.
[Dairy Products Laboratory, Eastern Utilization Research and Development Division, Agricultural Research Service, USDA, Washington, DC]

This paper first compiled and reviewed the characteristics of the bovine immunoglobulins based on data scattered among biochemical, agricultural, physiological, and immunological journals over a 25-year period. The paper also presented unpublished data on bovine IgA and free secretory component, immunological elements considered previously not to exist. [The *SCI*® indicates that this paper has been cited in over 115 publications since 1969, making it one of the highest impact papers published in this journal to date.]

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"I suppose the success of a scientific contribution depends on its timeliness, its influence on existing concepts, and its immediate or eventual credibility. The *Citation Classic* publication described here possessed these ingredients. In addition, my previous training in zoology also added new perspectives and perhaps naiveté to the review. The latter perhaps explains the willingness of a young scientist to challenge existing concepts. The success of this article, as judged by its frequent citation, is most likely traceable to the combination of these ingredients as well as the reference value of the review for an emerging field in veterinary and animal science. The conception of the publication is described here.

"I joined Allergens Investigations of the USDA, directed by E.J. Coulson and J.R. Spies[1,2] in October 1967, because the 1967 Israeli-Egyptian war interfered with my military orders to report to Cairo. In setting up my laboratory in October, I fell heir to data generated by my predecessor (Morris) on a cow's milk protein called glycoprotein-a. Through a combination of being clever and naive, I decided that glycoprotein-a must be the 'secretory component' (SC) for bovine IgA. Such a conclusion was astounding in light of the fact that in October 1967 free SC (separate from its parent molecule) had not been characterized in any species and it was the current belief that cattle lacked an IgA system (IgG1 being the functional equivalent)! With the addition of several experiments in late October to identify bovine IgA, these data were submitted in November as an abstract to the Federation of Experimental Biology and Medicine.[3] To the benefit of my future, this 'beginner's conclusion' was eventually proved by others and by myself to be correct. The popular success of these studies not only persuaded my supervisors to allow me to work further on bovine immunoglobulin, but encouraged me to summarize my findings, together with those of my predecessors, into a review article on bovine immunoglobulins. Hence, such was the origin of this publication. The publication of this review also reflected the 'pure scientific' attitude of my supervisors (Coulson and Spies). Unfortunately, their granting me the scientific freedom to study bovine immunoglobulins, which some of their supervisors judged as 'irrelevant to the problems of agriculture,' probably contributed to the abolishment of Allergens Investigations by the USDA. Considering this history, it seems ironic that work done in Allergens Investigations by two of the three scientists in the group has now become *Citation Classics*.[2]

"Scientific discoveries are rarely single-handed accomplishments but are built upon the discoveries of one's predecessors. In the example here, Merton Groves, a now-retired biochemist with the USDA, was the first to isolate and describe glycoprotein-a (bovine-free SC) from cow's milk.[4] Groves also isolated β_2-microglobulin from cow's milk (calling it lactollin in 1963[5]) although the true identity of the latter protein would remain a mystery for another 15 years.[6]

"A review article does not represent peer-reviewed, hard-core science and most scientists would rather be recognized in *Citation Classics* for the latter rather than the former. Nevertheless, review articles are particularly valuable in times of information explosion and with that purpose in mind a recent review of the subject has been published."[7]

1. **Spies J R & Chambers D C.** Chemical determination of tryptophan in proteins. *Anal. Chem.* 21:1249-66, 1949.
2. **Spies J R.** Citation Classic. Commentary on *Anal. Chem.* 21:1249-66, 1949. *Current Contents* (25):13, 20 June 1977.
3. **Butler J E, Coulson E J & Groves M L.** Identification of glycoprotein-a as a probable fragment of bovine IgA. (Abstract.) *Fed. Proc.* 27:617, 1968.
4. **Groves M L & Gordon W G.** Isolation of a new glycoprotein-a and a γG-globulin from individual cow milks. *Biochemistry—USA* 6:2388-94, 1967.
5. **Groves M L, Basch J J & Gordon W G.** Isolation, characterization, and amino acid composition of a new crystalline protein, lactollin, from milk. *Biochemistry—USA* 2:814-17, 1963.
6. **Groves M L & Greenberg R.** Bovine homologue of β_2-microglobulin isolated from milk. *Biochem. Biophys. Res. Commun.* 77:320-7, 1977.
7. **Butler J E.** Bovine immunoglobulins: an augmented review. *Vet. Immunol. Immunopathol.* 4:43-152, 1983.