

This Week's Citation Classic

Osborne D J. Effect of kinetin on protein and nucleic acid metabolism in Xanthium leaves during senescence. *Plant Physiol.* **37**:595-602, 1962.
(California Institute of Technology, Pasadena, CA)

As leaves age and yellow, changes take place within the cells which include degradation of proteins and nucleic acids. The discovery that senescence and loss of integrity of these macromolecules could be arrested by simply applying the requisite plant hormone to the leaves opened up a new and exciting era in studies of cellular senescence. The incorporation of radioactive precursors indicated that the hormone-maintained synthesis of nucleic acids and proteins deferred senescent change and retained cellular homeostasis. [The *SCI*[®] indicates that this paper has been cited over 245 times since 1962.]

Daphne J. Osborne
W.R.O. Developmental Botany
Agricultural Research Council
University of Cambridge
Cambridge CB3 ODY England

April 14, 1978

"In 1962, molecular biology was still in its infancy and the isolation and separation of nucleic acids was by today's standards, crude. The experiments described in my much cited paper of 1962 must now be interpreted in the light of our better technical knowledge. For example, I found then that not only were proteins and RNA degraded at leaf senescence, but DNA levels also fell. We now know that only a small proportion of DNA is associated with degrading chloroplasts or mitochondria and that nuclear DNA is remarkably stable so that total levels do not change. Rather, the DNA becomes enzymically cleaved *in vivo* into shorter fragments so that recovery by extraction is reduced. The implication of this for the concept of a progressive failure in genome expression is obvious.

"The general thoughts presented in my 1962 paper stimulated many scientists in different parts of the world to test the proposals put forward and the ideas have been extended and re-interpreted in the light of much new work. The hormonal control of cell senescence with a specificity of particular hormones, for particular tissues at particular times in their development, is now well established. The balance between synthesis (or repair) and turnover (or degradation) of macromolecules, is still a corner stone in current approaches to cellular senescence and the integrity of chromatin and fidelity of transcription and translation remain as central themes in our attempts to resolve the unresolved problems of ageing.¹²

"The knowledge we have now has taken us a long way from the simple discovery of those first experiments I did, when if drops of solutions of the right hormone were applied to a leaf surface the areas beneath the spots would remain green, metabolically active, and capable of photosynthesis while the rest of the leaf yellowed and died. But anyone can still write their name in cytokinin solution on a Xanthium leaf and have the satisfaction of seeing it immortalized in green! I have kept such leaves pressed in my old and cherished copy of Strasburger as a memento of the excitement of these early experiments and so it is that my fascination with trying to unravel the control systems of senescence remains unabated."

1. **Cheah K S E & Osborne D J.** DNA lesions occur with loss of viability in embryos of ageing rye seed *Nature* **272**:593-99, 1978.
2. **Osborne D J, Dobrzanska M & Sen S.** Factors determining nucleic acid and protein synthesis in the early hours of germination Society for Experimental Biology Symposium No. 31. *Integration of Activity in the Higher Plant*, D. H. Jennings, ed Cambridge University Press, 1977. p.177-94.