

This Week's Citation Classic

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Petit A, Delhaye S, Tempé J & Morel G. Recherches sur les guanidines des tissus de Crown Gall. Mise en évidence d'une relation biochimique spécifique entre les souches d'*Agrobacterium tumefaciens* et les tumeurs qu'elles induisent. (Investigations on crown gall guanidines. Demonstration of a specific biochemical relation between *Agrobacterium tumefaciens* strains and the tumors they induce.) *Physiol. Veg.* 8:205-13, 1970. [Station Centrale de Physiol. Végétale, Ctr. Natl. Recherches Agron., Versailles, France]

Plant tumors incited by *Agrobacterium tumefaciens* contain new compounds which are specific to the bacterial strain inoculated. These compounds are degraded with the same specificity by the pathogenic bacteria. This correlation may be the consequence of gene transfer during crown gall tumorigenesis. [The SCJ[®] indicates that this paper has been cited in over 135 publications since 1970, making it the most-cited paper published in this journal.]

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"Crown gall tumors are plant cancers incited by the soil bacterium, *Agrobacterium tumefaciens*. Work begun in the mid-1950s showed that crown gall cells synthesize new compounds,^{1,2} now called opines, which were claimed to be specific markers for these cells. In G. Morel's laboratory, at the Centre National de Recherches Agronomiques, in Versailles, France, where three opines had been discovered and structurally identified, we were trying to understand the reason for the synthesis of such substances in crown gall cells.

"The work reported in the paper is the follow-up of an observation³ that the type of opine found in crown gall tumors is determined by the bacterial strain that incites the tumor. We studied a number of crown gall tumors and not only generalized the observation, but also showed that the bacterial strains which incited these tumors degrade the specific opines which they induce the

crown gall cell to synthesize. This led us to propose that transfer of genetic information from the bacterium to the plant cell takes place during crown gall tumorigenesis, and we compared the phenomenon to bacterial transformation.

"Published in French, and rather heterodoxical, since DNA exchange between bacteria and higher organisms was certainly not considered kosher, the paper was not well received. A controversy developed on the validity of the claim that opines were specific markers for crown gall cells. Later, A. Petit observed concomitant loss of pathogenicity and opine degradation in *Agrobacterium* strains and she proposed that the corresponding genes were located on a plasmid.⁴

"We think the paper is often cited because it is the first report of the phenomenon it describes. The citation rate increased sharply after the discovery of the oncogenic Ti (tumor inducing) plasmids^{5,6} and the demonstration that our observations were the consequence of the expression of Ti plasmid-borne genes.⁷

"The paper earned us neither prestige nor money. Morel died before the discovery of the Ti plasmids. After his death we had to fight very, very hard to keep working together, and on the same subject. S. Delhaye left the laboratory. In spite of many difficulties, we continued the work. As it has progressed we have developed a more complete description of the system. The perfect correlation between induced opine synthesis by the host and catabolism by the pathogen has led us to develop a generalized theory whereby opines act as chemical mediators of parasitism. The 'opine concept',^{8,9} as we called this theory, finally earned us a brand-new laboratory in very friendly surroundings as well as warm friends the world over."

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