

Crozier A, Kuo C C, Durley R C & Pharis R P. The biological activities of 26 gibberellins in nine plant bioassays. *Can. J. Bot.* 48:867-77, 1970.  
[Biology Department, University of Calgary, Alberta, Canada]

This paper contains information on the biological activities of 26 gibberellins in the barley aleurone; Progress No. 9 dwarf pea; lettuce; cucumber; "Tangin-bozo" dwarf rice; and d-1, d-2, d-3, and d-5 dwarf maize mutant bioassays. Relationships between gibberellin structure and biological activity are discussed. [The SC<sup>1</sup>® indicates that this paper has been cited in over 145 publications.]

## Gibberellin Structure and the Induction of Plant Growth

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October 12, 1988

On completing my PhD in the fall of 1967, I left a damp basement bedsitter in London and moved to a postdoctoral position in the laboratory of Dick Pharis at the University of Calgary. My salary increased fourfold, and, for the next three years, I lived in a pleasant apartment with a magnificent view of the Rockies.

Pharis was interested in the role of gibberellins in cone induction in pines. As part of his research program, a group, including Hiro Aoki, Dick Durley, George Kuo, and me, was involved in analyzing gibberellins in extracts from conifer tissues. It soon became evident that existing methodology was inadequate, and increasing amounts of time were devoted to improving analytical techniques. Standards of most gibberellins were very rare commodities. Fortunately, investigators in the UK, the German Democratic Republic, and Japan responded most generously to pleading letters, and we received 1-2 mg samples of 26 gibberellins. These were used to obtain partition coefficient data and to calibrate gas and liquid chromatography systems. They were also tested in nine bioassays during a hectic, six-week period in the summer of 1969, the results being published in the *Canadian Journal of Botany* in 1970. A brief review of the devel-

opment of gibberellin research perhaps explains why this paper has been cited so frequently.

Gibberellins were originally isolated in 1926, and the first structural elucidation was reported in 1954.<sup>1</sup> In 1962 nine naturally occurring gibberellins had been identified, and data soon appeared on the biological activities of these compounds.<sup>2</sup> By 1969, 18 more gibberellins had been characterized, but information on their biological activity was sparse. At this time the use of gas chromatography-mass spectrometry (GC-MS) was in its infancy, and bioassays had a pivotal role in most studies of endogenous gibberellins. Typically, semipurified extracts were subjected to either thin-layer or column chromatography after which bioassays were employed to detect zones of gibberellin-like activity. Tentative identification and quasi-quantification were based on the published chromatographic properties of the individual gibberellins, coupled with a knowledge of their activities in the various bioassay systems. As a consequence, paucity of information on the biological activities of many gibberellins hindered interpretation of experimental data.

Our 1970 publication was therefore timely since it provided a comprehensive summary of almost all the then-known gibberellins in a wide range of bioassays. With the advent of computer-controlled GC-MS, bioassay-based gibberellin analysis has become somewhat antiquated,<sup>3</sup> and our paper is probably now referred to much less frequently than it was in the 1970s.

The paper also contains observations on gibberellin structure-activity relationships. In 1974 David R. Reeve and I published a more detailed and speculative review of the subject,<sup>4</sup> aided by the emergence of a clearer view of gibberellin metabolism pathways and by information on the biological activities of a further 12 gibberellins. More recently, elegant studies with single gene dwarf mutants of maize, pea, and rice have clarified the picture markedly with regard to the activity of endogenous gibberellins.<sup>5,6</sup>

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2. Brian P W, Hemming H G & Lowe D. Comparative potency of nine gibberellins. *Ann. Bot.* 28:369-89, 1964. (Cited 90 times.)
3. Hedden P. Gibberellins. (Rivier L & Crozier A, eds.) *The principles and practice of plant hormone analysis*. London: Academic Press, 1987. Vol. 1. p. 9-110.
4. Reeve D R & Crozier A. An assessment of gibberellin structure-activity relationships. *J. Exp. Bot.* 25:431-45, 1974. (Cited 40 times.)
5. Phinney B O. Gibberellin A<sub>1</sub>, dwarfism and the control of shoot elongation in higher plants. (Crozier A & Hillman J R, eds.) *The biosynthesis and metabolism of plant hormones*. Cambridge, England: Cambridge University Press, 1984. p. 17-41. (Cited 15 times.)
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