

## **Is genetic technology approaching the limit of its ability to help us understand the systematic biology of orchids? The broader implications of a case-study in *Epipactis***

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By the beginning of the 21st Century, genetics appeared to show every promise of revolutionizing every aspect of systematic biology. Molecular phylogenetics would result in much more stable classifications, while population genetics would objectively circumscribe species. DNA fingerprinting techniques would, once miniaturised, allow DNA-based identification of plant materials in the field. Genetic modification techniques would allow a much deeper understanding of plant development, telling us precisely what makes an orchid an orchid. 18 years later, we can see that progress toward this ‘brave new world’ has been slower than predicted, and that technological expertise has expanded more rapidly than the knowledge that it was expected to generate. Recent molecular phylogenies contain orders of magnitude more information than their predecessors but offer little more confidence in their accuracy. Species continue to be described through authoritarian pronouncement, in the absence of any underpinning science. Hand-held DNA sequencers for field use remain in the realm of science fiction, perhaps because the enormous size of the potential market has not yet been realised by developers. And translating knowledge of the genetic code into genuine understanding of mature morphology has been confounded by the spectacular array of epigenetic processes that should now be the main focus of biological research but as yet are not. In summary, progress is still being made, but we now have a far more realistic view of what can and cannot be achieved.