

Intracellular ice and cell survival in cryo-exposed embryonic axes of recalcitrant seeds of *Acer saccharinum*: an ultrastructural study of factors affecting cell and ice structures

James Wesley-Smith^{1,2}, Patricia Berjak¹, N.W. Pammenter¹ and Christina Walters^{3,*}
¹Plant Germplasm Conservation Research, School of Life Sciences, University of KwaZulu-Natal (Westville Campus), Durban, 4001 South Africa,

²National Centre for Nanostructured Materials, Council for Scientific and Industrial Research, 1 Meiring Naude Rd, Brummeria, Pretoria, 0002 South Africa and

³USDA-ARS, National Center for Genetic Resources Preservation, 1111 South Mason Street, Fort Collins, CO 80521, USA

* For correspondence. E-mail Christina.Walters@ars.usda.gov

Abstract

Cryopreservation is the only long-term conservation strategy available for germplasm of recalcitrant-seeded species. Efforts to cryopreserve this form of germplasm are hampered by potentially lethal intracellular freezing events; thus, it is important to understand the relationships among cryo-exposure techniques, water content, structure and survival.