

# Trip Report: USA botanical expeditions and the CRYO2019 conference in San Diego

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In July 2019 I had the privilege of travelling to the USA to present at the CRYO2019 conference held in San Diego, California. Adding an additional week onto the trip meant I could visit a couple of facilities specialising in seed conservation and cryopreservation (storage of biological samples in liquid nitrogen). Since my flight arrived in Los Angeles, I decided to stay there for two days, certainly not to compete with crowds at Disneyland Park or Hollywood Hill, but to visit some of the botanical icons such as The Los Angeles County Arboretum and Botanic Garden and The Huntington.

## **The Arboretum and The Huntington**

The Los Angeles County Arboretum and Botanic Garden is a 50 hectare botanical garden and historical site located on the old Rancho Santa Anita in the city of Arcadia. Their mission is to cultivate natural, horticultural and historic resources for learning, enjoyment and inspiration. I was surprised to find geographical collections from Africa, Australia and Madagascar, all rich in species representation. The interpretation throughout the arboretum was well thought out and focussed on public education around gardening for native bees, water-wise gardens, soil conservation practices and food gardens.

The following day I arranged a visit to The Huntington Library, Art Collections, and Botanical Gardens. In 1919 Henry and Arabella Huntington transformed their private estate, San Marino Ranch, into an institution for advancement of learning, the arts and sciences, and to promote public welfare. This became known as The Huntington, a non-profit collections-based research and educational institution serving scholars and the general public (Fig. 1). The botanical living collections include one of the largest collections of cacti and succulents from around the globe and a palm garden represented by more than 200 species (Fig. 2). The Japanese Garden was no less impressive, sporting a traditional Japanese house, moon bridge, Zen garden and large bonsai collection. The adjacent Chinese Garden reflects the traditional style of scholar gardens in Suzhou, China, and features a large lake, teahouse and tea shop, and waterfalls (Fig. 3). At the time of my visit (July 2019), construction was underway to build one of the largest classical-style Chinese gardens in the world. Builders from China are housed in the USA for the duration of the project (due date 2020) to ensure every aspect of the buildings is authentic. The main reason for arranging a special visit to The Huntington was to meet up with Dr Raquel Folgado, a researcher who was recruited in 2016 to head their cryopreservation and tissue culture projects. Since this is still a fairly new operation, the main focus currently is to secure priority species from the collections in tissue culture and thereafter preserve

the shoots through cryopreservation. My visit to The Huntington was a great opportunity to compare challenges and opportunities that come along with having a science facility in a botanical garden.



**Fig. 1** The historic house of Henry and Arabella Huntington, with a significant cycad collection in front.



**Fig. 2** The palm collection at The Huntington Library, Art Collections, and Botanical Gardens.



**Fig. 3** The Chinese garden at The Huntington, featuring a lake, sculptures and traditional buildings.

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## US Department of Agriculture – Fort Collins, Colorado: Sometimes size does matter

Increased airport security screening times coupled with unpredictable Los Angeles traffic meant I had to take a 3 am airport transfer for my flight to Denver, Colorado. The purpose of my visit to Fort Collins (an hour north of Denver) was to meet up with Drs Gayle Volk and Chris Walters at the US Department of Agriculture's (USDA) Agricultural Genetic Resources Preservation Research Department. This National Laboratory for Genetic Resources Preservation safeguards more than 500,000 accessions from nearly 12,000 species. Conventional seed banking (low moisture content and storage at  $-18^{\circ}\text{C}$ ) is done in a seed vault located one story below ground behind double security doors. Two stories down is the cryovault, an astonishing room housing 350 individual 1500 litre liquid nitrogen dewars (specialised vacuum flasks used for storing cryogens) (Fig. 4). I looked longingly at the discontinued dewars (due to age), wondering if I can get one through customs as checked luggage. I did appreciate seeing the guts of one of the dewars which has been dissected for illustrative purposes (Fig. 5). After a full day of very good discussions and idea exchanges I was on my way for yet an earlier transfer (2 am) to catch a flight to Phoenix, Arizona, where I was spending the weekend in the Sonoran Desert.



Fig. 4 The cryovault at the US Department of Agriculture in Fort Collins, Colorado.



Fig. 5 Dissected 1500 litre liquid nitrogen dewar showing the turntable on which sample racks are housed and thick insulation to maintain temperatures at  $-196^{\circ}\text{C}$ .

## Arizona – Cowboy movies and the majestic Saguaro Cactus

The Sonoran Desert covers large parts of the Southwestern United States including Arizona and California in the north and west, and south into Mexico. The area supports an astonishing 2000 plant species, including the Saguaro cactus, *Carnegiea gigantea*. This 12 m tall cactus is the icon of the American west and cowboy movies and restricted to the Sonoran Desert. My first encounter with this desert giant was at the Desert Botanical Garden in Phoenix (Fig. 6). With more than 4400 species, including 400 rare and endangered species and the world's most complete Opuntioideae (a subfamily of the cactus family) collection, this was well worth a visit (Fig. 7). The rest of the weekend was spent hiking in the Catalina State Park amongst thousands of Saguaro cacti and visiting the Arizona-Sonora Desert Museum outside Tucson (Fig. 8). Driving back to Phoenix to catch my flight to San Diego for the CRYO2019 conference, I was weighing up the consequences of forgoing the conference for another week in the desert.



Fig. 6 *Carnegiea gigantea* (Saguaro cactus) next to the administrative buildings at The Desert Botanical Garden in Phoenix, Arizona.



Fig. 7 The succulent collection at The Desert Botanical Garden in Phoenix, Arizona, is the world's most complete Opuntioideae collection.



**Fig. 8** The Tucson area in Arizona is in the heart of the Sonora Desert where the rich flora diversity includes thousands of Saguaro cacti.

### **CRYO2019: The freezing experts**

CRYO2019 was the 56th Annual Meeting of the Society for Cryobiology. The conference attracted participants from a multi-disciplinary field ranging from human organ storage for transplantation, human fertility and reproductive medicine, securing the world's food resources through long term genetic preservation of agriculturally important species and, lastly, protecting and preserving the world's endangered flora and fauna. I was delighted that biodiversity conservation dominated the first three plenary talks, the first delivered by Oliver Ryder from The Frozen Zoo of San Diego taking us through the 40 year journey of the Frozen Zoo and we all had a good laugh about the absence of health and safety regulations in 1975. I was really looking forward to the second speaker, Prof Hugh Pritchard from Kew Millennium Seed Bank. His talk did not disappoint as he highlighted the importance and urgency needed to use cryobiotechnology (using tissue culture and cryopreservation) for wild plant species conservation. The last plenary presenter, Dr Bart Panis from Biodiversity International (based in Belgium),

illustrated the use of cryopreservation for global food security. During the following two days the plant-related sessions delivered diverse talks covering crop species, native orchids from India, oaks from the USA and of course, New Zealand's own *Syzygium maire* (swamp maire). My presentation was wedged between a rather technical talk on the glassy state of cryopreserved seeds delivered by Dani Ballesteros (Royal Botanic Gardens, Kew) and Christina Walters (US Department of Agriculture) illustrating the response of papaya seeds during storage at sub-zero conditions. Being flanked by such experienced and accomplished researchers was rather intimidating and I was relieved when my presentation was well received, followed by many questions which, thankfully, I was able to answer. Delivering a presentation early in a conference is a great advantage since it provides a gateway for subsequent discussions. By the time the conference officially wrapped up, I found myself excited about the next season of my work on swamp maire. The general consensus from the cryopreservation gurus is that all the signs are there that swamp maire should survive the cryopreservation process. I was furthermore humbled by all the support and networking opportunities offered, not only because *Syzygium* is a global genus and we desperately need expertise in its conservation, but also because they learned about this small native botanic garden in New Zealand that is absolutely dedicated to plant conservation.

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