

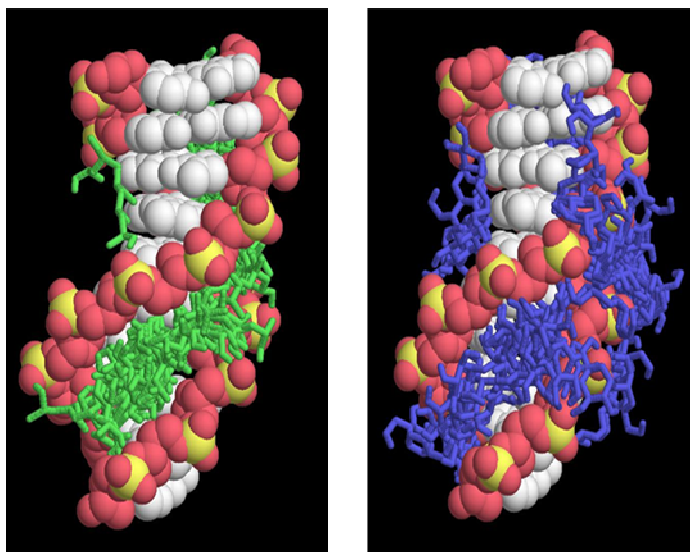
Case Study: Increasing Sustainability on University Campuses Room Temperature Biological Sample Storage

Introduction:

There are over 42,000 individual research laboratories housed on university campuses across the US that are advancing the field of biological and biomedical sciences. Researchers within these laboratories have assembled large collections of biological samples from clinical and field studies, representing enormous scientific and financial value for the researcher and the university. The samples are often irreplaceable and current research trends are driving growth of these collections at an escalating rate. Hundreds of ultra-low and low temperature freezers across campus store the current sample collections and require significant energy, space and resources to maintain. The energy demands for securing sample collections are recognized as unsustainable. As a result, sustainability leadership at a prominent academic institution recently commissioned and completed a campus wide pilot project to assess the environmental and financial impact of solely storing biological samples in freezers. Biomatrix Inc. entered into a collaboration with the campus to validate the use of Biomatrix's room temperature biostability technology for use as an alternative to freezer storage.

Case Study:

Biomatrix has developed SampleMatrix[®] technology, a bio-stabilization storage medium, to prevent the degradation of biological materials at room temperature and eliminate the need for cold storage. The technology is based on extremophile biology, originally identified by Dr. John Crowe, Professor Emeritus, UC Davis, that allows some organisms to survive in a dry state for more than 100 years (Crowe JH, et al., (1999). Annu. Rev. Physiol. 1998;60:73-103). Anhydrobiotic organisms can protect their DNA, RNA, proteins, membranes and cells for long-term survival in a dried state and later be revived by simple rehydration. Biomatrix's technology transfers the natural molecular principles of anhydrobiosis to a synthetic chemistry-based stabilization science that works by forming a thermo-stable barrier during the drying process to protect samples from degradation during storage at room temperature (Fig. 1 and 2).



Nature

SampleMatrix

Figure 1. Structural prediction of SampleMatrix

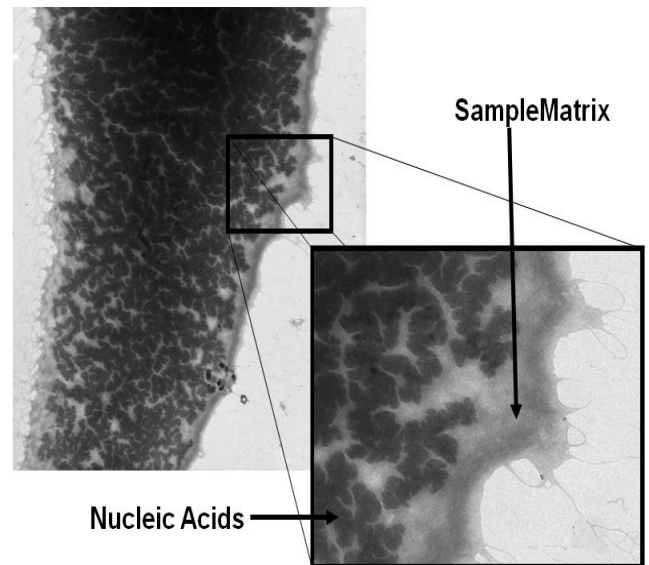


Figure 2. Electron micrograph of protective thermo-stable barrier.

Biomatrix recently completed a pilot study with the institution to assess the impact on energy usage, carbon footprint and costs of biological sample storage in freezers and validate the use and potential of Biomatrix's innovative room temperature storage system. Senior administration for the Schools of Medicine and Biology endorsed the project and helped to recruit the core participant group of twelve laboratories, representing a broad range of research areas and lab sizes. Nearly one million samples were identified within these labs to be transferable into Biomatrix's technology and over 60,000 of these samples were transferred to room temperature storage as part of the study to assess the technology and the sample transfer workflow.

The technology performance was validated by the pilot lab group to be equivalent to or better than traditional freezer storage. A sophisticated forecast model was developed using information from the pilot group, data from the institution, and industry trends to estimate the potential campus-wide benefits to the institution and any university. All assumptions were verified by respected industry sources and validated through institution personnel, as well as outside peer review.

The pilot lab data provided the basis for the model to make a conservative estimate of the total number of addressable samples, a mix of DNA, RNA and bacterial clones that exist across all of the institution's research laboratories and are candidates for transfer into Biomātrica's room temperature storage technology. In addition, the study was able to assess the estimated cost of maintaining the institution's biological sample collection within freezers.

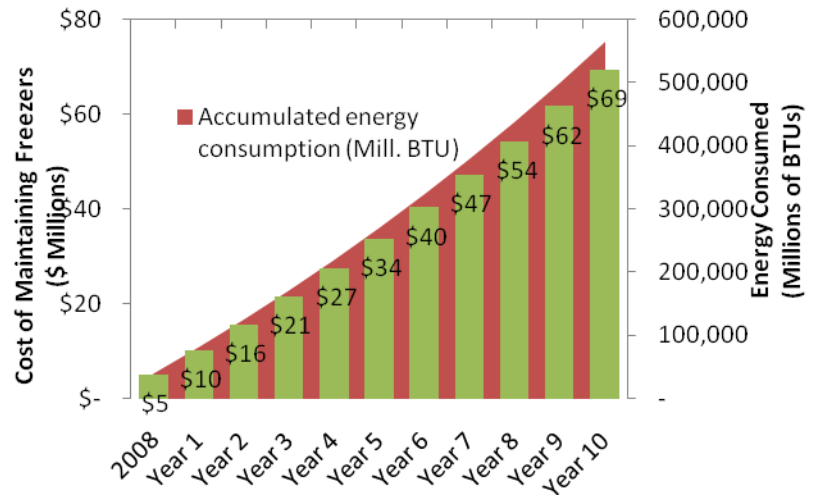


Figure 3. Ten Year Demand to Maintain Freezer Collections

Key Findings and Conclusions:

Universities are currently facing an escalating challenge if they continue to store and protect their biological

sample collections through current methods of storage in freezers. The analysis found that for one university to maintain its current freezer collection, the ongoing energy consumption is estimated at 564,000 MBTU, the accumulated cost is \$69 million with 51,000 metric tons of CO₂ generated if projected over a ten year period (Figure 3). The pilot study identified between 9 and 13 million samples across the campus as potential candidates for transfer to Biomātrica's room temperature technology. The initial investment in transferring these samples could be recovered in three to five years under a broad implementation program. This program would provide a forecasted savings potential of between \$11 – 20 million in costs, 160,000 MBTU in energy

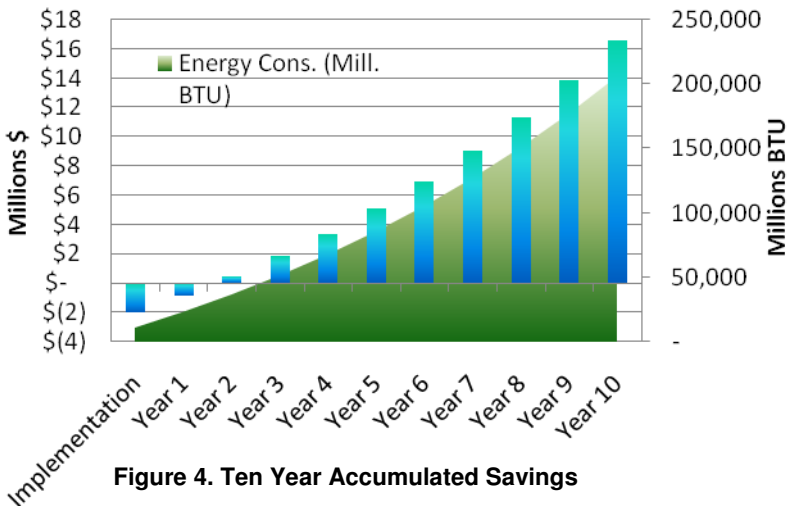


Figure 4. Ten Year Accumulated Savings

savings and prevent 17,000 – 20,000 tons of CO₂ from entering the environment when extrapolated over a ten year period.

Current freezer sample storage is unsustainable from the standpoint of energy consumption and space allocation. Based upon the pilot program, the performance of the Biomātrica room temperature storage system has been validated and analysis has demonstrated the potential for a dramatic reduction in energy consumption and carbon footprint. Additionally, there is a potential to save millions in direct costs and to free up additional lab space for research due to optimization of sample storage space, as well as to significantly reduce the risk of sample loss by reducing vulnerable freezer dependant storage and reducing containers and the use of dry ice in shipments. With the University's campus-wide interest in moving towards green practices, the pilot received enthusiastic support from scientists and researchers for the technology. Biomātrica is now moving forward to assess and implement a broad program across campus to realize these savings.