Nouvel Hay Magazine
SANS FRONTIÈRES

Cryo suite

Les faits marquants de cette semaine :
Nous nous plongeons dans la quête de longévité avec les innovations de la Silicon Valley, préservant l'identité dans la cryonie, préservant la santé cardiaque et retraçant le développement de la vitrification.

Le Life Hack de la Silicon Valley ajoute des décennies à la vie

Le style de vie unique de la Silicon Valley, axé sur la technologie et l'ambition, est synonyme d'innovation et de rythme de vie rapide. Les résidents emploient des astuces pour prolonger la vie, basées sur la modification génétique et les thérapies régénératives. Leurs routines intègrent la méditation, l'exercice et des régimes riches en nutriments, ce qui entraîne de profonds bienfaits pour la santé physique et mentale.

Cliquez ici pour lire l'article

Préservation de l'identité en cryogénie : les patients réanimés peuvent-ils rester les mêmes ?

La cryonie vise à préserver les identités en stoppant la dégradation. La réanimation des patients soulève des questions sur la continuité de la conscience et l'essence de l'identité personnelle, suscitant des débats en science, en philosophie et en éthique.

Cliquez ici pour lire l'article

Santé cardiaque : prévenir et gérer les maladies cardiovasculaires liées à l'âge
Protégez votre cœur vieillissant en comprenant les maladies cardiovasculaires. Les changements de mode de vie et les progrès de la recherche médicale offrent de l'espoir pour la santé cardiaque. Prévenez et gérez les maladies cardiaques liées à l'âge pour une vie épanouie.

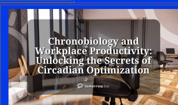
Cliquez ici pour lire l'article

Comment les procédures de vitrification se sont développées au fil du temps
La vitrification en cryoconservation a connu six générations d'améliorations depuis sa proposition en 1984 par Gregory Fahy. Il s'agit d'une avancée clé dans la préservation des matériaux biologiques.

Cliquez ici pour lire l'article

Tendance cette semaine – La critique lit :

Chronobiologie et productivité sur le lieu de travail : découvrir les secrets de l'optimisation circadienne
La chronobiologie, la science du temps biologique, souligne l'importance d'aligner les horaires de travail sur les rythmes circadiens pour améliorer la productivité et le bien-être. Des horaires flexibles, de la lumière naturelle et des espaces de travail ergonomiques sont essentiels.



23 des prédictions les plus folles sur l'avenir issues de l'Exposition universelle passée
Les Expositions universelles, rassemblements d'innovation, ont donné lieu à la fois à des succès visionnaires (comme les téléphones et l'éclairage électrique) et à des échecs amusants (comme les voitures volantes personnelles). Leurs prédictions audacieuses inspirent et repoussent les limites de l'imagination.

Construire le succès en biotechnologie : leçons tirées d'un bioentrepreneur à succès
Les bioentrepreneurs qui réussissent possèdent une vision, une résilience, une éthique et des compétences collaboratives. Ils obtiennent des financements de manière diversifiée et doivent composer avec des réglementations complexes. La constitution d'équipes, le réseautage et l'adoption des tendances du secteur sont les clés de leur succès.

La biologie rencontre la beauté : comment la biologie synthétique peut avoir un impact sur l'industrie cosmétique
La biologie synthétique révolutionne les cosmétiques avec des ingrédients durables issus de la bio-ingénierie et des organismes génétiquement modifiés (OGM), améliorant ainsi l'efficacité des produits tout en respectant la durabilité. Les considérations réglementaires et éthiques jouent un rôle crucial pour garantir une intégration sûre et responsable dans l'industrie de la beauté.

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Suivez-nous sur les réseaux sociaux

Cryopreservation procedures (both for humans and other biological materials) are improving over time, as scientists and researchers develop new technologies. That has been the case ever since the early days of cryonics in the 1960s. Probably the most effective implementation to date was the switch from straight freezing to vitrification with cryoprotection perfusion.

In this article, we take a look at when and how vitrification first became a part of the cryopreservation procedure and how it has developed over time.

What is Vitrification?

Vitrification is the transformation of a substance into a glass-like state. In cryonics, this is achieved by following multiple steps:

First, the patient is stabilised via external cooling, Cardiopulmonary support (CPS), and medication. Then blood is removed from the body, and a type of medical-grade antifreeze called a cryoprotectant solution is perfused into the body. Following this, the body is gradually cooled down until the patient reaches around -130°C. This is when they pass through the so-called glass transition temperature and become *vitrified*. Subsequently, the patient is cooled down further to the temperature of liquid nitrogen (-196°C) for long-term storage (or to about -140°C in the case of Intermediate Temperature Storage).

When Was Vitrification First Introduced in Cryopreservation?

In the early years of cryonics in the 1960s and 1970s, there was no vitrification to speak of. In fact, the first time it was even considered was in 1984 when cryobiologist Gregory Fahy proposed vitrification as an approach to cryopreservation.

Vitrification had been observed in cryobiology before, in cases where water cooled too fast to form ice crystals. Yet fast cooling was not an option for cryonics, as it would result in thermal shock. However, Fahy had an idea how to apply this knowledge to modern cryopreservation practices. He proposed to administer cryoprotectants that would bring down the freezing point of water inside the body to a point below that of the glass transition temperature. By doing this, it was possible to minimise ice crystal formation during the entire cooling process.

How Vitrification in Cryopreservation developed over time

It should come as no surprise that, while generally successful, first attempts at cryopreservation with vitrification weren't perfect. As scientists started to gradually understand the effects of cryoprotectants and vitrification on the human body better, they began adapting their methods. This adaptation can be summarised into six "generations" that showed a gradual increase in cryoprotection quality.

Generation 1

The first, and simplest vitrification was conducted by administering a single cryoprotective agent inside a carrier solution. This approach certainly did the job, but turned out to be less helpful and more harmful than hoped.

Generation 2

It was then discovered that a less toxic mix with a higher total cryoprotectant concentration could be achieved by combining DMSO with amides such as acetamide or formamide, and adding propylene glycol. This formed the basis for the VS41A (aka VS55) vitrification solution, enabling the most advanced vitrification of the mid 1990s.

Generation 3

Further research conducted by Fahy led to the discovery that cryoprotectant toxicity correlated with the number of water molecules per cryoprotectant polar group. This newfound knowledge was applied by replacing the propylene glycol in VS41A with ethylene glycol, generating the so-called Veg vitrification solution.

Generation 4

The next step in increasing cryopreservation quality came with the addition of polymers. Adding them to the cryoprotectant solutions permitted further reductions in toxicity by reducing the concentration of penetrating cryoprotectants necessary to achieve vitrification.

Generation 5

The addition of specific polymers continued in the 5th generation of vitrification procedures, as ice-blocking polymers were able to reduce the concentration of all cryoprotectants necessary to achieve vitrification even further. The most prominent solution of this generation is VM3.

Generation 6

The last major discovery regarding vitrification relates to chilling injuries. This type of damage is caused by passing through certain sub-zero temperature ranges, a problematic occurrence for cryonics as a whole. Researchers have found that this type of injury could be overcome by increasing the tonicity of non-penetrating components of vitrification solutions. VM1 and M22, the cryoprotectants currently used by major human cryopreservation companies are of this generation.

Cryonics doesn’t freeze people but vitrifies them instead.

Vitrification Today

Thanks to the outstanding research by leading cryobiology experts, successful vitrification has now been demonstrated for heart valves, vascular tissue, cartilage, cornea, human sperm, and more. Red blood cells can readily be cryopreserved for future blood transfusion and preserved sperm is frequently used for artificial fertilisation.

Additionally, vitrification has shown effectiveness in the preservation of tissue slices, including brain slices, and the histological preservation of larger systems. Nevertheless, vitrification research is anything but over at this point. Future generations of cryoprotectant solutions are tasked with finding an answer to dealing with their inherent toxicity amongst other problems that still need to be solved.

Removing toxicity from the equation could potentially have major impacts on organ preservation, another field where cryopreservation is currently being tested. Additionally, revival from biostasis could be made much easier through advancements of this kind.

Cryoprotection Perfusion with Tomorrow Bio

Currently, Tomorrow Bio and Cryonics Institute make use of an in-house optimised version of the VM1 agent, which has proven itself as one of the least toxic vitrification solutions in lab trials. However, improvements can definitely still be made, and many scientists today have made it their goal to find exactly those.

A lab called Advanced Neural Bioscience (ANB) is hard at work discovering more efficient solutions for cryopreservation. Tomorrow Bio's R&D Initiative is also amongst those that try to push the field of cryonics forward and find solutions to the obstacles currently in the way of future revival from biostasis.

Thanks to our members and generous Tomorrow Fellows funding, we are able to not only provide a state-of-the-art cryopreservation service but also help increase its quality over time