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Veit Braun, Sara Lafuente-Funes, Thomas Lemke, Ruzana Liburkina

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# Making Futures by Freezing Life: Ambivalent Temporalities of Cryopreservation Practices

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Veit Braun<sup>1</sup> , Sara Lafuente-Funes<sup>1</sup> ,  
Thomas Lemke<sup>1</sup>  and Ruzana Liburkina<sup>1</sup> 

## Abstract

The preservation of biological matter at extremely low temperatures has gained increasing importance in a broad range of life science fields in recent years. Social and cultural studies of cryotechnologies have often likened the freezing of life to a stillstand of time. This special issue explores the argument that cryotechnologies require us to rethink time and temporality more broadly: freezing does not simply equate to an interruption of the “natural” course of time. Covering diverse types of freezing practices and biological materials—egg cells, cord blood, lab mice, and breast milk—the articles in this issue inquire empirically and theoretically into different ways in which cryotechnologies contribute in making particular pasts, presents, and futures. In engaging with cryopreservation, we have to take into

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<sup>1</sup>Institute for Sociology, Goethe-Universität Frankfurt am Main, Hesse, Germany

## Corresponding Author:

Veit Braun, Institute for Sociology, Goethe-Universität Frankfurt am Main, Theodor-W. Adorno-Pl. 6, PEG Building | Hauspost 31, 60323 Frankfurt am Main, Hesse, Germany.

Email: [braun@soz.uni-frankfurt.de](mailto:braun@soz.uni-frankfurt.de)

account the complex, sometimes contradictory, pathways in which life, death, and time are made and remade through freezing.

### Keywords

cryotechnology, time, cord blood, laboratory animals, breast milk, egg cells

The preservation of biological matter at extremely low temperatures has gained increasing importance in a broad range of life science fields in recent years, from regenerative medicine to plant breeding. Cells and tissues are awaiting future use, stored at temperatures that can be as low as  $-196^{\circ}\text{C}$  in liquid nitrogen and dry ice. Once the time is right, they may be thawed and revived, transformed, implanted, or multiplied. The term “cryobank” for ultra-low temperature repositories of biological materials is not accidental in this context: frozen cells are viewed and presented as vital deposits, valuable backups, or options to be considered (Swanson 2014).

Social and cultural studies of cryotechnologies have often likened the freezing of life to a stillstand of time (see, e.g., Harrison 2017, 86; Hoeyer 2017, 2011; Keck 2017, 135). As the late anthropologist Deborah Bird Rose (2017, 152) stated, “[t]he result is, in effect, to freeze time by holding lives, body parts, and samples within the zone of the incomplete.” Indeed, the assumption that time will stop once living matter reaches temperatures far below zero underlies both the practical applications of cryopreservation and discussion about them. Metabolic processes cease. Developmental trajectories are interrupted. Death and decay grind to a halt. In this understanding, cryopreservation practices arrest vitality; they enact a “pause button” stopping the flow of time. The powerful image of cryopreservation as freezing both matter and time does more than fuel hopes, it is the basis for an important line of critique: the world cannot be kept from turning (Chrulaw 2017).

This special issue follows historian Joanna Radin’s (2015, 363) argument that cryotechnologies require us to rethink common notions of time and temporality, such as linearity or unidirectionality. Freezing does not simply equate to an interruption of the “natural” course of time, nor do its effects stop at the walls of freezers and nitrogen tanks. Freezing, and the practices around it, are world-making and bring changes that go beyond stopping time, as we can see in each of the cases analyzed in this Special Issue of *Science, Technology, & Human Values*. As the contributors show, practices of cold prepare for and anticipate—but they also produce—futures

to come. Complicating the prevalent idea of freezing as fixing time and organic material, the articles explore the dynamic and generative dimensions of cryopreservation as a way of modifying temporal relations and turning biological matter into things-to-become in different settings. Far from just stabilizing and preserving, putting organic materials “on ice” transforms and redefines collectives, politics, moral economies, and infrastructures, often in unexpected ways. Even though engineers and technicians inscribe particular properties and mechanisms into cryotechnological devices and systems, their actual uses and meanings depend on various circumstances that cannot all be controlled (Akrich 1994).

Covering diverse types of freezing practices and biological materials, the articles in this Special Issue inquire into how cryotechnologies contribute to the making of particular pasts, presents, and futures by suspending developmental processes. They include theoretical considerations of the entanglements of life and temporal pathways, as well as empirical explorations of what happens to time when life is frozen: from cord blood (CB) banking to the thermal assemblages of human milk, and from the use of strategic freezing in in-vitro fertilization (IVF) labs to the management of strains through cryopreservation in mouse labs.

Thomas Lemke’s opening article (this issue) elaborates on how cryopreservation practices extend the present by enacting “suspended life.” Drawing on sociologist Niklas Luhmann’s idea of an enduring present bound to the principle of reversibility, and Martin Heidegger’s concept of the standing reserve, the article explores the temporal and ontological liminality produced by cryopreservation. It identifies elements of a politics of suspension that both reserves time to keep options open and conceives of cryopreserved organic material as a disposable reservoir kept in an ambiguous state between no-longer and not-yet.

The urge to maintain the status quo and avoid irreversible change by mobilizing technologies of cold often results in new research infrastructures, business models, and care practices. More importantly, it also leads to reconfiguring life as Dmitriy Myelnikov and Sara Peres (this issue) show. Their close study of mouse strain preservation shows how the rationales for freezing life have shifted in the last fifty years: from security to ethical responsibility to genetic stability. These rationales have sedimented into cryopreservation practices and infrastructures and continue to exert their influence to this day. Different as they are, they have also sidelined mice as individuals, which through the intersecting objectives of cryobanking have become problematic. Individual mice have been replaced by strains, gametes, and cell lines, which are deemed more secure, less ethically

demanding, and genetically purer. Strains thus emerge from this history as the primary object of both care and control. At the same time, they embody and continue to enact the demands of past decades.

Uncertain futures are often seen as demanding action in the present to confront and counter the risks that lie ahead. Cryopreservation is a technology that promises to deal with what is to come, offering a sense of control. The role of cryopreservation in promoting logics of preparedness and risk-avoiding practices becomes apparent in Sara Lafuente-Funes's article (this issue) about the role of a fast-freezing technique called vitrification in IVF labs in Spain. More than leaving things "on hold," vitrification accelerates particular forms of change, creating an opportunity for certain medical interventions such as screening, classification, and selection of embryos. In the context of reproductive treatments in Spain, cryopreservation has gone from being mainly a storage practice to a strategic one: the time-window opened by embryo freezing transforms and optimizes IVF as it amplifies risk-avoiding procedures. It acts in the present to enhance control of the near future.

And yet, the future does not always turn out the way we expect it to. Indeed, as time goes by, what was once preserved in liquid nitrogen tanks with high hopes might well become detached from the value initially ascribed to it. Dealing with promises, and what to do when they do not come true, is a key challenge for cryobanks as Ruzana Liburkina's article illustrates (this issue). Far from the hype that emerged and persisted around CB in earlier decades, public and private CB banks in Germany today face an ambiguous situation of "nonfailure." Instead of being defined by optimism and success stories, their operations mainly revolve around the suspension of failure. To achieve this, value-making was reoriented from frozen biological material and its potential to the current ability to freeze. The long-term nature of the promises inherent in the preservation of CB samples bought time for the cryobanks, while they continued to search for new promises to make, further funding, and stability. These insights into the maintenance of nonfailure reveal how cryopreservation and its role in prolonging the here and now enables economic agency for cryobanking projects to persist against all odds.

Unlike cryopreservation projects with their grand long-term promises, milk banks are meant to serve basic nutritional needs in the present. Yet, as Carmen Romero-Bachiller and Pablo Santoro (this issue) show, even freezing things for a short time is a laborious undertaking that requires the parties involved to reorganize temporal routines and spatial arrangements. Following the pathways of breast milk conservation to the production of

biopharmaceuticals, the authors show how preserving this vital substance is not just complex but also potentially generative of different present–future relations. When utilized for probiotic purposes, microorganisms inherent in breast milk are turned into means of individual self-care and illness prevention, viewed as agents that can repair the human microbiome and render bodies (more) resistant. Preserving breast milk is a practice that feeds off abiding hopes for healthy futures. However, suspending life to prevent illnesses can also be grounded on heating techniques. Freezing and pasteurizing milk are two contradictory but intersecting biopolitical strategies for producing healthy presents and futures.

Cryopreservation practices entangle past, present, and future in unpredictable ways. So far, freezing biological material has been equated with arresting time. Straightforward as this image might appear, the articles in this collection show that the temporal effects of cryopreservation are far more diverse, ambiguous, and complex. The impacts of cryopreservation go beyond simply halting time: they actively make futures and reorder presents and continue to hold on to pasts that still exert their influence over life.

This multiple rearrangement of temporal trajectories poses a challenge for the critical analysis of cryopreservation practices. If the power of freezing life goes beyond arresting the movement of time, how should we reimagine cryopolitics? The image of frozen time has been central to the cryopolitical imperative of “making live and *not* letting die” (Friedrich and Höhne 2014, 2; Radin and Kowal 2017), which takes up and extends Michel Foucault’s work on biopolitics. Yet the various ways in which cryopreservation modifies and modulates temporalities suggest an open spectrum of different kinds of instrumentalizing, changing, controlling, and fostering life that goes beyond strategies to prevent death and decay. In engaging with cryopreservation, we will thus have to take into account the complex, sometimes contradictory, pathways in which life, death, and time are made and remade through freezing. The present special issue is intended as a step in this direction.

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## ORCID iDs

Veit Braun  <https://orcid.org/0000-0002-1769-6716>

Sara Lafuente-Funes  <https://orcid.org/0000-0002-0299-725X>

Thomas Lemke  <https://orcid.org/0000-0002-3022-1707>

Ruzana Liburkina  <https://orcid.org/0000-0003-0994-3606>

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## Author Biographies

**Veit Braun** is a postdoctoral researcher in the CRYOSOCIETIES project at the Institute for Sociology, Goethe University Frankfurt, where he studies the governance of animal biodiversity in cryobanks and the role of property in society. His work is situated at the intersection of science, economics, and law.

**Sara Lafuente-Funes** is a feminist sociologist currently based at Goethe University Frankfurt as a postdoctoral researcher on CRYOSOCIETIES. Her research interests include queer and feminist studies of science, and social studies of biology and biomedicine. In her previous work, she studied assisted reproduction in Spain, focusing on egg donation and the reproduction of heteronormativity. In addition to publishing papers in several journals, she recently published the book *Mercados Reproductivos: Crisis, deseo y desigualdad* (Katakarak, 2021).

**Thomas Lemke** is a professor of sociology with a focus on biotechnologies, nature, and society at the Faculty of Social Sciences of the Goethe University Frankfurt in Germany. His research interests include social and political theory, biopolitics, new materialisms, and social studies of genetic and reproductive technologies. In 2018, he was awarded an Advanced Grant of the European Research Council for a research project on the social and cultural impacts of cryobiology. His publications include *Biopolitics. An Advanced Introduction* (New York: NYU Press, 2011), *Science and Technology Studies. Klassische Positionen und aktuelle Perspektiven* (Berlin: Suhrkamp, 2017; coedited with Susanne Bauer and Torsten Heinemann); and *The Government of Things. Foucault and the New Materialisms* (New York: New York University Press, 2021).

**Ruzana Liburkina** is a postdoc at the Faculty of Social Sciences of the Goethe University Frankfurt, Germany. Her current work examines the entanglement of cryotechnologies and social life in the field of stem cell banking. She is particularly interested in intersections between science and technology studies and economic anthropology and in ethnographic approaches to human-environment relations.