

# Introduction: Laboratory times

Kristin D Hussey

Medical Museion and the NFF Center for Basic Metabolic Research  
(CBMR), University of Copenhagen, Department of Public Health,  
Copenhagen, Denmark

Rachel Douglas-Jones

Department of Business IT IT University of Copenhagen, Denmark  
rdoj@itu.dk

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## Introduction: laboratory times

In March 2021, the Material Life of Time conference convened more than 400 participants online, through zoom links, chat forums and virtual spaces. Organized across time zones by the Universities of Oslo and Edinburgh, the organizers asked attendees ‘How are times being made? Where are its materials coming from? Who or what is being displaced in the process? What kinds of material practices are being called forth?’ (Temporal Belongings, 2020) At home, quarantined in the second year of the COVID-19 pandemic, the editors of this

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collection moved between panels, overhearing snippets of conversation from colleagues spatialized as icons, taking ethnographic notes of the asynchronous global discussion in our respective isolations (Bastian et al., 2022). We found ourselves drawn to presentations that examined scientific practices as they are organised around and within laboratory spaces. While the ‘laboratory’ is a complex and contentious term, the presenters had all worked with *bench* scientists and technicians, following along as they carried out analyses, interrogated scientific objects, negotiated internal and external temporalities, and actively participated in the construction of new ones. The kinds of ‘science’ they represented were diverse (geological weathering, coral coring, chronobiology) but all shared an attentiveness to the materiality of both temporal and scientific practices. We began to think together about what these subjects might tell us about the status of the laboratory in time studies, and of temporality in Science and Technology Studies (STS).

In this editorial introduction, we present ‘Laboratory Times’ as a theme which brings together the study of the lab and its temporalities in STS and the study of science in time. Collectively, the pieces ethnographically generate insights into time’s lived, manipulated, and experimental qualities in laboratory settings. We regard the laboratory as a space where questions of control, management and *production* of time are central. The papers consider both how time organises scientific practice within the frame of a laboratory, and how scientists work with and create time to suit the frames of experimentation. In focus across the papers are questions of temporal simulation, real-time mimesis, and temporal displacement in the generation of data. Each examines distinctions made by scientists in and through their work between experimental and other (geological, biological, historical, technological) temporalities, complicating fantasies of real-time observations by demonstrating a proliferation of scientific times across a range of laboratory-based disciplines. Across the biological and inorganic divide, the papers illustrate how societal values inform the slowing, speeding, pausing and creation of experimental time in the laboratory. Together, they ask the shared question: what times are being generated for laboratory ends?

With this Special Section, we suggest that while canonical works from the early days of Laboratory Studies demonstrated the usefulness of thinking about time as a crucial object of laboratory practice, *a focused body of scholarship on the intersection of time and the lab has yet to fully materialize*. We demonstrate the potential for deeper study at this intersection by turning to the collection’s papers, introducing their subjects and reflecting on their overlapping themes. The laboratory emerges from these papers as a space where questions of control over, management and production of time are central. We make evident that time is made to structure and shape scientific practice within the physical frame of a laboratory and that in that same physical space, scientists work with and create time to suit the frames and needs of experimentation.

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Following on from the papers, we conclude by imagining a future for this kind of work, in which a research trajectory focused on ‘Laboratory Times’ might bring scholars in time studies and STS further into conversation.

## The lab in time studies

Let us begin with work that foregrounds time: How, where and as what kind of object does the laboratory appear within the field of time studies? A systematic review of existing literature is complicated by the variety of disciplines comprising the study of time, and the range of associated journals. Here, we have chosen to define ‘time studies’ as works which have been published in established journals dealing specifically with temporalities (like *Time & Society* or *Timing and Time Perception*) and books and edited collections whose primary focus is time. While far from an exhaustive review, the aim here is to highlight that the laboratory, while present in time studies, has perhaps not received the focused attention one might expect – particularly in contrast to the field of STS, to which we will subsequently turn. Following Barbara Adam’s (1994, 1996, 1998, 2004) influential notion of ‘timescapes’, one might expect to find scholars interrogating as many forms of scientific time as there are kinds of science. Yet, as Filip Vostal and colleagues (2019: 784) have observed, ‘inquiries into the temporal structures of science... [and] the role time plays in scientific knowledge production have been scarce.’ We might add that the specific temporalities of laboratory practice are even less so.<sup>1</sup> Nevertheless, we have identified at least three core ways in which the laboratory has been manifested in time studies: as a location or method for the study of time and time perception; as the site of scientific work practices and research agendas with their own temporalities; and as a place which contributes to wider societal and political perceptions of time.

First, for the scientific study of time, the laboratory is a crucial site. It is a location that turns individual and collective perceptions of time into objects of study, and where the scientific measurement of ever smaller units of time takes place. One need only look to the proliferation of books and journals explicitly dedicated to the study of timing and time perception to see this is a burgeoning area of interests for psychiatrists, neuroscientists, pharmacists, sociologists and more (Wearden, 2016; Arstila et al., 2019). In particular, COVID-19 and the significant changes in timing perception and experience reported as a part of lockdowns has been characteristic of a number of recent key works in this field (Ogden and Piovesan, 2022; Mioni et al., 2022; Huebner and Arya, 2020). In studies of time perception, the laboratory is generally a method, means or a context for research rather than the *subject* of it – it is a place to capture or quantify subjective temporal experiences. This is not to say that authors are not aware of the fact that the lab is its own particular kind of temporal context (especially in historical work on

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the subject like Clark, 2020), but that this remains more in the background of their analyses.

Beyond the lab as method, it is also a place where science contributes to the development of ways of measuring and thinking about time. As scholars have observed, the very understanding of time as something measurable, repeatable and regular is generated and reified by the sciences (Adam, 1988). The laboratory is a tool for creating and maintaining 'industrial' or 'technological' time. In her study of industrial farming and climate change, Adam shows how the practices of science, cultivated in the lab, disrupt the rhythmic times of nature and reify a capitalist idea of temporal modernity (Adam, 1998). Initially measured with the aid of sundials, today 'time' as it guides our digital systems emanates from atomic clocks, carefully maintained in laboratory settings around the globe (Audoin and Guinot, 2001). As a result, the physics laboratory has been a site of particular interest for time studies as a place where atomic technologies permit the measurement of smaller (and ostensibly more accurate) units of time (Mackenzie, 2001) and which generates sometimes violent temporal intrusions through acts of war (Barad, 2007).

Second, and more closely related to the area of interest presented in this Section, scholars have been keenly interested in both the historical and contemporary temporalities of the lab as a workplace for scientists. Authors across disciplines have observed the ways in which scientific practice is shaped by a research agenda which is future-oriented (Rheinberger, 2010; Keller, 2012).

Since at least the late nineteenth century, scientific research has been seen to produce a particular kind of futurity, one in which experimentation expands endlessly (Bush, 1945; Leyden and Menter, 2017; Shaw, 2022). From political science to research management, there remains a strong interest in the temporalities of science. Here, questions of time come to the fore, from institutional timelines to funding cycles and the career trajectories of scientists. Vostal and collaborators (2019, Virtová and Vostal, 2021; Vostal, 2021) have explored the 'temporal complexity of scientific knowledge production' (2019: 783) - particularly in the context of a wider anxiety around acceleration in the world of academic research. However, contrary to scholars like Stengers (2018), Pels (2003), Berg and Seeber (2016), and others who have focused on acceleration, efficiency, and production, Vostal et al. (2019) argue an emphasis on speed is far too simplistic. As a branch of knowledge-making, laboratory science is subject to its own peaks and troughs, connected to 'dialectics of 'fast' aha-moments, 'eurekas', institutions on the one hand, and 'slow' prolonged periods of incrementality, serendipity and stalling on the other' (Vostal et al., 2019: 796). This insight has yet to be applied to the many different distinct disciplines of science - which undoubtedly involve their own dialectics of fast and slow. These times are done and experienced differently by workers in laboratories, as Rachel Friedensen and colleagues (2021) make evident. Researching the encounter of queer identities with the norms of STEM disciplines, Friedensen

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et al. observe (2021:344) that managing identities and temporal practices requires a ‘bifurcation of selves, spaces and times’ to reconcile queerness and the temporalities of normative institutions like universities.

Third, as an extension of the ‘working times’ of science, as recently explored in another Special Section (Vostal et al., 2019), scholars have sought out particular kinds of scientific temporalities arising from specific locations. Time scholars thus explore the kinds of futures (real and imagined) science and scientific spaces like laboratories contribute to. It is here, in the examination of these scientific temporalities, where time studies and STS are currently most in contact. Since Sharon Traweek’s (1988) now classic ethnography of ‘beam times and lifetimes’, researchers have known layered temporalities of science and scientific careers. Traweek’s work in particle physics laboratories in the US and Japan, examining the interaction between these different kinds of time, created a sensitivity to the kinds of affordances of different technologies, scientific practices, and tempo. Yet despite this early, powerful account, there is comparatively limited work that attends as closely to time in specific laboratory settings. Hugh Gusterson’s (1996, 2007) examination of a US nuclear weapons laboratory is notable for its consideration of the temporalities of expertise, and the consequences of ‘losing’ nuclear skills with the end of the Cold War. Taking a similar approach to expertise over time, Marisa Cohn (2016) describes the temporally entangled lifetimes of software engineers in NASA’s Cassini mission, noting that over the duration of the spacecraft’s flight to Saturn, the ethnographer witnesses ‘the entangled lifetimes of careers, professional identities and programming languages and paradigms’ (2019: 424). Staying with sites of space science, in Zara Mirmalek’s (2009, 2020) study of NASA’s Mars Rover mission we find ‘Mars Time’ emerging from the ways terrestrial scientists and engineers adapt themselves to the phenomena they study. In thinking time as a site of adaptation, we might also look to Lisa Cromer’s work (2017, 2023) on frozen embryos in IVF labs, which foregrounds a *waiting* that is made powerful, political and poignant for the contestation Cromer uncovers over those embryos’ potential futures. Such ethnographically grounded work offers an exploration of how unique forms of time regimes arrive in their specific scientific settings.

In these three groupings from studies of time, the lab appears in distinct roles: as a necessary backdrop to work *on* time (experiences of it, measurements of it), as an environment prompting *work practices* with their own fascinating temporalities, and as a place from which particular practices (and understandings) of time arise. But what role does time play if the lab is one’s primary object of study?

## Time, the lab, and STS

For Science and Technology Studies (STS), the lab is an iconic field site. In the 1970s, STS was a young discipline in formation, and, borrowing anthropological

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methods of participant observation, researchers followed scientists into their workplaces: laboratories. As such, the field claims foundational ethnographic interest in what goes on behind the closed doors of the laboratory (Latour and Woolgar, 1986 [1979]; Knorr-Cetina, 1981; Traweek, 1988; Lynch, 1985). Laboratories, remarks Sergio Sismundo, 'are exemplary sites for STS because experimental work is a central part of scientific activity and is relatively visible' (2010: 106). The initial emphasis was on *seeing* what was going on (Sismundo, 2010: 107-108), looking at 'tinkering' (Knorr Cetina, 1981), alongside practices of 'professional hierarchy, organizational identity, informal identity, gendered identity, national identity, modalities of "safety" and "purity" of 'risk and threat, the complex microplay of benchtop negotiations, relations to industry and commerce, ritualistic performances, and the erasing of reported contingency' (Doing, 2008: 290-291; see also Sims, 2005 and Mody, 2001). Researchers rapidly realized, however, that the laboratory was far from a bounded space. In what Hess (2001) calls the 'second wave' of laboratory studies, researchers in the 1990s 'oriented towards social problems, [found] a wider range of field sites beyond the physical working spaces of scientists' (Stephens and Lewis, 2017: 203). Indeed, keeping 'scientific' work within the laboratory was challenging from the start: in the wake of the publication of his key text with Steve Woolgar, *Laboratory Life* (Latour and Woolgar, 1986 [1979]), Latour remarked that 'the Laboratory is just a moment in a series of displacements that makes a complete shambles out of the inside/outside and the macro/micro dichotomies' (Latour, 1983:168). With this, he advanced a line of thinking about permeability and scale, moving from locating scientific work inside laboratories to the networks that extended from them. Across papers, researchers increasingly discussed the *where* of scientific work (Law and Mol, 2001), often acknowledging temporality but keeping it in the background.

Nonetheless, questions of time have always been present. As Sismundo notes, for STS scholars, 'science and technology are *active processes*, and should be studied as such' (Sismundo, 2010: 11, emphasis added). Lab ethnographies produce literature littered with temporal artefacts, from the work of replicating experiments (Collins, 1985) and its tensions with 'efficiency' (Schuurbiens, 2011: 778); objects that are 'short lived' (Merz, 1999) in buildings with 'rhythms' (Stephens and Lewis, 2017), needing practices of 'improvisation' (Kohler, 1994). This is because, as STS scholars have long since pointed out, 'time and temporal orders are inseparable from social and political order'; they 'shape discourses and distribute power' (Marquardt and Delina, 2021:2-3). However, temporalities rarely anchor contemporary studies of the lab. When they do appear, they are tied to institutional analyses, or explorations of disciplinary norms, intersecting with time studies and its greater study of disciplinary time. Revisiting the concept of 'trading zones', Peter Galison observes that it is 'easy to think of our universities as highly stable, unchanging fixtures of the

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world' (2010: 48). However, the settings in which laboratory work takes place have their own, institutional time. Galison reminds his readers that in the United States, laboratory work carries distinctly post-World War II characteristics in its 'system of national laboratories, competition for contract funding, and the construction of government-owned and corporate-operate laboratory facilities' (2010: 48).

If the lab was core to early studies of science, providing a site from which to examine its making, then since the turn of the millennium, its definition – as well as its public and cultural salience – has notably expanded. In addition to work that has questioned a reified distinction between laboratory and field (Kohler, 2002; Geissler and Kelly, 2016; Heine and Meiske, 2022) we are also in an era of the metaphor of the lab. Media scholars Daren Wershler, Lori Emerson and Jussi Parikka note that the lab as metaphor 'has permeated contemporary culture to the degree that it can apply to just about anything' (Parikka et al., 2022: Introduction, emphasis added): they 'appear in universities and colleges... they're also in basements, warehouses, strip malls and squats' (Parikka et al., 2022: Introduction). Echoing the expansion of laboratory studies from the physical constraints of the lab itself, today's metaphorical lab 'serves as a kind of pragmatic persuasion, ordering, and organization of material and discursive regimes, invoking an entire network of power relations' (Parikka et al., 2022: Introduction).<sup>2</sup> From the laboratory's epistemic authority as a site of experiment, political efforts to democratize experimentation have led to the creation of 'living laboratories', positioning the experimental outside the laboratory as 'real world experiments' (Gross and Hoffmann-Riem, 2005). If, as Gross notes, for Latour, 'the success of scientist can be attributed to their ability to transfer their findings *out* of the laboratory', then today, 'increasingly experimental processes are planned and set up outside the laboratory and the definition of what constitutes a laboratory is determined retrospectively – if at all' (Gross, 2016: 614). The European Network on Living Labs, for example, describes living labs as 'open innovation ecosystems in real-life environments using iterative feedback processes throughout a lifecycle approach of innovation' (ENoLL, 2022). This openness not only shifts the physical boundaries of the lab but also distributes its practices temporally, into 'iteration' and 'lifecycle' models.

Such 'experimental setups' outside the lab thus come to precede work later relocated within it, 'to be dealt with in a more controlled environment' (Gross, 2016: 613). It is in these 'more controlled' environments that STS scholars are increasingly asked to go. When scientific discovery is modelled on a linear temporal line, 'upstream' is a temporal location, a site imagined where the social can shape scientific research. Whether tasked with making research responsible through critical reflection (Schuurbiens, 2011) or more 'ethical' (Viseu, 2015), the very presence of STS ethnographers in laboratories may well be the result of a temporal imaginary (Godin, 2006).

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This spatial reconfiguration has given rise to critical reflection on temporalities especially the ‘reductionist approach behind scientific and technocentric time-making’ (Vostal et al., 2019; cited in Marquardt and Delina, 2021:2). Researchers—whether in STS or time studies—may now draw on a far more extensive vocabulary temporal concepts concerning capital and innovation, such as the life of ‘anticipation’ (Alvial-Palavicino, 2015), ‘foresight’ (Barben et al., 2008) and ‘speculation’ (Adams et al., 2009). These contributions extend the ethnographer’s capacity to observe and understand the languages, expectations, networks, connections, policies, funding regimes, standards of evidence, technologies and techniques shaping today’s laboratory worlds. Returning these new sensitivities to bench practices also means incorporating updated reflections on what laboratories do, how temporal frames shape them as social and political entities. With the articles that follow in this Special Section, we show how returning these temporal sensitivities to studies of bench science practices in the laboratory stands to benefit from all that has been gained in the half century since the first ethnographies of everyday life in the laboratory.

## Laboratory times

By now, the common interest of these Special Section papers has come to the fore: the multiple and often layered times present in, and made by, the laboratory. How do times upon which scientists act interact with times they produce, and times which act upon them? Looking within, the papers interrogate the laboratory as a space where questions of control over and management and production of time are central to its functioning. They ask what temporalities are generated by the lab as a space. Looking without, they ask what kinds of temporalities inform the conditions of possibility for a lab, and explore how these times travel. Outward trajectories come in the form of data on the progression of climate change, new materials for conservation scientists, or scientific papers that re-focus life sciences to the very centrality of time within it. Our collection also considers both how time organises scientific practice within the frame of a laboratory, particularly how scientists work with and create time to suit the frames of experimental practice. Each examines distinctions made by scientists in and through their work between experimental and other (bodily, biological, historical) temporalities, complicating fantasies of real-time observations by demonstrating a proliferation of scientific times across a range of laboratory-based disciplines. The focus here is less on questions of speed and slowness, but rather on how the working practices of science meet with the social lives of scientists, technicians, students and laboratory animals. These ‘laboratory times’ are multiple and competing, with distinct consequences beyond the lab itself.

Through the three comparative ethnographies we encounter distinct temporalities produced and managed in scientific research laboratories across the globe. In



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Cameron McKean's paper, we visit the Australian Institute of Marine Science (AIMS) near Cairns, where data from coral reef growth is investigated as a proxy record of the planetary climate, coming to operate as an anticipatory chronometer. Using the frame of 'dimensional friction', McKean argues against a move towards vertical understandings of time in the context of coral science - instead demonstrating how 'volume' creates a broader understanding of how multiple times intersect and interact around coral cores, their pasts and futures. Studying the analytic practices of coral core scientists in their laboratory, McKean interweaves planetary, climatic, political, and ecological times. Rachel Douglas-Jones' paper also asks questions about the temporalities of climate, centring the scientific study of weathering and its replication, acceleration and manipulation by conservation professionals in Paisley, Scotland. Time is made material through the historic building materials studied by scientists - carrying within them a historical time through their degradation, a time which researchers aim to slow down through the application of new consolidants. Douglas-Jones attends to the temporalities that cross and shape these laboratory times - the changing weather patterns of climate change, the timelines of international research projects, and the internal temporal politics of the heritage profession - suspicious of new and untested innovations. Finally, Kristin Hussey moves us to the realm of molecular biology, where chronobiologists studying circadian rhythms make and manipulate time for their experimental subjects. 'Z-time' is the experimental system that allows the scientists to alter the perceived time of lab mice, a system Hussey unfolds as constituting an intersection between an idealized, controllable experimental time and the unruly embodied times of mice and scientists. She considers how embodied biological times limit or challenge the ability of the lab to 'time work' (Flaherty, 2003; Flaherty, 2011; Flaherty et al., 2020) - this tension contributing to the formation of emotional communities of scientists who study rhythms in the lab.

The 'lab' as we encounter it in these papers is a space of co-existing scales of time which extend into and out of scientific spaces. The actors we meet within them are similarly diverse: coral scientists, chronobiologists, conservation professionals, geo chemists, and animal technicians. Just as there is no generic 'lab', there are no generic lab times. In each discipline, in each temporal and geographical context - the times that are practiced made and felt are unique. We have taken 'science' as a broad category here - moving beyond what has arguably been an outsized focus on physics, undoubtedly a reflection of this discipline's interest in time itself. By putting both organic and inorganic times under consideration - from experimental models like mice to stone and dead corals, the laboratory work traced by the authors indicates the limits, contours, boundaries, of the manipulability/knowability of temporal processes by scientists. We draw attention to four commonalities: first, the material practices of these geographically diverse laboratories (Australia, Scotland, Denmark) *produce*

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times as much as they are subject to them. Second, the papers all reflect a dialectic of control/containment and resistance/slipperiness of times as scientists attempt to harness temporalities for their research. Third, each of the contributors is interested in the material practices of time they see in the lab, paying close attention to machines, tools and experimental protocols to more closely track the production of time in the specific contexts of these laboratories. Finally, the contributors have all taken an interest in questions of labour in science – in the intersection of career trajectories and innovation (Douglas-Jones), in work-life balance (Hussey), and in the development of institutional knowledge (McKean).

## Contributions and future directions

The intersection of critical studies of times of science, and ethnographic work foregrounding practices of *doing* time, is, we suggest, a generative place. Scholars of time, as we have demonstrated in this brief overview, have taken an interest in science (particularly physics) as a way of thinking about temporality, but has not yet delved into the multiplicity of scientific times that can emerge from a close study of the laboratory. In STS, the laboratory time in the lab makes a dual contribution: in part to the advance of understanding scientific practice but additionally, and more centrally for our purposes here, allows for interventions into the study of time in laboratory settings. From time studies, scholars in STS can take a deeper theoretical engagement with the ways that temporality emerges as a material and contextual phenomenon, while from STS, those working in time studies might engage more deeply with the highly differentiated nature of scientific practices and social world. Simply put, there are as many laboratory times as there are laboratories – and there is still a significant gap to be filled in exploring these unique times across disciplines. We hope this Special Section goes some way towards beginning.

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## Footnotes

1. Note that we are here taking the ‘lab’ to denote scientific research broadly in the realm of the experimental sciences (biology, physics, chemistry), and we do not include clinical spaces, which are of course the subject of their own robust literature crossing temporality studies and the medical humanities in areas like patient experience, diagnosis, waiting times, and more (Anucha et al., 2020; Bogicevic and Svendsen, 2021).
2. Missing from this list, and from Parikka, Emerson and Wershler’s book, is time (Parikka et al., 2022).

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