# Postdocs then and now

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Alexei Kojevnikov's recently published book is titled *The Copenhagen Network: The Birth of Quantum Mechanics from a Postdoctoral Perspective.*[1] During the period that Kojevnikov focuses on, 1920 to 1929, the postdoc had not achieved its subsequent status as an established career stage. But it was a necessary one. Funding for physics in Europe after World War I was meager. Even Werner Heisenberg and Wolfgang Pauli struggled to find permanent employment after they earned their PhDs. For them and others, temporary positions were a lifeline.

A central figure in the book is Niels Bohr, who served as the founding director of the Institute for Theoretical Physics of the University of Copenhagen. Denmark was neutral during the war. Lingering animosities that kept Austrian and German physicists from collaborating with British and French physicists in their home countries were less fraught in 1920s Copenhagen. Bohr's ability to raise money from the Rask-Ørsted Foundation, the Rockefeller Foundation, and other wealthy benefactors enabled him to fund visiting physicists, mostly young ones, from other countries. Among them were Oskar Klein, who turned Theodor Kaluza's classical five-dimensional field theory into a quantum one, and Douglas Hartree, who developed numerical methods for solving the Schrödinger equation.

Although "birth" appears in the book's title, most of the action takes place in 1923–27 when new observations of atomic spectra—notably the anomalous Zeeman effect—revealed the inadequacy of what became known as the old quantum theory as pioneered by Bohr, Max Planck, and Arnold Sommerfeld. Heisenberg, Pauli, Paul Dirac, and other young physicists saved the day with their bold extensions of the theory.

**Melinda Baldwin's feature article on page 26 recounts how Ernest Rutherford used letters to *Nature* to raise his visibility while a young professor at McGill University in Montreal.**

They did not do so in isolation. Besides passing through Bohr's institute and other centers of quantum research, such as Max Born's at the University of Göttingen, the physicists shared drafts of papers and corresponded with each other via mail. They were networked, to use a modern term.

I spent my postdoc years, 1988–90, at Japan's Institute of Space and Astronautical Science in Sagamihara, an industrial city outside Tokyo. The somewhat exotic choice was driven by opportunity. My field of research was x-ray astronomy. Because Earth's atmosphere is opaque to x rays, telescopes and detectors have to be mounted on spacecraft, which is expensive. I did my thesis on data from a European spacecraft, *EXOSAT*. The next x-ray astronomy spacecraft to be launched, *Ginga* in 1987, was Japanese.

My postdoc was funded by the Japan Society for the Promotion of Science (JSPS) as part of a program to attract foreigners to Japan. Candidates were selected by partner organizations in their home countries, in my case the UK's Royal Society. The JSPS occasionally hosted receptions for its Japan-based fellows. What struck me was the scarcity of Americans. "They prefer to stay in the US," a JSPS staffer explained to me. Indeed, the American postdocs I met as a graduate student at Cambridge University worried that their presence overseas would harm their prospects of a tenure-track position back home.

This past June the American Institute of Physics (the publisher of PHYSICS TODAY) released a report that sought to predict the impact of the COVID-19 pandemic on the physics enterprise. Postdocs, the report's authors concluded, were especially vulnerable, given their need for access to laboratories. "Separated from their research and scientific cohorts, these young scientists will have difficulty resuming their previous career paths."[2]

What connects the quantum postdocs of the 1920s, my postdoc of the 1980s, and the postdocs of COVID-19? One thing could be travel. The quantum postdocs and I went abroad for opportunities we couldn't get at home. Some countries are recovering from the pandemic more quickly than the US is. If you're a graduate student in the US, please at least consider applying for postdocs abroad. Without looking too hard, I found positions in strongly correlated quantum many-body systems at Aarhus University in Denmark, condensed-matter physics at the Chinese Academy of Sciences' Institute of Physics in Beijing, and active galaxies and galaxy formation at Seoul National University in South Korea.

## References

1. A. Kojevnikov, *The Copenhagen Network: The Birth of Quantum Mechanics from a Postdoctoral Perspective*, Springer (2020).
2. American Institute of Physics, *Peril and Promise: Impacts of the COVID-19 Pandemic on the Physical Sciences* (2020), p. 7.