their energy so quickly that damage from heat transfer is avoided.

Culminating in a recent publication,[2] our interdisciplinary and international collaboration provided a safe and nondamaging new technique for analyzing and sampling artwork.

Although such collaborations between scientists and art conservators aren't widespread, that sort of research is commonplace at OIST. Since I joined the institute in late 2011, I have witnessed mathematicians working with ecologists, chemists with engineers, and physicists with biologists to solve big scientific problems that no one discipline could solve alone and to innovate at the boundaries of academic disciplines.

Femtosecond light

Thanks to the close-knit community at OIST, I get exposed to worlds outside my own, including that of neurobiologists. In a collaboration that grew out of a conversation at a weekly OIST tea in 2012, we learned with Takashi Nakano and Jeff Wickens of the neurobiology unit that it might be possible to manipulate brain activity using femtosecond lasers. Together with chemists at the University of Otago in New Zealand, we attached gold nanoparticles to liposomes (spherical vesicles made of a lipid bilayer), preloaded them with dopamine—a key neurotransmitter in the central nervous system—and used femtosecond lasers to repeatedly release precise pulses of dopamine and other chemicals.[3]

In that truly interdisciplinary research, chemists, neurobiologists, and physicists worked together to design an experiment that capitalized on our various areas of expertise. Our latest results[3] demonstrate the applicability of the technique to interface with neural functioning, with implications for future brain and behavior research.

Using powerful femtosecond lasers to nondestructively release chemicals in a brain slice may be an unexpected application. But in general, neuroscientists are no strangers to femtosecond lasers: The devices are used ubiquitously in two-photon microscopes to image neurons.

At a swing dance class at OIST in the fall of 2014, graduate student Viktoras Lisicovas, who worked in the information processing biology unit, approached me about building a novel type of two-photon microscope that would allow him to image multiple neurons simultaneously in a live *Caenorhabditis elegans* roundworm. A traditional two-photon microscope, in which a tightly focused optical beam is scanned across the field of view, was too slow to record such an event.

So we embarked on a project to build a novel two-photon microscope demonstrated by Yaron Silberberg and colleagues at the Weizmann Institute of Science[4] and independently by Chris Xu and colleagues at Cornell University.[5] Instead of focusing the light beams tightly in space, as conventional techniques do, we focused them in time, which allowed us to image simultaneously a larger field of view and thus multiple neurons in *C. elegans*. With the first images just now coming out of our microscope, we hope that this work between physicists and neuroscientists will lead to a deeper understanding of the collective behavior of neurons in live *C. elegans*, and fruitful future collaborations between physicists and neuroscientists in general in the years to come.

A new model

Interdisciplinary and international research embodies OIST's core values. By actively discouraging the separation of scientific disciplines—both metaphorically and physically—and by having more than 50 countries and regions represented in the university community, the institute is at the forefront of a new model of research and education. In my unit alone, our 13 people represent 8 nationalities and speak more than 15 languages, including French, Lithuanian, Cantonese, Mandarin, Filipino, Hindi, and, of course, Japanese and English.

Without the support and administrative structure of OIST, the breadth and depth of collaborations I've described between physicists and people from other disciplines would probably never have happened. The sense of trust and teamwork that has developed among the faculty across disciplines, the willingness of researchers to try innovative ideas, and the flexibility in funding, personnel, and experimental setup all help in developing successful interdisciplinary projects that further our shared pursuit of knowledge.

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LETTERS

More details on Israel's water story

In a letter in the January 2017 issue of PHYSICS TODAY (page 12), Gabriel Antonius takes offense at a report in the June 2016 issue (page 24) that covers Israel's innovative water technology. He claims that "a key policy explaining the effectiveness of Israel's water management" is "monopolizing water in occupied Palestinian territories" by denying Palestinians the right to drill wells or repair existing ones and by destroying wells, irrigation systems, and water lines. The source for that claim is one report from 2009 by Amnesty International, an organization known for anti-Israel incitement[1] but certainly not known for its expertise on water use and maintenance. That eight-year-old, biased report has been widely debunked in several detailed documents.[2]

Since the signing of the Oslo agreements between Israel and the Palestinian Liberation Organization, the amount of fresh water available to the Palestinian Authority (PA) has increased considerably. In fact, if one takes as starting point the year 1967 when Israel gained control over the West Bank, per capita freshwater consumption in the Palestinian-controlled regions of the West Bank increased by more than 30% over the ensuing 40 years, despite a threefold increase in population. In 1967 only 10% of the Palestinian households were connected to the water infrastructure, whereas by 2012 that figure had risen[2] to 95%. Furthermore, the joint water committee established in the Oslo accords in 1995 has approved approximately 100 new wells and 55 upgrade requests in the areas under jurisdiction of the PA in the West Bank. The approvals resulted in a 50% increase in annual freshwater availability, to more than 250 million cubic meters—about 10% beyond that called for in the accords.

Careful consideration of the historical, political, and cultural context offers a much clearer insight into the regional water issues than impressions gleaned from a superficial view of the situation. One such study is a scholarly thesis that analyzed the water issue in the context of the political failings on both sides, including internal Palestinian politics that undermined the water agreements.[3]

Examples of politically motivated impediments to water supply abound.[2] For instance, Palestinians refused to accept a donation from foreign donors of a seawater desalination plant on the Israeli coast for their exclusive use.[2] They also have refused donations to set up sewage treatment plants, and as a result less than 8% of the sewage from Palestinian towns and cities is treated. Some 30% of the remaining 92% effluents are treated by Israel after flowing into Israel by way of polluted streams; infusion of untreated sewage water—some 33 million cubic meters per year—into the Mountain Aquifer endangers the viability of that important water source. Furthermore, 250 illegal wells dug by Palestinians were documented[2,4] from 1995 to 2005, accounting for 10 million cubic meters of water per year. Because the flow of aquifer water is from east to west in the region where those wells were dug, the illegal drilling further endangers the delicate balance required in maintaining underground water quality within Israel.

Gaza is in a far worse situation than the West Bank. Immediately after Israel's withdrawal from the Gaza Strip in 2006, over 3000 unapproved wells were dug, which caused a severe drop in the aquifer level.[2] Agricultural methods in Gaza not only waste water, but they also allow fertilizer to enter the already depleted and polluted aquifer. The only solution for Gaza to avoid a true humanitarian crisis is cooperation on resource management with Israel, which looks unlikely now due to lack of political will between the ruling Hamas and Israel. Here again, political impediments have made their mark. A new sewage treatment plant funded by the World Bank is ready for operation in Gaza, but there is no electricity to run it: PA president Mahmoud Abbas has cut off payments for electricity to the Hamas-controlled Gaza Strip.[5]

In short, without belittling the very real water problems faced by the PA, particularly in Gaza, the picture is much more complex than Israel monopolizing this precious resource. Efforts to improve the situation are taking place, but there are many political obstacles. In fact, rather than, as Antonius says, "tacitly endorsing the brutal oppression of the Palestinian people" by publishing the June 2016 article (as stated by Antonius), the American Institute of Physics has shown the important role scientists can play in improving regional quality of life. Many of the technologies showcased in that article could go a long way toward alleviating the problems.

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Magnetic monopole search, past and present

For a longtime magnetic-monopole aficionado like me, it was thrilling to learn from Arttu Rajantie's article (Physics Today, October 2016, page 40) that we soon shall have data from the highest available energies at the Large Hadron Collider on whether magnetic monopoles with mass up to a few TeV have been detected.

Such an observation would be an even bigger shock to the standard model than would have been *non*-observation of the Higgs boson at mass 125 GeV. As Charles Goebel concluded in 1970, a consistent description of photon–monopole scattering requires the monopole to have a radius much larger than its Compton wavelength.[1]

Sometime later I developed another argument for the same conclusion.[2] The reasoning used simple energy considerations. In principle, a monopole could be confined in a region not much larger than its Compton wavelength, with only a modest addition to its energy. However, the magnetic Coulomb field outside that region would carry an energy much greater than the rest energy. To avoid that contradiction, the monopole radius should be at least an order of magnitude bigger than the Compton wavelength.

Dirac's quantization condition on the product of electric and magnetic charge holds in quantum electrodynamics and in the standard model. Thus in either of those theories the monopole charge can-