PEACE OF MIND

A young Palestinian neuroscientist hopes to create a research oasis in the West Bank that transcends politics

By **Martin Enserink**, *in the West Bank; Photography by* **Mahmoud Illean/AP Images**

On a sunny winter afternoon, Mohammad Herzallah is driving his father's Hyundai north on highway 60 to see his family near the town of Jenin. The road weaves through rugged terrain and olive groves in the heart of the West Bank, passing the occasional Palestinian village. Some hilltops are crowned with the modern contours of Israeli settlements, a major obstacle in the quest for peace. "They're called facts on the ground. … It's an interesting term," Herzallah says, coolly.

The Israeli military checkpoints dotting the area can paralyze traffic at a moment's notice, but today they aren't causing delays. Herzallah, a Palestinian neuroscientist now at Rutgers University, Newark, in New Jersey, recalls how hard the roadblocks made life early in his career, when he crisscrossed the West Bank visiting Parkinson's patients. "I learned to live with the checkpoints," Herzallah says. He passes them very slowly. "You don't want to get shot at," he says.

But Herzallah isn't interested in discussing the Israeli occupation. His prime concern

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Founder Mohammad Herzallah has sought to keep politics out of the Palestinian Neuroscience Initiative, housed at Al-Quds University in the West Bank.

is the Palestinian Neuroscience Initiative (PNI), which he founded in 2009 as a medical student at the tender age of 24. What he has built is remarkable, colleagues say: a research and training program in the impoverished, conflict-riven West Bank, where neuroscience, until recently, was nonexistent. Based at Al-Quds University in Abu Dis, on Jerusalem's outskirts, PNI has already trained dozens of students, bagged a $300,000 grant with Rutgers from the U.S. National Institutes of Health (NIH), and started publishing papers. A key focus is clinical depression, which is rampant in the Palestinian territories.

Even without the tools found in neuroscience labs elsewhere—brain imaging equipment, animal facilities, or DNA sequencers—Herzallah has accomplished a lot, says neuroscientist Edvard Moser of the Norwegian University of Science and Technology in Trondheim, who visited PNI in January 2014, 8 months before he and his wife May-Britt Moser won a Nobel Prize in Physiology or Medicine. "He is very determined, balanced, thoughtful, and pragmatic," Moser says. "I admire him."

"Mohammad is really a person you don't meet every day," adds computational neuroscientist Alessandro Treves of the International School for Advanced Studies in Trieste, Italy, a strong PNI supporter and a personal mentor to Herzallah. "Science is a form of personal emancipation for him."

Herzallah, who visits the West Bank twice a year, sees his project as a recipe for "capacity building"—the elusive goal of strengthening research in developing countries. In his case, sticking to the science is a key ingredient. "If this becomes a political story, it could put everything I've built at risk," he had warned before my visit. He feels the enervating and seemingly endless Israeli-Palestinian conflict is distracting too many young Palestinians from contributing to society. "We shouldn't produce another generation that can talk only about politics," he says. "We need people who can speak another language, who can do something else. We need the peace of mind."

THE MAIN CAMPUS of Al-Quds University abuts the eastern side of the 8-meter-high concrete barrier separating Israel and the West Bank. From some vantage points, you can see Jerusalem, including the glimmering golden dome of Al-Aqsa mosque, which adorns the university's logo. A few Al-Quds departments and training hospitals are in East Jerusalem, on the other side of the wall, greatly complicating life for faculty and some of the 12,500 students. When Herzallah arrived here as a medical student in 2003, the wall was lower; you could jump it and walk to the old city in less than half an hour, he says. Now, the trip takes twice as long by public transport, via a checkpoint to the north. (West Bank Palestinians are not allowed to drive to Jerusalem.)

The neuroscience program here grew out of a long-time friendship between Mark Gluck, who leads a group at Rutgers focused on memory and learning, and Adel Misk, a neurology professor at Al-Quds. In 2008, Misk and Gluck set out to recruit and train three Palestinian medical students for a study on cognitive function in Parkinson's patients. One, Gluck says, was "a superstar" who overcame all manner of hurdles and collected most of the data. That was Herzallah.

In 2009, Herzallah spent 6 weeks at Gluck's lab, where he finished a paper on the Parkinson's study. (Its main finding: anticholinergic drugs for treating Parkinson's impair generalization, the application of previously learned rules to a new situation.) Together, Gluck and Herzallah raised money from private donors in the United States for what was initially called the Rutgers/Al-Quds Brain Exchange Program. Herzallah later founded PNI at Al-Quds; he moved permanently to Rutgers in 2010 to begin his Ph.D. with Gluck.

As an initial project, the duo applied for NIH funding to expand the Parkinson's work, but their proposal was rejected because there was nothing special about Parkinson's in the West Bank, Gluck says. The project "didn't cater to a specific need in the area."

Clinical depression fits that bill much better. Studies have found that about a quarter of West Bank Palestinians suffer from major depression disorder, a severe, disabling condition. That's about three times the percentage in the United States. (Based on his own unpublished work, Herzallah says the West Bank rate may be as high as 36%.) Many blame the Israeli occupation, economic stagnation, and a general sense of hopelessness that pervades the West Bank. Herzallah says he's not sure of the causes: "We're brain scientists, not epidemiologists," he says.

Herzallah and his wife, Joman Natsheh, at his parents' home near Jenin. Natsheh is also involved in PNI and has started a project focused on Palestinian women's mental health.

Few patients here seek treatment because there's a strong stigma attached to mental illness. "It's related to the Arab mindset," says PNI's Hamza Mousa, a collaborator on the depression project. "Being depressed is seen as shameful and weak. People will think you are crazy. Your daughters may be unlikely to get married." Even those who want treatment are hard-pressed to get it: Herzallah says there are fewer than 25 psychiatrists in the West Bank, which is home to some 2.8 million Palestinians.

That makes it possible to do studies that would be difficult in the United States, where untreated severe depression is hard to find. "Anybody who has a hint of depression is put on medication," Gluck says. "If

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Mohammad Herzallah discusses results with postdoc Osama Abu-hadid after a lab meeting at Al-Quds University. Back at Rutgers, Herzallah conducts meetings by Skype.

you want to study cognition in clinical depression, you never know if you're looking at the underlying depression or the side effects of the drugs." Gluck and Herzallah convinced NIH that studying depression in the West Bank had local as well as global significance, and they set up several studies that required little more than laptop-based tests.

One paper in 2013 showed that untreated depression patients were slower than healthy controls to guide an animated character named Kilroy out of a maze—a task known to rely on a brain structure called the striatum. Once on treatment with selective serotonin reuptake inhibitors (SSRIs), patients mastered the maze as deftly as controls, but now they had trouble with a generalization task, in which Kilroy suddenly appears in a new environment. That confirms previous evidence that SSRIs have a beneficial effect on the striatum but may dull the hippocampus, the brain region that fires most actively during generalization, Herzallah says.

The paper is one of only five to emerge from data collected in the West Bank, but several more are in the works, Herzallah says. One—which he calls "the Inshallah paper"—could make a splash, he believes. A well-known problem with SSRIs is that half of all patients or more don't respond to treatment. A new study in Palestinian patients suggests that before they are medicated, these nonresponders respond poorly to punishment in a learning task. (In the study, patients had to make predictions about the weather based on clues presented on a computer screen; the "punishment" for a wrong answer was losing points.)

If the finding holds up, Herzallah thinks it could lead to software or a device that identifies depressed people unlikely to respond to treatment. The correlation may also yield insights into the roots of clinical depression and suggest drug targets, Gluck says.

HERZALLAH GREW UP in Ya'bad, a town 12 kilometers west of Jenin where his family owns a compound with several homes. He calls himself a "half-refugee": His mother's family was expelled from their home in Haifa, in present-day Israel, in 1948 and she grew up near Ya'bad. For our visit, she has laid out a lavish lunch of grilled turkey, red peppers, and kobbit-laban, a local specialty made of ground veal cooked in yogurt and herbs. Two sisters and an aunt join the feast.

Herzallah says his family was enormously influential in instilling his scientific curiosity and work ethic. His father is a biochemist who obtained a master's degree in the United Kingdom and a Ph.D. in Germany; he is now a lecturer at An-Najah National University in Nablus. His aunt, a linguist who did her Ph.D. at Cornell University, recalls that Mohammad was a precocious kid who would read English books in her home library. As a fifth-grader, he studied German as well, which later helped him read Albert Einstein's original papers. Physics entranced him, but his father convinced him that the field had a dark future in the West Bank. So he chose medicine.

Herzallah still comes across as older than his age. That helps him run a tight ship at PNI, where most staff and students are just a few years his junior. At a lab meeting, he smiles rarely, and sternly reminds students of obligations. "He knows how to be strict and firm, but also when to be more like a brother and a friend," Mousa says. But Mohamad Taha, a PNI alumnus who's now a postdoc at Harvard University, says Herzallah can be a bit overbearing. "He's a very good leader and he keeps people on track, but sometimes they need a little space," Taha says.

Herzallah mostly wields his influence in the West Bank from across the Atlantic. He spends a few months a year at Al-Quds and the rest of the time at Rutgers, where he teaches, holds lab meetings, mentors students, and discusses papers over Skype and email. He's now a postdoc in Denis Paré's lab at Rutgers, where he's studying the role of the amygdala in rat behavior.

"He really has two parallel jobs," Gluck says. To keep it up, Herzallah says he starts at 4 a.m. every day and works 7 days a week—a pace that he says has caused friction with his wife, Joman Natsheh, who's doing a Ph.D. in neuroscience at Rutgers. She is involved in PNI and also set up the Palestinian Women Mental Health Initiative, which aims to train female doctors, support research, and reduce the stigma associated with mental health disorders.

Although 18 people are affiliated with PNI one way or another, only three are full-time; most are medical students learning how to do research. Such opportunities are rare in the West Bank, which helps explain

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why roughly 50 of the 70 students who enter the medical faculty annually apply to PNI, says Herzallah, who only accepts a few.

Finances are still tight. Herzallah says he has raised some $150,000 from sponsors in the Arab world, including several Palestinian business executives in Jordan. But now that the NIH grant has run out, it's not enough to sustain the initiative long term, especially with PNI branching out into other neuroscience areas.

Other forms of support have been plentiful. Herzallah has set up student exchanges with scientists at Rutgers, Harvard, and the Swiss Federal Institute of Technology in Lausanne. And Edvard Moser invited Herzallah and four students to a Nordic Neuroscience meeting in Trondheim in 2015. "Palestine is now a Nordic country," quips Herzallah, who hopes one of his students will find a training opportunity in Moser's lab.

Few are willing to discuss any political dimension to their support. "I'll be blunt and say that I'm not going to talk about politics and religion," Gluck says. "I'm not going to analyze the Middle East conflict in *Science* magazine," Moser says.

PNI has no links with Israel and its vibrant neuroscience scene. Few Palestinian scientists do. After the Oslo Accords in the 1990s, when a peaceful solution seemed in sight, ties between Israeli and Palestinian academics flourished. But as violence on both sides flared, virtually all partnerships disintegrated. Al-Quds's policy since 2009 has been to not collaborate with Israel, says the university's president, Imad Abu-Kishk. Any collaboration could lead to political problems—or worse, others say. "You would immediately be labeled a traitor," Treves says. "Your life would be in danger."

The cold shoulder frustrates scientists like Yonatan Loewenstein at Hebrew University in Jerusalem, who co-organizes meetings that bring together Israeli and Arab scientists (see sidebar, right) and is eager to work with Palestinian counterparts. "It doesn't make any sense that I work with researchers in the U.S. and Europe, but I can't meet colleagues who are less than 10 miles away," Loewenstein says.

Herzallah has avoided any collaboration with Israel out of what he calls "a mix of pragmatism and principle." He prefers to stay focused on building up his creation. As the sun sets and he looks out from the roof of his parents' home in Ya'bad over a West Bank valley dotted with scrubby vegetation, Herzallah is clear about his ambitions. "A full-blown institute here in Palestine, where I can pursue my scientific interests. … That's what I want. I want to show that in spite of all of the suffering and the obstacles, we can move forward." ■

Gatherings aim to bridge a wide divide

By **Martin Enserink**, *in Paris*

When 20 neuroscientists from Israel and the Arab world gathered for dinner at a Left Bank bistro here in September 2015, it didn't take long for the conversation to turn from duck breast to the Middle East—and for the temperature to rise. The researchers, including two Palestinians, bickered over the Iran nuclear deal, the war in Syria, and, of course, the Israeli-Palestinian conflict. "The two-state solution is dead!" one Arab scientist argued. "We need to think about a one-state model." "That will never work!" an Israeli colleague shot back. As the evening wore on, the debates got more animated and louder.

The scientists didn't solve any problems that night, but at least they were talking—and that was the point.

They had assembled at Paris Descartes University for a 3-day meeting that sought to foster relationships across the political and religious fault lines dividing the Middle East. NeuroBridges, as it's called, is one of several science diplomacy efforts focused on the region; the most ambitious is SESAME, a synchrotron light source in Jordan expected to come online in 2017 that involves nine unlikely bedfellows, including Turkey, Israel, the Palestinian National Authority, Iran, and Pakistan.

NeuroBridges grew from the friendship between Ahmed El Hady, an Egyptian neuroscientist at Princeton University, and his Israeli colleague Yonatan Loewenstein of the Edmond & Lily Safra Center for Brain Sciences (ELSC) at the Hebrew University of Jerusalem. After they met in Germany, Loewenstein invited El Hady to an ELSC retreat in Ein Gedi, an oasis near the Dead Sea in Israel. During a hike, the duo agreed that science could bring more researchers together, both professionally and personally. The first NeuroBridges, later that year at the University of Göttingen in Germany, came at an awkward time: 3 weeks into the 2014 Gaza war.

> ***"We really need opportunities for dialogue."***
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> **Mehdi Khamassi**, Pierre and Marie Curie University in Paris

Science sat in on the 2015 successor, in a monumental Parisian university hall adorned with tapestries woven for King Louis XIV. After an unusual preamble describing their own geographical, religious, or political background, attendees presented their work, which spanned a range of neuroscience areas. The mood was friendly.

"We really need opportunities for dialogue like this," says Mehdi Khamassi, a French-Tunisian researcher at the Pierre and Marie Curie University in Paris, who noted that relations between Arabs and Jews in France have deteriorated rapidly: "We seem to have imported the conflict from the Middle East." (The meeting took place 2 months before the 13 November 2015 terrorist attacks here.)

Like El Hady, almost all of the Arab participants live and work in Western countries. The mood in most Arab countries is fervently anti-Israel, and scientists there could face a political price for attending NeuroBridges, El Hady says. Mohammad Herzallah, who heads the Palestinian Neuroscience Initiative, has declined an invitation twice (see main story, p. 1158).

Critics of Israel's occupation of the Palestinian Territories say that meetings like NeuroBridges fail to address the root issue. A mostly scientific meeting that doesn't focus on problems faced by Palestinian academics contributes to the "normalization" of the occupation, says Jonathan Rosenhead, chair of the British Committee for the Universities of Palestine in London and an advocate of an academic boycott of Israel. El Hady disagrees. "Academics are the most reasonable people," he says. "If we cut off contact with them, we lose the last resort."

This year's NeuroBridges will be at a chateau in Burgundy, France, in September. To reach a wider and younger audience, it will be a 10-day summer school in computational neuroscience. Can such meetings bring peace in the Middle East any closer? "To be honest, this is not a question that concerns me very much," Loewenstein says after a very long pause. "The question I ask myself is what I can personally do to improve the situation." ■

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