

WORKING WEEKENDS.  
LEAVING AT MIDNIGHT.  
FRIDAY EVENING MEETINGS.  
DOES SCIENCE COME OUT THE WINNER?

# THE 24/7 LAB

BY HEIDI LEDFORD



**I**t's just about midnight on a hot Friday night in July, Enrique Iglesias' 'Dirty Dancer' is on the radio, and 26-year-old graduate student Sagar Shah is starting to look winded. The problem, he says, is not how late it is, or even that he has spent the past three hours working in a cramped sterile cell-culture hood. The problem is that the routine cell-culture maintenance he is doing, bathing his collection of rare human tumour cells with fresh medium, produces no data. And a lack of data, says Sagar, makes him "hungry" for it.

Next to Sagar, Lyonell Kone, a 22-year-old student, rises from another sterile hood and heads for the microscope, jostling his lab-mate Nathaniel Tippens out of the way. He squints at his cultures, checking to make sure the cells are growing at the right density. Satisfied, he backs away, gingerly places his flasks in an incubator, rubs his eyes and stretches. He's finished for the night.

The weary waltz within this cramped cell-culture room is the only flicker of activity at this hour in the Koch Cancer Research Building at Johns Hopkins University in Baltimore, Maryland. It's the Friday before the 4 July holiday, and even the night cleaners quit hours ago, leaving behind the faint smell of disinfectant and the occasional haunting beep of an autoclave echoing down silent hallways. But these members of neurosurgeon Alfredo Quiñones-Hinojosa's laboratory are accustomed to being the last out of the building. In a lab where the boss calls you at 6 a.m., schedules Friday evening lab meetings that can stretch past 10 p.m., and routinely expects you to work over Christmas, sticking it out until midnight on a holiday weekend is nothing unusual.

Many labs are renowned for their intense work ethic and long hours. When I set out to profile such a laboratory, I wanted to find out who is drawn to these environments, what it is really like to work there

and whether long hours lead to more or better science. I approached eleven laboratories with reputations for being extremely hard-working. Ten principal investigators turned me down, some expressing a fear of being seen as 'slave-drivers'.

Number eleven — Quiñones-Hinojosa — had no such qualms. His work ethic is no secret: a 2007 essay in the *New England Journal of Medicine*<sup>1</sup> and several television and newspaper reports have traced his path from 19-year-old illegal immigrant from Mexico, labouring in the fields of California, to neurosurgeon at one of the United States' leading research hospitals. He did not get there by working 9 to 5.

Quiñones-Hinojosa fondly recalls the long nights he worked alone in the laboratory as an undergraduate at the University of California, Berkeley, and again as a medical student at Harvard University in Cambridge, Massachusetts. When he was a resident at the University of California, San Francisco, his three young children thought he lived in the hospital. In effect he did, putting in 140 hours a week and grabbing 10-minute naps when he could. Quiñones-Hinojosa credits his professional rise to his resilience and a seemingly limitless capacity for hard work. "When you go that extra step, you are training your brain like an athlete," he says. And the fact that his group has published 113 articles in the past six years and holds 13 funding grants is not, he says, because he is brighter or better connected than colleagues. "It's just a matter of volume," he says. "The key is we submit a couple of dozen grant applications a year, and we learn from our mistakes."

And so, at ease with hard work and the media and steeped in the long-hours culture of medicine, Quiñones-Hinojosa eagerly welcomed me into his research laboratory. "I would be delighted," he said.

The morning I arrived — at 8 a.m. sharp — Quiñones-Hinojosa insisted that I observe his first surgery of the day. He and his resident,

LEFT TO RIGHT: JAMES KEGLEY; HEIDI LEDFORD; MAX FRANZ; DAVID PURGER; HEIDI LEDFORD



Alfredo Quiñones-Hinojosa (centre, with surgery team) selects lab members who expect long hours and motivates them by inviting patients to lab meetings.

Shaan Raza, were removing a pituitary tumour from a 54-year-old woman. The operating room is an extension of his laboratory, Quiñones-Hinojosa explained: it is there that he collects the tissue samples that his staff — with the patients' consent — will immortalize in cell culture. They are the grist for the lab's studies of how cancer stem cells fuel brain-tumour development and how tumour cells spread through the brain.

Quiñones-Hinojosa had gone to bed at 1 a.m. the night before, and was up again at 5. Walking to surgery, he passes by Kone, who is climbing the stairs to the lab. "You ready to rock 'n' roll?" Quiñones-Hinojosa asks reflexively as he walks by. Then he glances at the time and a mischievous smile darts across his face. "Hey, it's 10 a.m.," he calls over his shoulder, never breaking stride. "What are you doing coming in at 10 a.m.?"

As we walk out of the building Quiñones-Hinojosa nudges me with his elbow and laughs: "See, now he's going to go back to the lab and tell everyone, 'Dr. Q caught me coming in at 10 a.m.!' " (Lab members, who in fact mostly arrive after 9 a.m., confirmed that Kone did exactly that.)

Quiñones-Hinojosa is gregarious and charming, with an infectious energy and a habit of advertising his humility. But he also knows how intimidating he can be to the people who work for him, and he's not afraid to capitalize on that. In 2007, just two years after he started at Hopkins, he rounded a corner in the cafeteria and saw his lab members sitting at a table, talking and laughing. When they caught sight of him, he says, they stopped, stood up, and went straight back to the lab.

Quiñones-Hinojosa has another way to keep his lab motivated. Every so often, he asks a cancer patient or his or her family to join the lab meeting. It is a chance for the patients to learn about the research being done with their tumours. And for the lab, it is a reminder of the

urgency of their work. Quiñones-Hinojosa draws out each patient's personal story: how they found out they had cancer, how they felt when they got the news and how it has impacted on their family. Being confronted with all this can be a shock for researchers without medical training. "You can see it in their faces," says Hugo Guerrero-Cázares, a research associate in the lab. "When someone says 'I'm going to die in six months', it really hits them."

Back in the operating room, nurses and surgeons buzz about setting up equipment around the unconscious patient. Pituitary tumours can nestle between the two carotid arteries that supply the brain with blood, making the growths exquisitely difficult to remove. (Quiñones-Hinojosa says he woke up last night worrying about the operation and spent two hours practising every move of the surgery in his mind before nodding off again.) Normally the tumours are about the size of a pea; this one is closer to a golf ball. Quiñones-Hinojosa and Raza meticulously scoop out the tumour piece by piece.

The surgery seems to be a success. Quiñones-Hinojosa steps back from the patient and makes sure the sample is labelled and stored appropriately on ice. He checks with the pathologists down the hall to make sure it includes the tumour tissue he wants, then sends it on to his lab: sample 872 in his collection.

#### FAST FOOD

In the laboratory, near lunchtime, endocrinology research fellow Nestoras Mathioudakis prepares the tissue in a sterile tissue-culture hood. While the cells are incubating with an enzyme that destroys contaminating red blood cells, he dashes out to eat a frozen meal. He practically lives on them, he says, but worries that the high salt content may be giving him searing headaches. One day, after eating about five

frozen dinners, he sat down at a microscope and found it difficult to focus his right eye. Still, the meals are cheap, fast and a way to grab food without leaving the lab, and Mathioudakis predicts that today will be a busy, multi-frozen-dinner day.

He doesn't really mind. "Only people with a certain type of personality would stay in a lab like this," says Guerrero-Cázares, who has worked there for four years. The night before I arrived, Quiñones-Hinojosa was checking his e-mail on his way home when he noticed a message from a medical student at Rosalind Franklin University of Medicine and Science in Chicago, Illinois, who wanted to work in the laboratory. Quiñones-Hinojosa receives several such enquiries a day, but something about this student — Joshua Bakhsheshian — caught his eye. He fired back a message: give me a number at which I can reach you at 6 a.m.. It was midnight. A minute later he had his reply.

At 6:02 a.m. Quiñones-Hinojosa called Bakhsheshian. "I laid it on so thick for this guy," Quiñones-Hinojosa crooned later that morning. "I said, 'You've seen me on TV, you think I'm so nice. But you come into my lab, you're going to work. The people in my lab, they work 24 hours a day. They're here over Christmas and New Year writing grants, and you will be, too.'"

"That's music to my ears," replied Bakhsheshian, who later told me he had never expected such a speedy reply from the busy surgeon, and had stayed up much of the night frantically studying the lab's publications. (Quiñones-Hinojosa later offered him a spot in the lab if Bakhsheshian could get a fellowship.)

Not everyone whom Quiñones-Hinojosa selects adapts well to the rigours of his laboratory. Research fellow David Chesler, a neurosurgery resident at the University of Maryland in College Park with a PhD in neuroimmunology and circles under his eyes, recalls a technician who "wasn't keeping up" — and Guerrero-Cázares recounts the tale of a colleague who simply stopped coming to the Friday night lab meetings. Both left the lab. Quiñones-Hinojosa says that he asked them to leave "very nicely," and helped them to find positions elsewhere.

Still, Quiñones-Hinojosa's technique of screening for work habits and personality traits may be one reason why the lab runs so smoothly, despite its intensity. Pierre Azoulay, associate professor of strategy at the Massachusetts Institute of Technology's Sloan School of Management in Cambridge, says that asking an employee to work long hours can backfire if that person is used to operating differently. "Unless you select your trainees very carefully on those criteria — which I wager most principal investigators don't — there would presumably be deleterious effects."

Another key is autonomy. Many members of the Quiñones-Hinojosa lab develop their own projects, and write the grant applications to fund them. They express a proud sense of ownership when it comes to their work. And despite the 6 a.m. phone calls from the boss — made during his commute to the hospital — they say they feel reasonably free to set their own schedules. Shah says that 20-hour days are not uncommon for him. But "I don't believe in clocking in and clocking out," he says. "I could do that at Walmart and get overtime."

That freedom is essential to keeping researchers happy and productive, says Azoulay. "Science is a harsh mistress," he says. "I think relatively few scientists are expecting 9-to-5 jobs. But they are expecting autonomy, and a principal investigator that violates that expectation could potentially run into problems."

So far, Quiñones-Hinojosa's lab seems relatively problem-free. But are the long hours and personal sacrifices worth it, for the lab members and for science? In 2004, Steven Stack, a sociologist at Wayne State University in Detroit, Michigan, published an analysis of survey data collected by the US National Research Council on 11,231 PhD scientists

and engineers working in academia<sup>2</sup>. He found that the average scientist worked about 50 hours a week, and in general the more hours an individual put in, the more publications he or she cranked out.

Quiñones-Hinojosa's lab seems to fit that mould. Of the 113 articles he has published since he launched the lab in 2005, most are from a small 'dry' laboratory working on clinical outcomes in cancer. His 27-person 'wet' lab has published 29. Overall, his *h* index — a measure of productivity that factors in the number of articles published and how often they are cited — is 27, compared with 10.7 for US neurosurgeons at the same associate professor level<sup>3</sup>. Quiñones-Hinojosa also notes that it takes researchers in his department an average of 15 years to be promoted to full professor. He was recommended for a full professorship this year, after just six.

Biochemist Philip Cohen of the University of Dundee, UK, says that of the 70 postdocs and nearly 50 students he has supervised during his career, the most successful were those who put in long hours and worked efficiently. Cohen frets that the lab culture is changing. "Everyone's told not to stress themselves or overdo things, and I could not disagree more," he says. "I'm afraid they're losing all the fun in life if they don't really push themselves to the limit."

But not everyone agrees that more hours yield more results. Dean Simonton, a psychology researcher at the University of California, Davis, who has studied scientific creativity, says that the pressure

for publications, grants and tenure may have created a single-minded, "monastic" culture in science. But some research suggests that highly creative scientists tend to have broader interests and more hobbies than their less creative colleagues, he says. Chemist Stephen Buchwald of the Massachusetts Institute of Technol-

ogy urges the members of his lab to take a month's holiday every year, and not to think about work when they're gone. "The fact is, I want people to be able to think," he says. "If they're completely beaten down, they're not going to be very creative." His approach does not seem to have hurt productivity: Thomson Reuters declared Buchwald one of the most highly cited chemists from 1999 to 2009, with an average of more than 86 citations for his 171 papers.

An intense work schedule also comes with personal costs that can be hard to measure. "The area in which I have failed the most is as a father," Quiñones-Hinojosa readily admits. It is something he is trying to correct, by spending more time with his kids and shuttling them to swimming lessons (although phoning lab members on the way).

And postdoc Pragathi Achanta looks wistful when she talks about her niece in India, who was six months old the last time Achanta saw her — now she's nearly five. Achanta has been working on grant applications over the holidays, and hasn't had time to visit her family.

Now, at 8 p.m. on Friday 1 July, Achanta is taking advantage of the unusually short lab meeting to prepare surgical tools for a mouse experiment to model the effects of radiotherapy on stem cells. She wants to be ready so that she can complete the surgeries quickly on Saturday morning before she leaves to help teach a course at Cold Spring Harbor Laboratory in New York. Later this year, grant schedule allowing, she hopes to travel to India to see her niece at last. But she admits to being nervous about broaching the subject with the boss.

Quiñones-Hinojosa, though, says that he has nothing against holidays. "Vacations are great," he says. "Take a weekend off." ■

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1. Quiñones-Hinojosa, A. N. *Engl. J. Med.* **357**, 529–531 (2007).

2. Stack, S. *Res. Higher Ed.* **45**, 891–920 (2004).

3. Lee, J., Kraus, K. L. & Couldwell, W. T. *J. Neurosurg.* **111**, 387–392 (2009).