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Béchir Jarraya considers the Fondation Bettencourt Schueller—a French foundation that supports science and the arts and promotes an inclusive society—a precious jewel for his nation, for science, and in particular, for his own career. He has received financial support from the foundation four times over the years.

“I would say the foundation changed my life,” says Jarraya, who uses functional magnetic resonance imaging (fMRI) to explore how deep brain stimulation can potentially restore consciousness and improve the lives of Parkinson’s disease patients at several French institutions, including the NeuroSpin neuroimaging research center in Saclay. “With their help, researchers can really make a complete and successful story—the Young Researchers Bettencourt Prize helped me do a postdoc in Boston; they helped me again to come back to France and install a new laboratory with the ATIP-Avenir grant, then again to grow my career, and then yet again to grow our lab with strong structure to attract talent. Their support spans individuals, teams, and systems.”

He is not the only laureate—as those who are funded are called—who sees his grant as transformative. When virologist Chantal Abergel received the Bettencourt Prize Coups d’elan pour la recherche française in 2014 (which translates to “momentum” in English), she was ecstatic. “It was like the foundation was ‘kicking the ball’ and making it fly very far away. It was exactly how I felt getting this prize—it gave me momentum and changed my life.”

Abergel, who serves as research director of structural biology/life sciences at Aix-Marseille University, works in a frontier arena related to giant viruses. “It’s not a type of research that has a clear, specific outcome, and it is very hard to get grants. Not every foundation is willing to take big risks. But the [scientific advisory] committee is visionary.”

As a result of her prize, Abergel was able to purchase new laboratory equipment and train students and other early-career scientists in techniques to identify and scrutinize large viruses. But perhaps most importantly, “the prize gave credit to this exploratory research and recognized it as being good science,” she says. “This was a trampoline—from the moment I got that grant, it was much easier to get other grants which changed the life of the lab.” In summer 2019, Abergel was awarded a prestigious € 2.2 million (USD 2.4 million) European Research Council Advanced Grant.

### 30 years of changing lives and research

In a certain sense, one could say that the foundation is in the transformation business. Its motto, “taking talent to the top,” is woven into everything that it has done since it was founded 30 years ago by the family that launched L’Oréal group: Liliane Bettencourt, her husband André Bettencourt, and her daughter, Françoise Bettencourt Meyers. With the goal of contributing to a better French society and boosting France’s influence on the international stage, it supports life science, the arts, and social progress initiatives. Four scientific prizes support winning researchers at key moments in their careers. These grants help improve researchers’ working conditions and, in specialized research institutes, promote the emergence of new approaches in emerging fields.

The four awards are: (1) The Liliane Bettencourt Prize for Life Sciences for a European researcher under the age of 45 who is a leader in his field and recognized by the scientific community. The grant amounts to € 300,000 (USD 350,000); (2) The Bettencourt Prize Coups d’elan pour la recherche française, which aims to improve infrastructure and working conditions for biomedical researchers by funding renovation, reorganization, acquisition of equipment and materials, and operational assistance. This € 250,000 (USD 290,000) prize is awarded annually to four research teams at the French National Institute of Health and Medical Research (Inserm) or at the Institute of Biological Sciences (INSB) of the National Center for Scientific Research (CNRS) in France; (3) The
ATIP-Avenir grant, a € 300,000 (USD 350,000) award in partnership with Inserm and CNRS, given to researchers with outstanding projects who wish to create their own team and return or move to France; and (4) The Young Researchers Bettencourt Prize, a € 25,000 (USD 29,000) prize awarded annually to 14 top early-career French Ph.D.s or M.D./Ph.D.s to enable them to do a postdoctoral internship abroad.

This year, the foundation celebrates the 30th anniversary of the Young Researchers Bettencourt Prize and the 20th anniversary of the Bettencourt Prize Coup d‘élans pour la recherche française.

“The process to award these prizes is quite robust and detailed,” notes Hugues de Thé, member of the French Academy of Sciences and president of the foundation’s scientific advisory board. Depending upon the funding program, once potential candidates are identified, internal reviews of their credentials and proposals take place, and, for the Liliane Bettencourt Prize for Life Sciences, outside experts are tapped to add an additional filtering layer. A formal presentation is required for some awards.

De Thé shares that the foundation’s success in funding brilliant scientists and supporting potentially transformative research is reflected in its founders. “The foundation really has adopted the values of the family,” he says. “It really believes in people and tries to sustain individuals who have good ideas, good track records, and good intentions to develop something new.”

A novel approach was exactly what Nathalie Vergnolle, research director at Inserm, and director of the Digestive Health Research Institute (IRSD), was thinking when she was awarded the Coup d’élans prize in 2015. It was not her first funding from the foundation, but in this case, the prize allowed her to open the first core facility in France dedicated to growing 3D organoids.

“It is a very complicated technique, and the impact of the funding was on all the teams of the institute,” says Vergnolle, a gut physiopathologist. It attracted researchers from across the nation and even abroad to come and learn how to use organoids in life science studies. IRSD is still the only dedicated facility of its kind in the country. “The foundation realized that this technology is the future model for important medical research to develop,” she says. “In that sense they are visionaries putting energy and money in new techniques.”

A family spirit in a family foundation

Although it has grown in structure, scope, and impact, the foundation remains a tight-knit organization that still treats each of its laureates like family, something that many of the prize winners appreciate. From regular phone calls to check in with the laureates, to a flexible funding mechanism that allows them to modify or extend the allocation of their funding should their research require it, to annual get-togethers that facilitate diverse networking and mentoring, the foundation is a strategic partner enabling the triumph of its laureates over the entirety of their careers.

“I was really affected when Mrs. Liliane Bettencourt—who passed away a few years ago—invited us to receive the prizes in her personal house,” says Jarraya. “It was very touching.”

On the lighter side of being in the Bettencourt “family,” Jarraya laughs enthusiastically when he recounts being informed of his second grant in November 2008. A foundation staff member called him.

“He said, ‘I have important news to announce: Barack Obama was elected!’” recalls Jarraya. Indeed, it was November 2008. “This staff member likes to joke around. I said, ‘Thank you very much. This is great news,’” Jarraya continues. “And then he says, ‘Well, I have more news—you won the funding!’”

Whether it is through treating its prize winners as family or through its funding mechanisms, the foundation aims to make society better for everyone, and it is not afraid to take risks. As Pierre Corvol, former president of the scientific advisory board who helped initiate the Bettencourt Prize Coup d‘élans prize in 2000, notes: “Some projects would not be funded elsewhere because the work is very early work. We choose very good projects and are not thinking about the practical aspects of the return on the investment. It’s about funding good science and good scientists.”
Qatar is possibly the most water-stressed country on Earth. According to a recent report from the U.S. World Resources Institute, it is one of 17 countries classified as suffering from extremely high water stress. In those countries, demand from agriculture, municipalities, and industry uses more than 80% of the available freshwater supply, making those nations vulnerable to even temporary shifts in rainfall patterns.

**A history linked to water and oil**

Water—how to get it and how to manage it—has been a major concern for all of Qatar’s history. An arid country, Qatar averages just 82 mm of rainfall annually. As recently as the 1950s, a British observer noted that “Doha was a big village in which everyone knew one another … There was hardly enough water for washing or cooking, and the little there was came from wells in the desert, which we used to boil and filter.”

Discovery of vast natural gas and oil resources led to a dramatic change in Qatar’s way of life. When Qatar gained independence in 1971, its population was just under 120,000. Now, many of its 2.8 million people live in conditions that would be utterly unrecognizable to those alive in the 1950s. With rapid development has come dramatic growth in water use: 595 L per capita per day in 2018, roughly on par with the United States.

Qatar’s first desalination plant was commissioned in 1953, and water was stored and delivered to consumers in tankers. Despite the Gulf nation’s ever-increasing investment in desalination plants (that today supply 98% of the country’s potable water), until recently it had just three days’ supply in reserve. So it’s no surprise that improving water security has been one of the country’s top strategic goals.

Its plans to improve water security include massive infrastructure projects to boost water storage and management. The state utility, Qatar General Electricity and Water Corporation (Kahramaa), in 2018 opened the world’s largest potable water mega-reservoir, which increased the country’s reservoir capacity by 155%. Consisting of 15 concrete reservoirs, each holding up to 100 million gal, the $4 billion project is designed to ensure seven days of reserve supply through 2026. Future expansion plans will increase capacity to 40 reservoirs holding a total of 4 billion gal.

**Innovation as a solution**

As demand for water continues to increase, innovative thinking is required to bring the goal of increased water security within reach. “It’s key to tackling the country’s water budget,” says Dr. Huda Al-Sulaiti, senior research director at the Qatar Environment and Energy Research Institute (QERI) and head of its water program. “Our work focuses on water resources as well as new materials and methods to make it more sustainable and more efficient to produce the water we need.”

In addition to rising demand from a growing population, there is an increasing need to support expanded food production. Agriculture has been the country’s biggest user of scarce groundwater resources. The aquifer under Qatar is shared with neighboring Saudi Arabia and Bahrain, with recharge rates across the region far lower than extraction rates, causing the water table in the area to drop by about a meter per year.

Groundwater is being extracted for irrigation to grow crops and fodder for livestock at a rate of more than 220 million m³ per year. Treated wastewater is injected to help replenish the aquifer and makes up about 20% of the water used by the agricultural sector, but is insufficient to balance extraction rates.

In recent years, the situation has become even more challenging. In June 2017, neighboring countries Saudi Arabia, Bahrain, and the United Arab Emirates, along with Egypt, imposed an economic and trade blockade on Qatar. This disrupted existing supply chains for a wide variety of imported staples, including meat, vegetables, and dairy products. In response, Qatar worked to quickly increase its own food production by, for example, importing dairy cows that are housed in air-conditioned enclosures.
Desalination

QEERI, a part of Qatar Foundation, is helping to drive the implementation of technology solutions for the country’s water crisis. Desalination remains the primary source of Qatar’s water. Thermal desalination and reverse osmosis (RO) methods represent the primary desalination technologies applied in Qatar. Currently, the older thermal desalination method dominates, making up 75% of the market. However, its energy consumption is relatively high compared to RO.

Recognizing the need to address local needs in Qatar, in early 2019, a 20-year collaboration agreement was signed between QEERI and Qatar Electricity and Water Company (QEWC), which committed the partners to building a pilot plant that used the latest desalination technology, known as multi-effect distillation (MED).

The first phase of this program aims to test a novel MED plant design that will improve efficiency, thereby reducing energy consumption by 40% and dropping the unit cost of water by around 30%.

The second phase will investigate the performance of high temperature antiscalants to increase the productivity of existing thermal desalination technology, while in the third phase, thermally enhanced polymer tubes will be tested to mitigate corrosion and scale fouling experienced when using existing metallic tubes in concert with MED technology.

Water from oil production

Adding to its water security challenge, Qatar is one of the world’s leading producers of oil and natural gas. One might not immediately see the connection between oil and gas production and water, but the reality is that they are intimately intertwined.

“Oil and gas companies are really water companies,” says Dr. Samer Adham, head of the ConocoPhilips Global Water Sustainability Center (GWSC) at the Qatar Science and Technology Park. “Producing a single barrel of oil also produces on average three to four barrels of water.”

This so-called produced water, especially from oil fields, tends to have high salinity and also contains contaminants. It is often pretreated to remove particulates and injected back into the oil reservoir to maintain pressure therein, extending the reservoir’s productive life. However, there is normally an excess of water over what is required for reinjection. This excess has traditionally been pumped into deep disposal wells, but could also be recycled, albeit at significant cost.

The produced water from gas fields is typically lower in salinity than that from oil fields, presenting an opportunity for desalination to generate fresh water. Desalinating this produced water uses less energy than is required to desalinate Gulf seawater, which, due to natural factors impacting the Gulf, such as high evaporation and shallow depth, has higher than average salinity (up to 57 g/L of salt as compared to normal seawater salinity of 35 g/L).

In Qatar, advanced treatment systems including membrane bioreactors and RO are being installed at gas fields to recycle and reuse process water onsite. By doing this, the country can depend less on seawater desalination plants, enhancing the country’s water security.

According to Adham, GWSC actively supports multiple industrial wastewater reuse projects in Qatar through the application of advanced technologies. In addition, GWSC is developing new methods for sustainable management of wastewater from gas field operations. With the support of the Qatar National Research Fund, GWSC developed “forward osmosis” technology, a process that uses concentrated brine from desalination plants to draw water from a wastewater stream, in order to reduce its volume prior to disposal and also dilute the salty desalination brine before it is discharged into the Gulf. Bench-scale trials have shown that the process is cost effective, and field trials are currently underway.

The challenge of water security—and its impact at the nexus of water, energy, and food—is becoming ever more urgent as the global population increases. Qatar’s continued growth, coupled with its inhospitable environment, has placed it at the front line of these challenges. That responsibility has spurred innovation that may help people far beyond Qatar’s borders.

Al-Sulaiti concludes, “We hope the work we are doing now in Qatar can benefit many others for decades to come.”

Reference

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