Vaccine Gardens

Medicago's growth is steady in a field of science known for surprises

By Robert Price

In science fiction-horror films, pandemics kill millions before the chin-scratching scientists have figured out what they're dealing with. By then, if one of them hasn't caught the deadly illness (and made a teary, deathbed farewell speech), the civilian authority is so understaffed and confused that help has to arrive by helicopter.

To subdue a fast-moving pandemic, governments need fast moving scientists and labs and manufacturing facilities able to churn out vaccines targeted to the deadly viruses. Speedy delivery of vaccines is exactly the business of Medicago, a Quebec-based biotech with manufacturing facilities in Quebec and North Carolina.

As Canadian biotechs go, Medicago is a success. If a pandemic ever strikes, and panicked politicians need a fast solution and faster vaccines, Medicago could fill the role of one of the heroes.

Vaccines from plants

Medicago is a star on the Canadian biotech stage. Whether celebrity goes to good management of the business or savvy deployment of the company's proprietary technologies depends on whom you ask—but most people will say Medicago is a star. And anybody with an inkling for vaccine science will say Medicago's method for producing vaccines is cool—as cool as any Hollywood charmer.


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(1-5) Medicago's North Carolina facility produces vaccines from tobacco leaves. (6) Régis Labeaume, Mayor of Quebec City; Andy Sheldon, President and CEO, Medicago; Sam Hamad, Minister MDEIE; and Max Fehlmann, President and CEO, CQDM. (7) A tobacco plant in Medicago's lab.

Photo Credits: (1-5) courtesy of Medicago; (6) by Louise Leblanc

Where traditional vaccines production uses eggs to produce vaccines, Medicago's technology uses tobacco plants as a factory for producing vaccines. When the company is called to produce a vaccine, it first synthesizes genes for the specific flu strain—like a mutant strain of the bird flu—and then transfers these genes into the cells of a tobacco plant. The plant then grows what the company calls virus like particles, or VLPs, a protein that looks like a virus but doesn't act like a virus. VLPs lack the flu's genetic material, making the VLP non-infectious and unable to replicate. But because they look like a virus, the body's immune system develops defenses against the particular strain of flu without having to fight the flu. After six days inside the plant, the VLPs can be harvested and manufactured into a vaccine.

One of the key benefits of cultivating vaccines inside plants is the speed of manufacturing. In just 14 days from beginning to end, VLPs can be processed into vaccines, compared to a turnaround of six months if the vaccines are generated from eggs. The difference is enormous when considering that a pandemic flu can spread over the globe in less than six months.

And there are other benefits to using plants, explains Medicago's President and CEO Andy Sheldon. "The beauty is that a plant-made system, which is a living system, in our case a living tobacco plant, can produce very complex molecules. So we're able to do things which haven't probably been done before which allow us to look at some very interesting targets." These targets include a variety of viruses and flus but also other molecules that society needs—almost anything that's a protein based, like enzymes needed to create biofuels, monoclonal antibodies for front line health care, or biosimilars for biopharmaceuticalmanufacturing."Anything that is protein we have a shot at producing it," says Sheldon.

Growing the business

In a sector where many businesses fail a clinical trial and fold, or run out of funding before making it to market, Medicago has been a case study in how a business can grow by setting and meeting milestones, moving quickly and having a product the market wants. Sheldon says the company's success is having the right timing. "The timing is now—this is when the growth is in the market. I think from all ends we're in the right place at the right time."

Calculated investments and a growing customer base help too. Earlier this year, the company invested $4 million into its Quebec City pilot production facility, with the intention of accelerating the clinical approvals of its products, including preclinical testing of a new rabies vaccine. The investment added 20 new employees to the company's roster and boosted its presence in the capital region. At the same time, the company has been hustling for business in the U.S., notably with the U.S. Department of Defense. So far, the company has received $19.8 million of a possible $21 million to show how quickly its manufacturing plants can scale up productions of vaccines. The goal, the company says, is to prove that its 97,000 sq. ft. manufacturing facility in North Carolina can produce vaccines quickly when influenza hits.

Recent discoveries that the bird flu virus can mutate and infect mammals raise the profile of Medicago's business and the importance of pandemic preparedness planning. Sheldon says Medicago has followed the developments in bird flu research "very carefully."

Along with tracking the possibilities of pandemics, Medicago has in the pipeline a U.S. Phase II a clinical trial for a quadrivalent seasonal flu vaccine, a Phase I clinical trial for a one-dose H5N1 VLP vaccine, and it is conducting toxicology studies for a rabies vaccine and working with Japanese firm Mitsubishi Tanabe Pharma to develop a vaccine for rotavirus and at least two additional vaccine candidates. To find new markets for its technologies, Medicago is researching ways to develop biosimilar products.

Why biotech?

Medicago is one Canadian bio business at the top of its game and Sheldon, his peers in the industry say, is at the top of his game too. Sheldon was recently named CEO of the Year by the World Vaccine Congress, an honour Sheldon says is "very, very pleasant" and a testament to the quality of Medicago's employees.

A 30-year veteran of the life sciences industry, Sheldon has served as Medicago's President and CEO since 2003, following increasingly senior positions at Shire Biologics, Merial Canada, Rhône Mérieux and Smithkline Beecham. From his perspective, he says, Canada will benefit from taking a more interventionist approach to growing the life sciences industry in Canada. "Canada needs to re-evaluate a little bit its position in terms of assistance to the industry in Canada. I think that would be a timely thing," he said, adding that, "in the recent budget, the government seemed to have wanted to get involved more—let's put it that way—in biotech and we'll see what form that takes in the coming 12 months."

Sheldon says he built his career in biotech because the science excites him and because biotech has something to offer the world. "At the end, today, we have a wonderful opportunity to really try and contribute, not only to the health of western civilization, but to take a platform like [Medicago's] and use it in the developing world as well," he says.

"It's an attractive thought that you can actually go out there and manufacture things for health that can save lives. It has been a driver in my career." BB