

VACCINE VICTORY

How a Canadian virologist created a breakthrough five-in-one livestock vaccine that could transform the lives of millions in Africa and beyond



POSTED BY ALANNA MITCHELL ON MAY 16, 2017

Like smallpox in humans, highly contagious viruses can race through livestock populations, killing and sickening cattle, sheep and goats. That's a big headache if you've got thousands of animals on a commercial farm. But it's an immediate catastrophe if you've only got a handful of animals and they're the main source of your family's protein and income. That's the problem in sub-Saharan Africa, when tiny family farms, often run by women, are hit with lethal livestock epidemics.

And while vaccinations against the viruses are available, the barriers against using them in the developing world are high. For one thing, some require multiple doses for each disease. For another, most vaccines need to be kept reliably cold until they're used.

About four years ago, Lorne Babiuk, a superstar virologist at the University of Alberta, began to wonder whether he could create a new type of vaccine. Not only would a single dose guard against several livestock diseases at once, but it would also keep its strength without refrigeration.

The International Development Research Centre hadn't invested in such a basic biology project before, Babiuk says, but decided

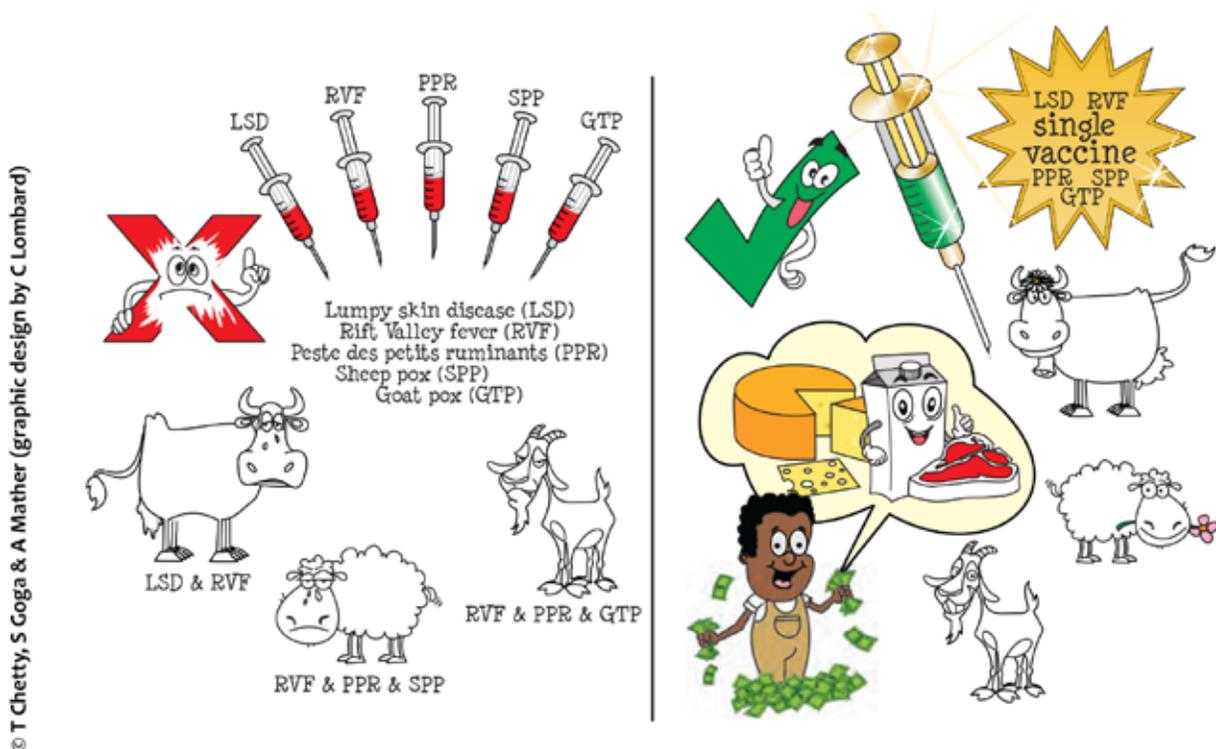
Lorne Babiuk at the University of Alberta, where he developed a five-in-one livestock vaccine that could improve the lives of millions across Africa and beyond. (Photo: Richard Siemens)

that the benefits of doing so could be vast. Millions of animals and billions of dollars could be saved. Untold human suffering could be avoided. If it worked, this program could help not just villages and regions, but whole continents, says Kevin Tiessen, a senior program specialist at IDRC. In 2014, IDRC partnered with Global Affairs Canada via the [Canadian International Food Security Research Fund](#) to launch the \$5-million [program](#) and Babiuk headed to the lab.

The focus was on the family Poxvirus, to which smallpox belongs. In cattle, the virus leads to lumpy skin disease; in sheep, it's sheep pox; in goats, goat pox. Together, the three are common throughout Africa and the Middle East and they're moving into Eastern Europe. They're called "neglected" diseases because while common, the ability of small livestock farmers in developing countries to pay more than a few pennies a dose for the vaccines is not. So, for-profit vaccine producers show no interest.

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© T Chetty, S Goga & A Mather (graphic design by C Lombard)

The virus's large genome had already been mapped and Babiuk's team worked out how to modify it, snipping out pieces to disable its killing mechanism while inserting other bits to make a vaccine that could inoculate against all three types of pox in a single dose, with no need for refrigeration. When that worked, the team looked at peste des petits ruminants, a virus that wipes out large numbers of goats and sheep. They added another piece of its genetic material into the pox vaccine and made it effective against that fourth disease.

"Then we said: 'OK. Let's be even smarter,'" Babiuk says.

So the team looked at Rift Valley fever, a viral disease of cattle, goats and sheep that also strikes humans. It is related to West Nile virus but causes more severe illness. Again, the insertion of its genes into the pox vaccine was successful. Babiuk's team had made a five-in-one, single-dose, heat-resistant vaccine. It was a breakthrough.

What's more, it was cheap. A single litre of the vaccine can inoculate a million animals, hopefully for life. Babiuk reckons it will cost just pennies a dose. His goal is for local governments in the region to subsidize the cost for livestock farmers. He's found that if it's free, farmers don't value it and won't use it. If it's too expensive, they won't buy it.

This infographic depicts the potential benefits to farmers following use of the single vaccine Lorne Babiuk created. (Infographic: T. Chetty, S. Goga & A. Mather, with graphic design by C. Lombard, courtesy of the Agricultural Research Council of South Africa)

Challenges remain. Babiuk will be in Kenya in July to oversee local production of the vaccine and small trials in the field. Then the vaccine, which will be modified region by region for whichever of the five diseases are prevalent, will need regulatory approval from each country, beginning with Kenya and South Africa.

The lobby against the validity of genetically-modified organisms is strong in Africa and its members have been arguing that the new vaccines should not be used because they are made in a lab. Babiuk's response is that vaccines for humans and animals have been safely used for 50 years, and he has yet to find a logical, scientific argument that risks exist. In addition, the virus in the vaccine is killed off by the body within two weeks.

With luck, the new single-dose vaccine will leap over regulatory hurdles in key countries within two years, he says. Then, the task will be to teach small farmers or their veterinarians how to inject it into their livestock, keeping healthy and alive not just the animals but also the people who depend on them.

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READING AS THINKING

Before you read the article, look at the infographic.

1. A) What do you see in the infographic?
- B) What is the message? How do you know?

After reading the article, answer the following questions.

2. Circle the keywords and underline the main ideas in the article.
Use this information to explain the infographic in a more in-depth way.

3. Explain at least three barriers against vaccinations in the developing world and some ways to overcome them.

4. The reach of this biology project extends beyond villages and regions to continents.
At which level do you think it will make the biggest impact? Justify your answer.

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5. The lobby against the validity of genetically-modified organisms does not support the use of the vaccine because it was created in a lab. Evaluate this argument.

6. Lorne Babiuk has found that if the vaccine is free, farmers don't value it, so they won't use it. However, if it's too expensive, the farmers still won't buy it. Propose some solutions to remedy this.

7. Why is the five-in-one livestock vaccine important? Provide evidence from the article.

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Think-Pair-Share

8. *Think*

The single-dose vaccine will have to go through trials and regulatory hurdles before it is available to farmers. Afterward, there will be other challenges. Make a list of the potential challenges.

CHALLENGES

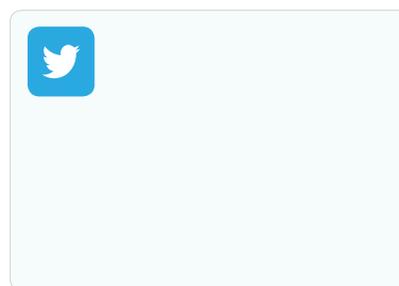
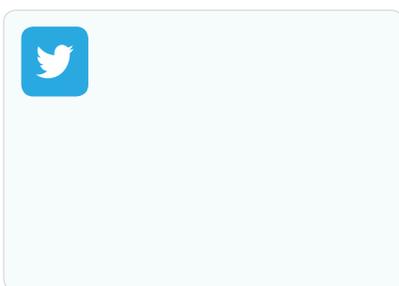
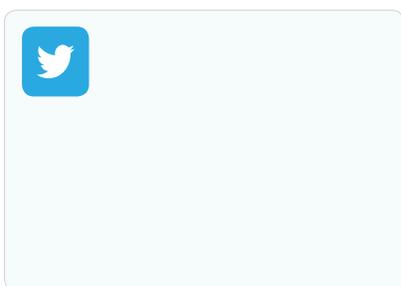
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9. *Pair*

With a partner, design a series of Twitter posts that promote the single-dose vaccine to farmers in sub-Saharan Africa. Each post should include the following:

- One meaningful hashtag (#)
- One relevant mention (@)
- A significant picture

Keep in mind the challenges that you listed above.



10. *Share*

Share your Twitter posts with the class. Justify your choice of hashtags, mentions and pictures.

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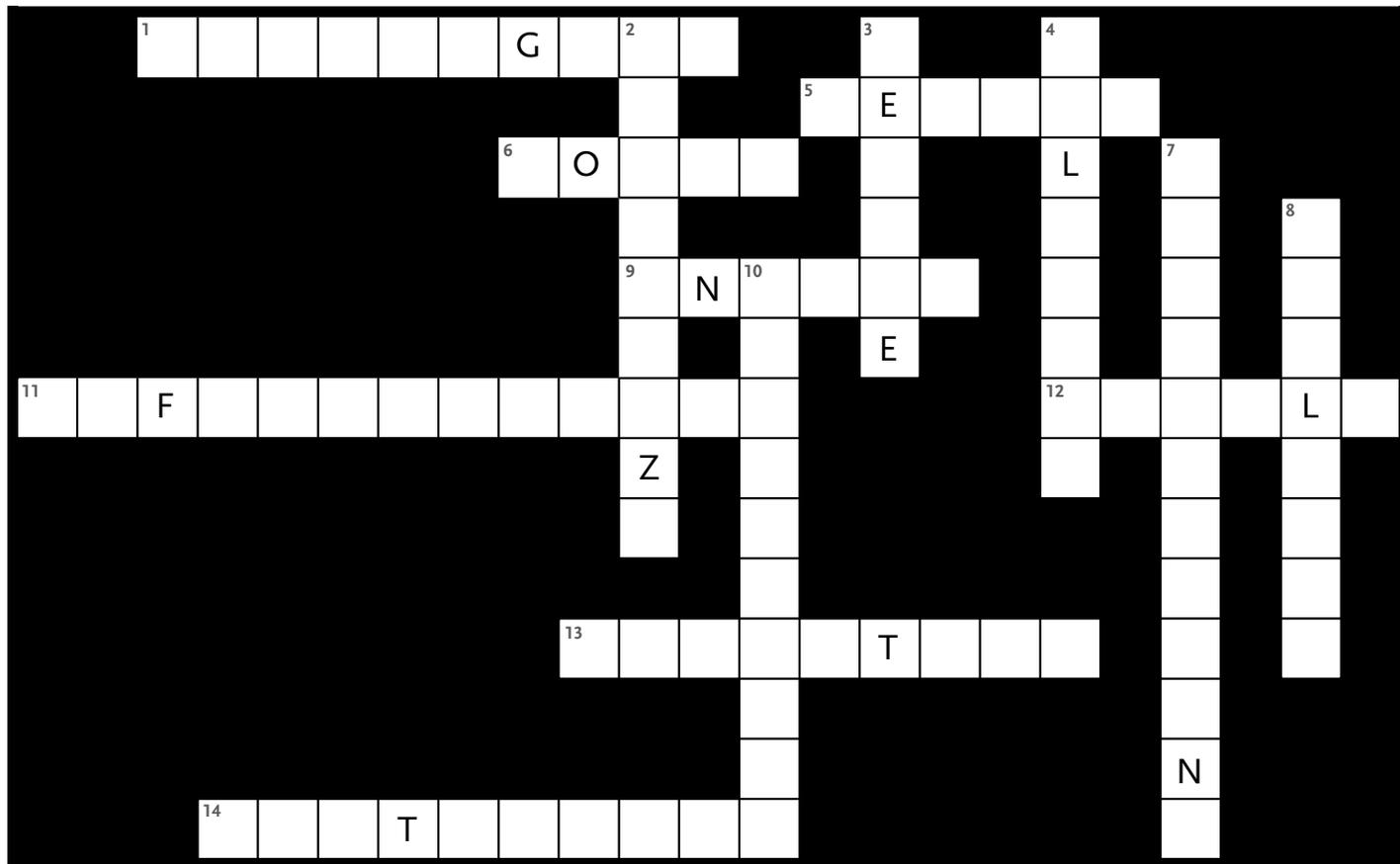
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ONLINE

1. Using [Google Maps](#), locate South Africa, and explore the country by using Street View and the satellite and map modes. Using the quick facts section and other research tools, find the following:
 - a. The population
 - b. The capital city
 - c. The neighbouring countries
 - d. The major bodies of water
 - e. An ideal spot to raise goats or sheep
 - f. National parks
2. Read more about the [two vaccines under development](#) to help farmers in sub-Saharan Africa.
3. Watch [how vaccination helps poultry farmers in Kenya](#).
4. Learn about the [benefits of cattle vaccination](#) for girls in rural Africa.
5. Choose one of the [projects](#) by the Canadian International Food Security Research Fund and find out more about it. Think about how it contributes to reduce global hunger.
6. Read this [fact sheet](#) from the organization [World Hunger Education](#) on hunger and poverty. Follow their [Twitter account](#).

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CROSSWORD:

Across

1. Lorne Babiuk's profession
5. Deadly
6. To campaign for or against
9. Revenue
11. Babiuk and his team created a new type of vaccine that does not require this
12. Tests
13. Cattle, sheep and goats
14. Communicable

Down

2. Babiuk's goal is for local governments to do this for the cost for livestock farmers
3. Comprised of chromosomes
4. Effectiveness
7. These are used to combat contagious viruses
8. This virus belongs to the Poxvirus family
10. There are seven of these by convention