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CEO Reid Rubsamen talks about Flow Pharma's COVID-19 vaccine

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CEOCFO: ***Dr. Rubsamen, what is up at Flow Pharma, Inc. today?***
Dr. Rubsamen: Flow Pharma is a vaccine company. We develop vaccines for two different purposes. One is making vaccines that can actually be therapeutic to treat patients with cancer. That is also known as the immuno-oncology space, using the patient's own immune system to combat cancer, by giving them vaccines that focus their immune systems on cancer cells only, to provide cancer therapy without the side effects associated with chemotherapy.

Our second activity is making vaccines to prevent viral illness. We have done quite a bit of work in that space; including developing a successful vaccine for Ebola that we tested in animals with the University of Texas medical branch and US National Laboratory at Galveston. We are now developing a vaccine for Marburg, which is like Ebola, but a weaponized version of Ebola. We are doing that work under contract with the United States Department of Defense.

We are also currently testing a vaccine for COVID-19 to protect against SARS-CoV-2, the virus that causes COVID-19, and we are doing that work again with our partners at the Texas at University of Texas Medical Branch, one of the premier centers in the world for animal model testing of vaccines for complex and dangerous viruses.

CEOCFO: ***What do you understand about developing a vaccine that gives you an edge? What do people misunderstand or not recognize about what goes into this process?***
Dr. Rubsamen: Vaccine development, for the last many decades, has been focused on antibody vaccines. These are vaccines that work by injecting a dead piece of the virus, or a virus that has been attenuated so it is not toxic, so it produces an antibody response, where antibodies are then produced and circulate throughout the body. When a circulating antibody sees and successfully attacks that virus, the virus becomes neutralized. That approach has been very successful for many viruses.

Polio vaccine, vaccines for childhood illnesses and so on, have been marvelously successful. However, there are some viruses for which antibody vaccines have never been developed. Most notably HIV and also of course, the common cold. There is no vaccine for the common cold, and we are now dealing with this disease called COVID-19, caused by SARS CoV-2, which is another coronavirus. However, antibody vaccine development can be challenging, because, at any time, a virus can change rapidly through mutation, and can escape the targeting of the antibody.

We are testing a T-cell vaccine for COVID-19. This is a cellular vaccine that stimulates killer T Cells, little submarines that circulate through the body with chemical torpedoes to kill cells that are infected by a virus. This enables us to attack targets on the virus that do not mutate very much. The part of the virus we are focused on is located inside the virus and cannot be easily targeted by antibodies. This is a critical edge that we have, and our approach is supported by observations that survivors of SARS epidemics in 2003 have circulating T-cells eleven years later, targeting the same parts of that virus that we are targeting with our vaccine. A sustainable immune response to coronavirus appears to be very importantly linked to the cellular part of the immune system, and maybe not so much to antibodies, for long term protection. Basically, we looked at the survivors of the SARS outbreak, and we are copying the behavior of their immune systems with our COVID-19 vaccine. We took the same approach for FlowVax Ebola, which provided 100% protection in a mouse model.

CEOCFO: ***What does it take to switch over? How do you ramp up? How do you not lose what else you have been working on? What are the logistics?***

Dr. Rubsamen: Fortunately, we have a vaccine platform. Our platform has a name. It is called FlowVax™. Our vaccine platform uses microspheres, tiny beads of biodegradable material, into which we place tiny markers called peptides that are little tiny, tiny pieces of a virus that we make synthetically. Therefore, there is no virus component in the vaccine. We combine with those microspheres and the peptides with chemicals called adjuvants to enhance the immune response. We have made, and successfully tested, doses of FlowVax vaccine for Ebola and a FlowVax vaccine to treat breast cancer. We have now made, and are testing, doses of a FlowVax platform vaccine to protect against COVID-19.

By using this platform technology, in a high-level sense, we simply reprogram it, or reload it, with these special peptide targets specific for a particular virus or cancer. We have a contract with the US Department of the Defense, for example, to use FlowVax to develop a Marburg vaccine. Marburg is like Ebola, but it has been weaponized, so the Department of Defense is quite concerned about it as a bio-weapon threat on the battlefield. By having a vaccine platform, and leveraging that platform, we were able to pivot to quickly develop a COVID-19 vaccine, which we are now testing in primates in Texas at the US National Laboratory, working with the University of Texas medical branch.

CEOCFO: ***What are you finding in the tests so far?***

Dr. Rubsamen: We have been able to get a good immune response in the primates by delivering our COVID-19 vaccine to primates by inhalation. We believe that inhalational delivery is important, because, in most cases, the virus is entering the body by breathing particles in the air. Therefore, having the primary immune response in the lungs may provide the most beneficial effect for protecting people against the infection. We are very encouraged that we have seen an immune response for FlowVax COVID-19 given to primates. The primate study is in multiple phases and involves a long series of events, but we plan on challenging the first set of vaccinated animals with the actual human SARS CoV-2 virus to begin to assess the level of protection next month.

CEOCFO: ***Is inhalation used in other vaccines?***
Dr. Rubsamen: Yes. Nasal delivery, of course, is available for flu vaccines. I know that my kids, when they were growing up, did not like needles, so they like the flu vaccine delivered by nasal spray. Commercial vaccines marketed today are generally not designed for delivery by inhalation. We see vaccine delivery by inhalation as an advantage for COVID-19, because we are talking about wide-spread inoculation where you do not have to use a syringe and a needle, so you can get yourself out of the need to have medical clinics and physicians, nurses and other trained medical personnel having to be present to administer the vaccine. For worldwide delivery, this can have significant benefits.

CEOCFO: ***Are you funded for what you need to do next? Are you looking for addition funding or partnerships?***
Dr. Rubsamen: Our company is funded by angel investors and grants. We are indeed raising money now to ramp up and accelerate our COVID-19 vaccine program. We have a great partnership with Oakwood Laboratories in Cleveland, Ohio to manufacture our vaccines for human use. They are hard at work doing that now. They will be rolling vials of vaccine off the line for us to be able to test in humans later this year. We are also very fortunate to have a relationship, as I mentioned, with the University of Texas Medical Branch at Galveston.

CEOCFO: ***What have you been finding from the investment community? There are so many ideas on how to develop a viable vaccine. Is it easy to understand the Flow Pharma approach?***
Dr. Rubsamen: We are on the World Health Organization consortium of about seventy vaccine developers. We are part of two committees on the WHO consortium. We have representatives on the assay committee and on the animal model committee. Of the seventy, we are the only people developing a T-cell vaccine, as far as I can tell. It is really kind of interesting that everyone else has an antibody vaccine directed towards the surface of the virus where the rapidly mutating proteins live. We are focusing on the internal parts of the virus that are difficult for antibody vaccines to attack. The literature, really over the last several months, is starting to talk actively about what I just told you; that T-cell responses in survivors of SARS infections are durable and maybe more durable, and provide more effective protection, than antibody responses.

We are doing this work at a time when there seems to be general

recognition in the academic community that a T-cell vaccine approach could be critical for COVID-19. There was an analyst report out recently about Moderna, which was interesting, saying that the T-cell response could be important and pointing out that Moderna was not talking about that. I think that we may actually be in the right place at the right time and as I speak with investors, they are starting to realize this. I think that we are really finding out that there is an evolution of understanding here that we may be onto something very important and this is an interesting opportunity for us to tell our story as interest in this alternative approach is increasing.

CEOCFO: ***How much attention do you pay to what is going on at the other companies working on vaccines for COVID-19?***
Dr. Rubsamen: First, it is nothing short of amazing that companies have gotten vaccines fielded so quickly to deal with COVID-19, and this is possible because of great advances in immunology, biotechnology and of course gene sequencing, which enables the sequence of the virus to be elucidated so quickly. It is very important that everybody with something to bring to the table is out working on this critical problem. This virus is an existential threat to humanity, it is a threat to how we operate and interact and do things, and of course it is turning deadly in many cases. Vaccine manufacturers like us all have a slightly different approach, and maybe some of those approaches will work great and some will not. However, I think that in this case, our approach that looks at cellular side of the immune system is critical because of what we are learning about the benefits of the T-cell response seen in survivors of the original SARS epidemic.

We have published three peer reviewed journal articles. We presented our COVID-19 vaccine design in our most recent article which came out this month in the journal Vaccine, a well-recognized peer review journal in this space. We are trying to go one step at a time; publish the articles, get the data out, do the appropriate pre-clinical and clinical tests working with centers of excellence. We are actually one of the few companies in this space doing primate work with a COVID-19 vaccine candidate. When you are doing science like this, even when you are in a hurry, you have to work carefully and methodically. It is critically important to me that our vaccine be safe! We have to give doses to hundreds of millions of healthy people to protect them. I still see patients a few days a month. I am a practicing physician. I think that we just have to be extremely aware of the fact that we are trying to help people here and move forward with a safe and effective technology as methodically as we can, but also as quickly as we can, given the pressing need for a COVID-19 vaccine.

CEOCFO: ***Why do you stay active as a practicing physician?***
Dr. Rubsamen: My purpose as a trained professional is to heal the sick, literally. I am fortunate to have had excellent training. I studied computer science at Berkeley, Stanford and MIT. I got my MD at Stanford concurrent with my Masters Degree in computer science. I went on to study as a post-doctoral fellow at the Laboratory for Computer Science at MIT beginning while I was a Chief Resident at Massachusetts General Hospital. My whole professional life has been about taking care of patients and I have these additional tools, an understanding of

bioinformatics and a background in biochemistry and immunology, that enables me to think about how to make vaccines. However, to me, all of this is just another way for me to take better care of my patients. Last March I was intubating critically ill people in the ICU and that changes how you think about things. These people need our help. Virus threats are complex problems, and we need to do everything that we can to bring safe and effective vaccines forward.

There is great part of the Hippocratic Oath that I like as much "First, do no harm," which is, "Whichever home you shall enter, it shall be to heal the sick." As physicians, we are here to take care of sick people and to prevent people from getting sick. All of the things that I do are part of that and, of course, we have to raise money to be able to do these things. We want investors to be rewarded for the vision and risk that they took by giving us some of their precious resources so that we could move forward. However, the ultimate goal, the master goal here, is to take better care of people and to prevent them from getting ill from these terrible viruses.