FINAL
Biopharming Ad Hoc Committee
May 22, 2006
Meeting Minutes

Present

Members: Katy Coba Dr. Thayne Dutson, Bernie Faber, Dr. Keith Harcourt, Candace Mueller, Jim Rue, Gail Shibley, Bob Shoemaker, Dr. Steve Strauss, and Dr. Lisa Weasel. Bob Shoemaker was unable to attend.
Staff: Shannon Brubaker, Dr. Paul Cieslak, Chuck Craig, Dr. Don Hansen, Christina Hartman, Dan Hilburn, Joel Sherman and Dr. Dave Stone.
Guests: Dr. Charles Arntzen, Arizona State University; Rick North, Oregon Physicians for Social Responsibility; Alex Polasky, Oregonian; David Rosenfeld, Oregon Health News, Terry Witt, Oregonians for Food and Shelter.

Handouts: May 22, 2006 Meeting Agenda and Meeting Schedule, Final March 27, 2006 Meeting Minutes, Draft April 24, 2006 Meeting Minutes, Speaker biosketch; Trends in Biotechnology; Plant-based biopharmaceuticals, USA Today-article; Biotech firm raises furor with rice plan, Applications of Plant Science; Plant-derived Vaccines, Flyer – Plant-Made Vaccines Class May 22 @ 7pm, The World & I – Article Designing Foods to Prevent Diseases and USDA- Draft Guidance for APHIS Permits for Field Testing or Movement of Organisms with Pharmaceutical or Industrial Intent

Meeting called to order at 1:03 p.m.

Introduction and Opening Remarks

Jim Rue welcomed the members and invited introductions.

The April 24, 2006 meeting minutes were approved with one adjustment in the public Comment section, Rick North pointed out that he was quoted incorrectly "…does not oppose genetically modified crops, but the outside growing of the crops." Should in fact read "…does not oppose *biopharmaceutical* genetically modified crops, but the outside growing of the crops."

Speaker Update and Roadmap

Dan Hilburn updated the Committee on the status of Dr. Lori Lee, Duke University, stating that Mondays are her clinic days and her availability at one of the taskforce meetings may not be possible. Dan noted that he has sent questions

prepared by Dr. Steve Strauss to her with the hope that she is able to answer these questions in writing to have available for the next taskforce meeting.

Dr Charles Arntzen, mentioned a few names of Immunologists that he has worked with; Bob Buchanan at UC Berkeley and Carol Tacket at The University of Maryland, Dan was asked to contact these two and determine their availability for future meetings.

Roadmap: Jim Rue, overviewed the upcoming meetings, he clarified to the Committee that in order to have a policy drafted by the end of September that the June meeting should have dialogue toward the decision making process; the Committee should come out of the July meeting with a draft policy; August meeting the Committee should be settling on a draft policy that will be posted on the internet for public comment to close before the September meeting; Septembers meeting should be a final discussion on the policy although there is an option of continuing into the early part of October if the members feel that more time is needed.

Jim requested input on the conflict for the June 26 the meeting, suggesting that the Committee consider moving the date ahead one week to June 19th.

Action:
Dan Hilburn was asked to change the June meeting to June 19th. He was also asked to move the Salem meetings to the Agriculture Building.

Dr Charles Arntzen, Arizona State University – Plant-derived Pharmaceuticals

Dr Charles Arntzen, briefly described his background in agriculture, and plant derived vaccines.

Dr Arntzen explained that he works at the Center for Infectious Disease and Vaccinology at the Arizona Biodesign Institute where the goal is to do basic science that is outcome driven. The ultimate goal is to find new means to reduce the load of infectious diseases through antibiotics, drugs and vaccines. He stated that vaccines have a high social value they are of enormous value to reduce the amount of disease in the world.

Dr. Arntzen, stated that all protein-based drugs (vaccines, antibodies, enzymes) must be manufactured using a living system. For instance smallpox immunizations, uses a cowpox inoculation method. He also used hepatitis B vaccine as an example showing the extensive process starting from the culture broth of yeast cells to the final product.

There are a few examples of protein production systems; bacterial fermentation such as insulin, mammalian cells in fermentation, yeast such as the hep B vaccine, Insect cells proposed for approval in 2006 to be used as a vaccine for cervical cancer, and green plants only in prototypes as of 2006.

Studies in 1989 began using transgenic plants; in 1992 expression of hepatitis B surface antigen in transgenic plants was attained. In 2006 the primary commercial targets are vaccines, monoclonal antibodies, and enzymes.

In plant-derived protein drug manufacturing the goal is to design a gene for proteins of choice and introduce it into a vector such as *Agrobacterium* or a plant virus such as tobacco mosaic virus or germinivirus. To do this one of two strategies are used; to create a transgenic plant or do transient expression.

In the 1990's (the edible vaccine era) there were five clinical trials, three trials used raw potatoes, the others used corn seed or lettuce. In 1998 immunogenicity in humans of a recombinant bacterial antigen was delivered in a transgenic potato; in 2000 human immune responses to a Novo Norwalk virus vaccine delivered in a transgenic potato; in 2005, immunogenicty was delivered by an edible vaccine for hepatitis B. By the end of the 1990's there was no question that some plants would express antigens in immunogenic form. But in 2006 the word edible will be abandoned and the focus will turn over to vaccines as regulated drugs. Dosage, stability and other drug properties are not amendable in "fresh food" delivery, current research is focused upon partial or fully purified/concentrated antigens from plants.

Using another example – Bird flu, Dr Artnzen pointed out that flu vaccines have traditionally been produced in eggs inoculated with the virus. The current emphasis is cultured cells, still inoculated with the virus. Could bird flu vaccines be made in plants? Dr Artntzen indicated that from a technical standpoint that a poultry vaccine produced in tobacco cells has received license approval but that from a commercial standpoint the alternative platforms are too far down the road. The only place for plant production to have an advantage would be in large scale, inexpensive production of a vaccine to treat birds. He mentioned that outside

production of vaccines may work in the case of treating mass quantities of poultry but that indoor production is important when considering vaccines for humans as insects and other contaminants need to be considered.

Dr Arntzen is currently working on plague vaccines in tobacco plants, indicating that just 100 plants will yield a gram of purified vaccine enough to create 75,000 doses of the vaccine.

Dr Artnzen's closing comments:

- Ethical drugs (FDA approved products for humans) which are produced in plants will be grown in greenhouses (to optimize yield and uniformity, and to meet product licensure requirements.)
- Production of protein drugs in plants will demand high expression levels to meet economic demands on product quality/assurance needs.
- High protein expression places a yield drain on the crop; excellent agronomic practices will be needed. A corollary is that gene 'escape" to wild populations is not favored by nature.
- Vaccines or therapeutics for animal use may require field production to get low costs per dose; Government regulations are in place to take new experimental PMP prototypes through careful evaluation. Regulation of research and commercialization activities can only be done on a product basis, as is the current regulatory framework.
- The greatest impact of PMPs will be in the developing world where there is no "third party payer" system health care, and new manufacturing technology can have the greatest impact.

Taskforce Policy Dialogue

There was no discussion regarding the topic.

Public Comments

Mr. North clarified some information from the bill from 2005 legislative session – that the bill was not a moratorium on all biopharm crops but that it was a moratorium on the outside growing of the biopharm crops.

Mr. North gave a handout to the taskforce members on the USDA's handling of the Ventria rice trials in North Carolina.

Terri Witt, stated that the taskforce should reread the bill from the 2005 session to get the correct wording on the moratorium of biopharm crops.

Meeting adjourned: 3:21 p.m.

The next Biopharm Ad Hoc Committee meeting will be held on:

Monday, June 19, 2006, 1-3 p.m.
Oregon Department of Agriculture
635 Capitol St NE
Salem, OR 97301

If you would like this these minutes in an alternate format,
please contact Shannon Brubaker at (503) 986-4621.