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Date: November 18, 2009

Subject: Spirochete Targeted Antibiotic

The market for a spirochete targeted antibiotic is very widespread. Spirochetes are a type of gram negative bacteria that are shaped like a helix. Furthermore spirochetes are the cause for a variety of diseases such as syphilis, Lyme disease, and leptospirosis. The Centers for Disease Control report that there have been around 25,000 cases of Lyme disease in 2009. Therefore spirochete targeted antibiotic would have a very large market. Furthermore the market would not only be in antibiotics, but in vaccines also. Finally this idea is viable, and therefore needs further attention in order to stay ahead of the competition.

The initial research shows that spirochetes have a mode of movement which involves endoflagella. An endoflagellum is a whip like structure in between the inner and outer membranes, which causes the spirochete to drill through the medium which can be seen in figure 1 below. The endoflagellum is made of two types of proteins called FlaA and FlaB. FlaB makes up the core of the flagella, and is then coated in FlaA to form a sheath (1). FlaA and FlaB are essential to spirochete movement. A basic diagram of a flagellum is displayed in figure 2, endoflagellum have the same basic parts but are different on a chemical level (1). A study, published with the American for Microbiology, has found that these proteins are fundamental in providing motility and shape for the spirochete (1). Moreover many microbiologists agree that motility is a major virulence factor. Therefore attacking these proteins would greatly reduce the virulence of these infections.

A more in depth outline of our design is to be described now. The study mentioned before used genetic mutations to prevent the sheath from being made. Furthermore their findings indicated that without the sheath proteins that specimen was less motile than the wild type. However our design would not use a genetic mutation, instead we are confident that a chemical can be synthesized to prevent the building of the whole endoflagellum all together. During the creation of the endoflagellum a cap goes on the top of the rotor to guide the Fla proteins while they are making the whip (2). If we create an antagonist to take the area then the flagellum would never be finished. Furthermore the antagonist would do nothing. A good video about the creation of a flagellum can be found at www.youtube.com/watch?v=Ey7Emmddf7Y. Therefore the microbe would be completely unable to move, and the overall structure of the spirochete would be diminished.

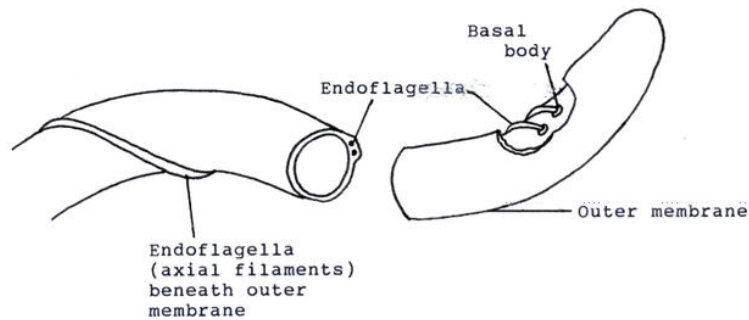
The initial effects of the drug will not be damaging to the patient and will in fact help. Many of the effects of spirochetes are that they borrow their way through parts of the body. This antibiotic would prevent anymore burrowing. In Lyme disease the bacteria drills through cartilage causing arthritis. Therefore the inflammation caused by the microbes would be quickly reduced using our formula. Most side effects of antibiotics are caused from disturbing the local flora of the body. However spirochetes are not a large part of the normal flora, therefore there would be very few side-effects caused by the drug (3).

A vaccine would be possible using this design. A vaccine is basically a weakened form of a bacteria used to get the immune system to remember it. Using this antibiotic to immobilize the bacteria would create a suitable vaccine for Lyme disease, syphilis, and leptospirosis. Since the bacteria

cannot move mean that the immune system will easily be able to defeat the bacteria and this would create memory. Thereby making the vaccine successful.

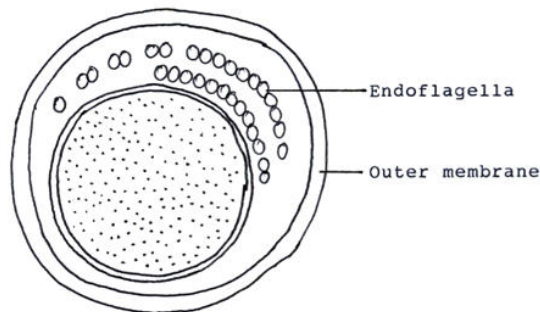
This approach permits two products to be made. First the antibiotic would open up the market for all the people that have one of these diseases. The second market would be in the vaccine created using this formula to injure the microbes. Injecting the incapacitated microbes would allow the immune system to create memory without causing full blown infection. Furthermore a vaccine would greatly increase the use of the product. Vaccines are being used more in last few years. Within the last twenty years the number of vaccines given to a baby went from four to twelve. Why not add all of the spirochetes to the list of vaccines given. Finally more research into this design would aid the company in the long run by beating the competition to this market.

Fig.6: Endoflagella in Spirochetes



Cell Structure of a Spirochete
(after Holt, 1978)

On solid substrates, spirochetes also exhibit gliding and "inchworm" movements.



0.1 um

T.S. large spirochete
(Listgarten & Socransky, 1964)

Figure 1

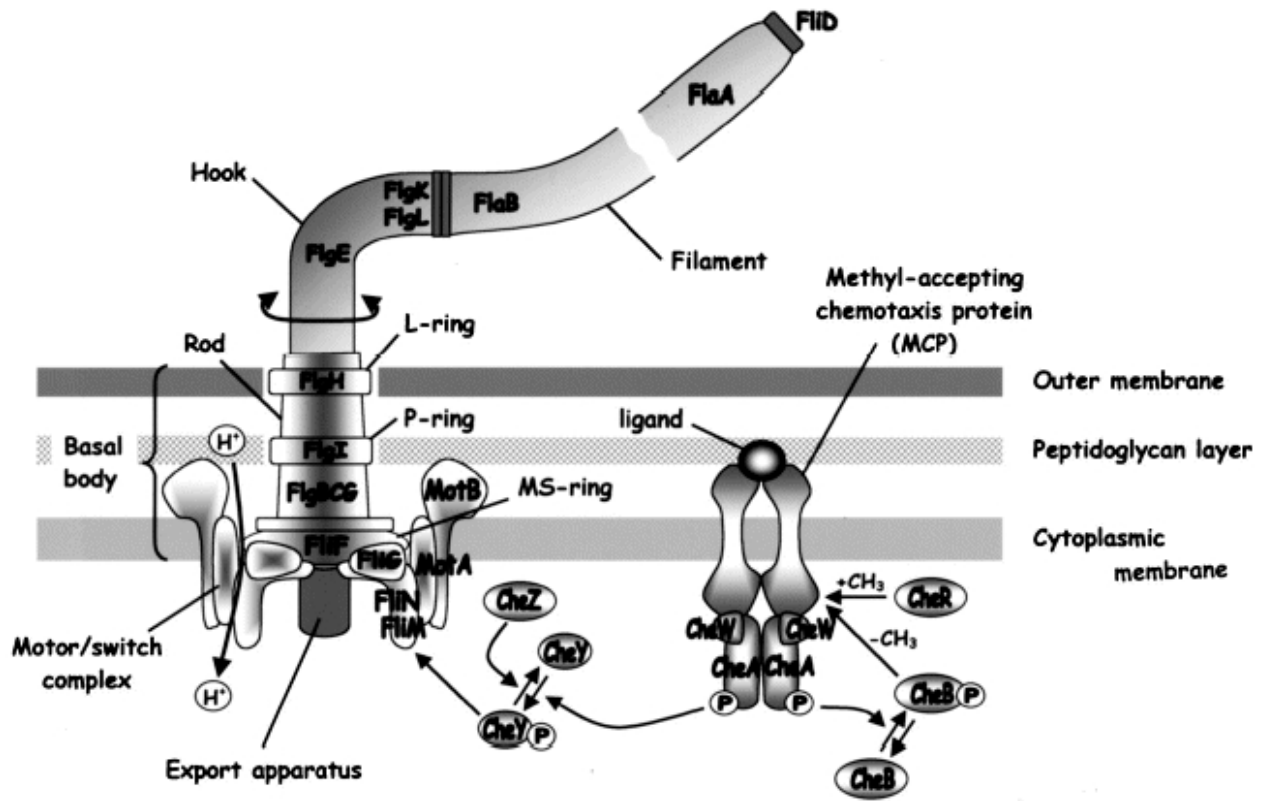


Figure 2

1. Chunhao Li, Linda Corum, David Morgan, Everett L. Rosey, Thaddeus B. Stanton, and Nyles W. Charon. The Spirochete FlaA Periplasmic Flagellar Sheath Protein Impacts Flagellar Helicity. *J Bacteriol.* 2000 December; 182(23): 6698–6706.
2. Bacterial Flagellum. In: *Essential Cell Biology, Third Edition.* Alberts, Bray, Hopkin, Johnson, Lewis, Raff, Roberts, et al. Garland Science, 2009.
3. Cundell D. *Biol-221-Microbiology Notes.* Philadelphia: Philadelphia University, 2009. Pg. 103-107.