Polio Biology VIII
Post-Polio Pathogenesis

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There are words we use to describe aspects of pathology, which means the study of disease. Often, when we look for a clue to unlock a mystery like Post-Polio Syndrome we neglect the words invented by epidemiologists and get confused about what we are truly seeking. Let me give you an example of what I'm getting at. Everyone with the debilitating and uncomfortable fatigue of Post-Polio Syndrome eventually asks the question: "what is **causing** this?" When they find out they have PPS they may obsess about the **cause**. When you talk to people they will tell you PPS is caused by the overwork of already over-burdened muscles. Or some may say it is caused by aging of a damaged neuromuscular system (this really doesn't tell us much --- muscles or nerves? --- how is the aging manifesting itself to **cause** [that word again] damage)? Some are beginning to say that PPS is **caused** by latent viral particles inside cells of the central nervous system.

Ever since the writings of Copernicus we, in the Western Hemisphere, have used reductionism in our thinking to the extent that we think problems must always have a single cause. So we say this, not that. And we seek until we find a single simple explanation. Nothing but a single understandable cause, it seems, will relieve the nagging uncertainty about what is going on inside our bodies. I don't think things are this simple, especially inside the nervous system.

Let's get back to the words that epidemiologists use to clarify aspects of disease. First, there is the etiology of a disease. Etiology means cause. When we are asking what is the cause we are really asking for the etiology. The etiology could be very simple: "People who overuse muscles enervated by giant motor units (one nerve cell with multiple fibers) will over tax those nerves and the nerves will die". This is the most common idea for an etiology of PPS right now. Another epidemiologist's word, which is a bit more complex in its meaning, is pathogenesis. The pathogenesis of a disease is the mechanism, or steps which occur in the disease manifesting itself. This can be very complicated.

We have found, recently, that motor nerve cells infected with polio virus do not die the way we thought they did. We thought that if a neuron was infected with polio virus the virus multiplied inside the cell and lysed it. The infected cells were always killed in this lytic model. This is one reason why many medical doctors think that once an individual recovers from acute polio it is clear sailing for life. Now we know differently. Many infected cells did die because the cell itself, not the virus, proceeded through a series of programmed steps toward its own death and disintegration. This programmed cell death occurs after certain cell structures have been damaged and appears to be an evolutionary adaptation that removes cells

which have no chance of normal function. The process is called apoptosis. Many polio infected cells underwent apoptosis and not lysis. The significance of this is that many cells that were infected did not apoptose and consequently trapped viral particles inside. Pathogenic organisms that live inside cells have a neat adaptation. They evade the immune system by being safely tucked away where immune processes cannot remediate. Add to this the blood brain barrier and you have an ideally insulated hideaway. The blood brain barrier consists of extremely tight junctions between capillary cells nourishing the brain and spinal cord. Because of it many drugs can't even get into the brain and this has been a problem in medical intervention for tumors and other disorders of the central nervous system. But I digress.

There are other pathogens which elude immune attack by living inside cells. The tubercule bacillus is one of them. Now also, with polio, we have detected unquestionable signatures of the virus in a little more than half of those studied who have PPS but we find no virus in people who have had paralytic polio without late effects.*[1]* What are the role of these polio viruses in PPS? Are they etiological or are they a part of the pathogenesis of this disease? I think right now there is a consensus building that they may be a part of the pathogenesis of Post-Polio Syndrome.

What results in their release? It is likely that cells are suddenly undergoing apoptosis many years after acute polio. Why? Overuse? Immune attack? Age? Each answer leads to a new question. And it seems we've arrived where we started, looking for causes. One thing is for sure: we will find many steps in the pathogenesis of PPS along the way toward understanding an etiology.

References.

1. J Neurol 1999 Jun;246(6):472-6, Postpolio syndrome: poliovirus persistence is involved in the pathogenesis., Julien J, Leparc-Goffart I, Lina B, Fuchs F, Foray S, Janatova I, Aymard M, Kopecka H. [PubMed Abstract]

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