

Whatever Happened to Honoring Defenses?

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This post is based on a presentation given in the Dupont Summit conference dealing with science and public policy at the Carnegie Institute of Science in Washington DC on December 7, 2012. The session was on complexity as a paradigm game changer. Understood was the fact that our thinking remains stuck in the mechanical model where we analyze the system and expect everything to be connected linearly. Even when we deal with complex and networked systems we still try to understand them in this way. Those familiar with Common Sense Medicine know that overcoming this short-sighted view is what we are all about.

One way to cope with this problem is to show evidence for something more inclusive which is what I tried to do in my presentation:

Whatever Happened to Honoring Your Defenses?

Wendell Berry suggested that we not look for answers to our problems in our temples; it is the desert that has usually provided insight into our deepest problems. Our temples are established to promote and teach current thinking; in the desert you have to adapt and make do with what you have. More often those in the desert learn to see differently. While I don't claim any hook up with the divine I have spent time in the desert and I do tend to see things differently.

Prior to medical school I got a Master's degree in the history of science and ideas, so I always seem to ask why we do it this way, and when you ask this type of question about medical practice much of it seems stuck in ancient thinking. I say ancient because this type of thinking began before ancient Greece, but it was still in place during the flu epidemic after WW I and while the characters have changed the model still dominates much medical thinking today. In humoral medicine health is defined as the balance of symptoms, so drugs or procedures were used to balance those seen as out of kilter; today, while we have changed the symptoms to make them more scientific, the focus is still on balancing them.

That's a mechanical approach that we need to change. But it has been in place for a long time, and it is a major contributor to our GDP, so the first step is deciding what our goals are in public policy. Whom do we serve: the public, or the financial gods of our system? That's a decision we need to make in whatever area of policy we work in. I firmly believe that the public option is a better choice, and that if we want to put a human face on our policies we better get a more accurate model of what the public is than the analytical, linear model that currently dominates our thinking. I am a physician and the world I speak of is that of medicine, and there is no way that linear, analytical, mechanical thinking honors the complexity that makes up the human body. Complex systems are networked and with many elements the body defies modeling at any level. In addition we adapt and adaptation is completely out of the range of simpler linear systems.

The foundation of understanding adaptive systems is not taking them apart and analyzing them, but in watching how they adapt and trying small changes in the environment to see how they affect that adaptation. These principles are not limited to medicine and are just as applicable to education, to international relations, to our healthcare system, and to how we fight our wars, whether they be with bacteria or Al Qaeda. That said, let's look at how we do medicine.

Our current medical model is the linear, mechanical one that uses drugs or procedures to balance symptoms. A good example of this kind of thinking, and one that shows the value of defenses is a procedure that is no longer used: blood-letting. For most of the last 3000 years symptoms like redness, swelling, fever or pain were seen as representing an excess of blood and the treatment, and getting rid of some of it made sense. It had to make sense for it to last that long, and it did because but you could actually watch the body return to balance as the blood-letting progressed; the redness and swelling diminished, the skin became cool, and even the pain lessened. Then, in the mid 19th century, scientists discovered that more people died after the procedure. But why did they die?

Most have accepted the conventional wisdom that the loss of blood was the cause, but every doctor knows a person can bleed to death. The amount of blood taken was carefully measured and seldom more than the two units that are sometimes taken from healthy donors today. They died, not because of the loss of blood, but because a critical defense was hobbled. If you want your favorite football team to win, don't hobble the defense, but optimize it, make it stronger.

It's the same with us. Those of you with some medical experience likely recognized the humoral signs of too much blood as the rubor, dolor, calor, and tumor that we know today as the inflammatory response, the body's primary defense against infection. This defense signals a problem and brings, not an excess, but a needed amount of blood to the area of infection in order to fight it. Blood-letting was so successful because the loss of blood is more critical than infection and it triggers another defense; it's a case of one defense trumping another. Shock, the defense for the loss of blood, shuts down peripheral circulation saving more blood for the critical organs in our cores, and in the process it eliminates the symptoms of inflammation which are most often seen from the outside. But trumping a defense wipes it out; your team is less able to fight the infection, and you are more likely to die. And that's what they found in 1835 when they looked at people with pneumonia who were bled. Since then we have dumped the humors, like too much blood, and gone to 'scientific' symptoms, but the principles of humoral thinking persist—we still balance them.

Lesson number one from blood-letting is: make sure the symptoms you are treating are not defenses before you treat them. Randy Nesse and George Williams tried to open the practice of medicine to this kind of biological thinking with their book *Why We Get Sick*. They explain that other symptoms we commonly treat, like a fever, are also defenses. Artificially infected snakes prevented from moving into the sun and warming themselves die more often, and rabbits similarly infected die more often when given the drugs we use in humans to 'balance' a fever. It would be nice to see some human studies, but they would be unethical, and we can't learn from rabbits so we keep balancing our fevers.

And there are other defenses. In fact, from an evolutionary point of view, most of our symptoms are there because they give us a survival advantage. That's how natural selection works; we adapt to our environment, and that environment is filled with infecting agents looking to recycle us before we want. Williams and Nesse conclude that we get sick in large part because we hobble our defenses and eliminate the survival advantage they give us.

There are other symptoms called *manipulations*, like the profuse watery diarrhea of cholera, where our bodies are tricked into doing things that help the infecting agent get around easier. And then some, but not many, are just side effects. Side effects can be treated. Manipulations need to be blocked, like we do with clean water in the case of cholera, screens and bed nets for malaria, and even hand washing—and there is a real benefit for doing so. Paul Ewald looked at how bacteria adapt and wrote about it in his book, *The Evolution of Infectious Disease*. He found that when we find ways to block bacteria from getting around as easy we actually apply

pressure on them to adapt in a less virulent manner. It's an idea we will follow up later. But defenses need to be honored, supported and optimized. That's the essence of Darwinian, biological, or what we call common sense medicine, and it's where we need to go.

In our book, *The Boids and the Bees*, published by the Institute for the Study of Coherence and Emergence, we carry this idea further. Infections are most common where our bodies open to the outside: the GI tract, the respiratory tract, and the GU tract. This is also where our defenses are strongest, except where they are handicapped. And often they are handicapped by our humoral thinking. Diarrhea is a bother so we leap to treat it, but it is the backup defense of a challenged GI tract. Primary defenses don't much bother us; they work 24/7 to keep us healthy. But when not up to the task there is always a backup, like diarrhea, which is often bothersome so that we know something is wrong. Many lives are lost from serious infections that are associated with diarrhea, and from this way of thinking the risk should be greater if the defensive diarrhea has been treated. The WHO agrees with this, cautioning us about the early uses of antidiarrheal medicines, but doesn't talk in terms of it being a defense. When I asked researchers looking at deaths from toxigenic *E. coli* if treating the diarrhea increased mortality they agreed that it was an interesting question, but no one, they said, was interested in funding it, so it remains unasked. Seeing differently may change that. So what should we do with diarrhea?

I began practicing around the time that oral rehydration was shown to be so effective in maintaining the body's water in the face of cholera, and it became the most useful treatment in my practice for all gastrointestinal problems. Oral rehydration is one of the greatest medical advancements of the last century because it saves lives; in 10 years it saved more lives than penicillin had in 40. It optimizes our backup GI defense by turning on a molecular pump in the stomach that pumps water into the body; it is by far the simplest, safest, and most efficient way to get water into the body—it keeps the tank full so the defense can work. But it is not well known or used in this country. Why give someone a quart of oral rehydration costing a quarter when we can hook them up to an IV and bill over a \$100.00, and honor the gods of the GDP in the process? And why give them something they can control and maintain independence when we can take that power and treat them with shock and awe.

This kind of thinking goes back quite a ways too. A hundred years ago Dr. Sara “Jo” Baker was working for the New York City Public Health Department. Her part of the city, Hell's Kitchen, was plagued with epidemics of typhoid and cholera, both spread by poor toilet hygiene. Beside getting ‘typhoid Mary’ out of the kitchen—twice—she dealt with this by teaching the girls in high school the importance of regular hand washing, and it helped curtail the epidemic. In fact it helped so much that 30 Brooklyn pediatricians petitioned the mayor to stop her program because the lack of sick children was hurting their practices. She tells this story in her autobiography, *Fighting for Life*. It was, she says, the greatest testimony to her work she ever received.

Profiting from illness has never been a good way to promote prevention, but it's how our system is set up. The most common response I get when I talk with physicians about the benefits of optimizing nasal defenses is something like, “Why should we do that when we can make so much from allergy testing and shots?” We had to go to Australia to find someone willing to ask the question, “What happens to asthma if the nose is clean?” Many problems, allergic and infectious, begin in the nose and optimizing nasal defenses can prevent many if not most of them; at least that is my experience.

Primary respiratory defenses are the combination of the mucus, which traps all the garbage, the cilia, which sweep it out, and the airway surface fluid, which facilitates the process. But this cleaning is handicapped by our nice centrally heated or cooled environments that dry the air we breath, which leads to more of the bothersome back up defense. Like other washing defenses, rhinorrhea is bothersome, but it is still a defense. It's triggered

by histamine, which opens the taps for the washing, increases the mucus for holding on to more irritants, sneezing to get rid of it all, and, if it can't contain the pollution in the upper airway, it shuts down the lower airway to protect the more vulnerable lungs from the pollution upstream in the process we know as asthma. That's all a rather simplistic explanation that you won't likely hear from your doctor, but you should, and likely would if they could switch their thinking from the mechanical, humoral, balancing of symptoms model they have slept with for the past century to a biological model that more accurately represents the body they are dealing with along with its adaptations and defenses.

The consistent increases in respiratory problems began in the early 1970's and by the mid 60's central heating and cooling was in half of all new homes. Arundel shows the risks of dry air in more upper respiratory problems. Nor are they helped by our use of decongestants and antihistamines that hobble the defense, which were made available over the counter at the same time. In 2007 the FDA removed these drugs from the pediatric formulary because studies showed they caused more problems than they helped. When I suggested to them that what they were seeing was what happens when you hobble a defense the response was: "That's an interesting idea." Ideas are one thing and easy to dismiss; seeing differently is another. It's harder to get to, but it stays with you.

This is systems thinking. Our current model is linear; we connect the dots and it's easy to understand, and we really like it because we think we can predict what will happen. But the body is not that way; it's networked, and there too many elements to keep track of, and our predictions are more often than not countered later by unintended consequences. Complex systems like the weather have a number of networked elements and we can model them with some accuracy on our computers, but as the number of elements increase this becomes impossible. Combinatorial numbers that you get from networking are bigger than cosmic numbers; they defy simulation or any other attempts at modeling or prediction.

You have to look at things like *attractors* to understand them. This is more representative of living organisms, in fact we are more like *strange attractors* because we adapt; and we do so in novel ways in what is called emergence. That's what I've been talking about; looking at how and why the body has adapted as it has, and even asking how to guide the process. The subtitle of our book is: *Guiding Adaptation to Improve our Health, Healthcare, Schools, and Society* and I recommend it if you are involved with policy making in any area that treats living things and especially human beings, because in the end we are not linear, connect-the-dots-to-understand them organisms, and linear, mechanical, humoral thinking in any area dealing with living things is wrong-headed. It's time to stop the blood-letting and treat people and their systems as the adaptive organisms that we in fact are. It's time to recognize that an area of our most significant adaptation is our defenses and that, bothersome though they may be, they help us to better survive; we need to look at how we can help them work better, and to realize that hobbling them is a large part of "Why We Get Sick." This is a paradigm shift and it comes with all the benefits associated with such changes in our models and thinking; and it's the first step to putting a human face on public policy.

This is the application of complex adaptive thinking to the way the body works. It can benefit us all now. Shift the way you see whatever symptoms you may have; ask if they're defenses, and if they are don't hobble them. Then expand this way of seeing to the rest of the living world.