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Compost, Soil Chemistry and Wholeness

Elements, Nutrients and Healthy Farms

It is the dilemma of a modern analyst to be stretched between "parts" and "whole": between the mere "data" of a soil or compost test and the "meaningful" interpretation in view of the whole field or farm. Where do the data and parts stop being separate and become whole and relevant? Can we reach the whole farm by way of the isolated chemistry parts?

The word "analysis" comes from the Greek ana = "from above" and lyse = lysis "to separate". The analyst separates and distinguishes what was once whole. The data or parts of the laboratory chemist appear irrelevant to the untrained eye such that there is essentially no relation to any whole. Without knowing the context it would be very hard to take the data and say "oh - that's a soil", let alone say "oh, healthy soil!". Even if we can go the further distance, having experience, it is still possible that a lab report may suggest that a soil is infertile yet the grower feels good about it. Similarly, we can construct the forage ration analysis which indicates excellent feed, but the animals don't seem well. Something is missing.

This paper could be presented as "Compost and Soil Chemistry" – without the word 'Wholeness'. This word adds a new dimension. After two decades of working analyzing soils and composts, this author has questions about meaning and about the interpretation of analytical data.

We are all aware, as we work with analytical numbers, that at some point in the reading of data they may cease being mere numbers and become meaningful; they relate to something else; they form a "togetherness". A path exists - which we introduce as a hermeneutic circle – and it proceeds from parts to whole, changing from one into the other, or from letters to words and eventually to meaning. Somewhere along the way an activity that "organizes" the data appears to be implicated.

The intrinsic organic activity that we use to sense a wholeness or reveal a whole farm is what we are trying to address in this presentation. Yet, the process of getting to the whole is always unsatisfactory, particularly today: somehow we remain transfixed by the parts that don't seem to support a whole view.

One thing we may recognize in these dilemmas is the fact that in our modern agricultural science – as virtually all science – we employ models to represent wholes and these are constructed from abstracted parts. It is simply the way we do things. Why is this a fundamental problem when we attempt to grasp the quality of a whole farm?

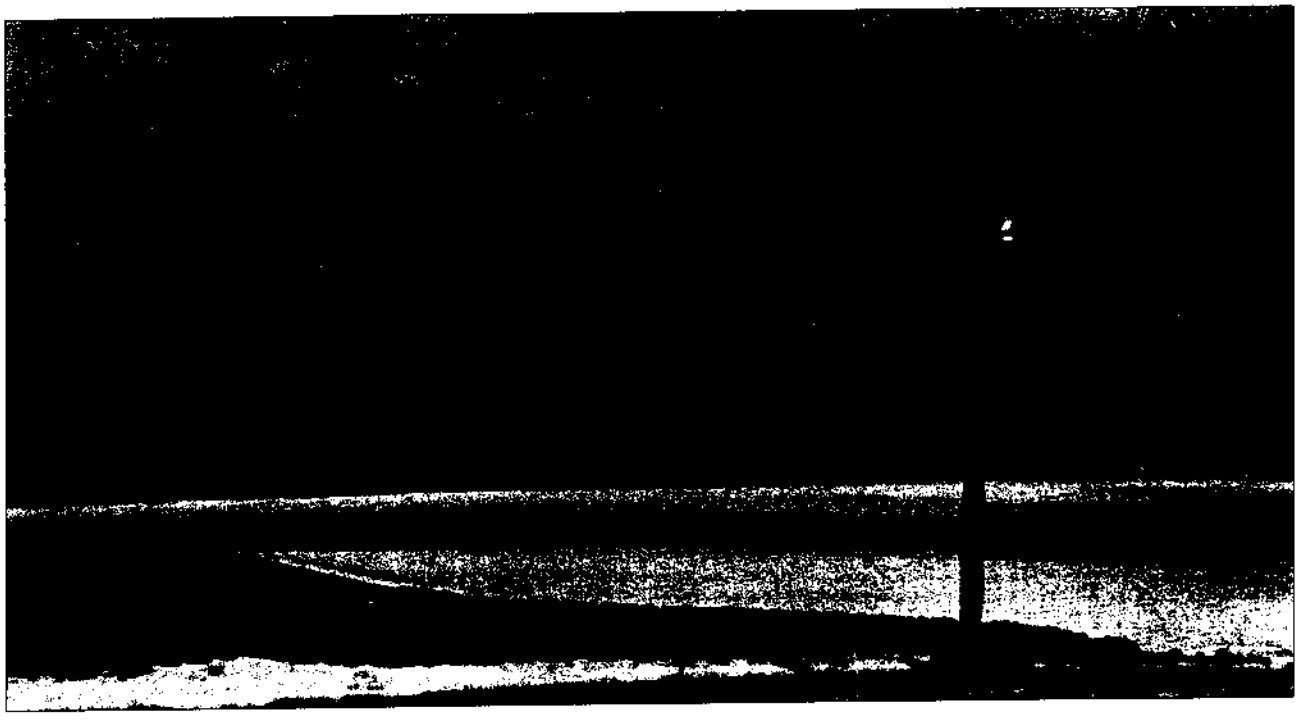
The attempt to grasp the whole without resorting to parts orientation belongs to the emerging field of phenomenology. It is not based on any attempt to set up polemics with reductionistic methods, not to become mystical. It is an unfortunate but widely held view that phenomenology of this kind is some kind of variant on subjectivism (Hammond et al., 1991). It is, in fact, a new science, and in so far as biodynamic farming is concerned, it is the form of science with which its formulator Steiner first concerned himself, even before he turned thirty years old, in his attempts to characterize Goethe's phenomenology as scientific (Steiner, 1883-1897). Biodynamics is thus based on a fundamentally different starting point than traditional agricultural science, and for that matter, than much of organic farming.

Context: Recognizing in the Seeing

A farm landscape lies before us. The question is raised – what do you see?

This scene is presented somewhat out of context, and the viewer may feel offended, yet this is precisely the point. We are asking you to tell us what you see. Through modern empiricism it is considered that in the sensory data alone we find the explanation. This is purportedly how science is done. In this first example, chances are you have never seen the particular soil or farm in the scene. Yet you will have distinct impressions by looking at it.

The farm scene seen above is one which was presented to a group of city travellers who saw it for the first time and did not know what they were looking at. Some aspects of the setting made it all the harder for them – the fact that they had flown from New York City several hours north: the fact that it was cool on a summer day, and so on. None of these contextual facts helped them place into a meaningful context the actual scene as they found it: a huge potato farm in the north of Maine, along the St. John River, next to Canada. The author was with an ABC film crew from New



York, and the director had not seen a farm of this kind before. His question was: what are we looking at? An honest question since empiricism patently fails us when we are presented with raw data like this. But this is only the beginning of the observational–meaning dilemma. Why is the soil so light and the crops so dark? It is so quiet; no birds, no wildlife. Can we see to recognize what is actually the nature of this place, this landscape, this eco-system?

Knowing in Seeing

The conflict of landscape data versus ecological wholeness is a classic problem if we stop to look at what is happening here as we travel a circle which starts (or ends) with sensory data and ends (or starts) with meaning or the understanding we put onto the situation.

If you the viewer were instructed that the farm scene observed in the north was a "dying farm, stripped of all fertility and bolstered only by artificial chemicals" you may have seen it differently. You might suddenly recognize the dreary nature of the washed-out soil, lack of hedge-rows and sensuously blue-green, stiff foliage bolstered by artificial chemicals and lack of any insect life from excessive spraying (which suddenly you notice you can smell in the air). Having this meaning, you see the parts differently. Try to see the farm again romantically – as our New York city visitors did on the visit – after knowing these new facts, and you will find it is very hard. The landscape is no longer picturesque, the soil no longer looks "cared-for".

The context of seeing versus interpretation-meaning is sharpened by another example. Here we travel to the southeast and arrive at a rural farm along a back road somewhere in Georgia. I am travelling with a GATT lawyer from Belgium who exclaims excitedly that he has never seen an American peanut farm and does not know to recognize how peanuts are grown and harvested. He insists on stopping to photograph this idyllic, romantic American rural scene. His excitement does not infect me, however, since I see the same scene differently (see image on opposite page).

The soil, I explain, is severely depleted, judging by its almost white color, and clearly, the plant debris is not being reincorporated into the earth. What is more, that is not smoke from the harvesting equipment, but soil, blowing off in the wind. Our visitor/observer is suddenly crestfallen. By presenting a new interpretation, the author destroyed the visitor's naive meaning and brought forcefully into play another picture that powerfully reinterpreted the "facts" before our (his) eyes. We turned the car and drove along the far side of the field where soon a layer of silty-humusy-soil settled on the hood and we could collect a fingerful without any difficulty. I had once analyzed such windborne soil and found it to be the richest fraction of the soil, full of humus and microbes.

Now look again at the entire scene in terms of its

sensory data, with newly "trained vision", and you will see more than the Belgium lawyer did in the first round with his inexperienced, if not naive, nature observation. As a fact, this is a common occurrence. It is increasingly the case that the average individual when presented with a scene from nature of any kind can not distinguish it from any other in any way that could be called meaningful – and often all such a person "sees" is what they remember watching on a PBS Nature series, or reading in National Geographic – that is their only context. We are constantly putting into sensory data what we already know or don't know about it. I am really talking about two things here: first, the fact that sensory data by itself is meaningless, and secondly, that we assert ourselves into the data with poorer or stronger information and thereby affect how we see it. We moderns have a dilemma in dealing with sensory input, particularly that which involves nature, and in assembling these "data" into meaningful wholes in a way that truly represents participating in the scene at the moment it is arising, and could be called natural or non-technological.

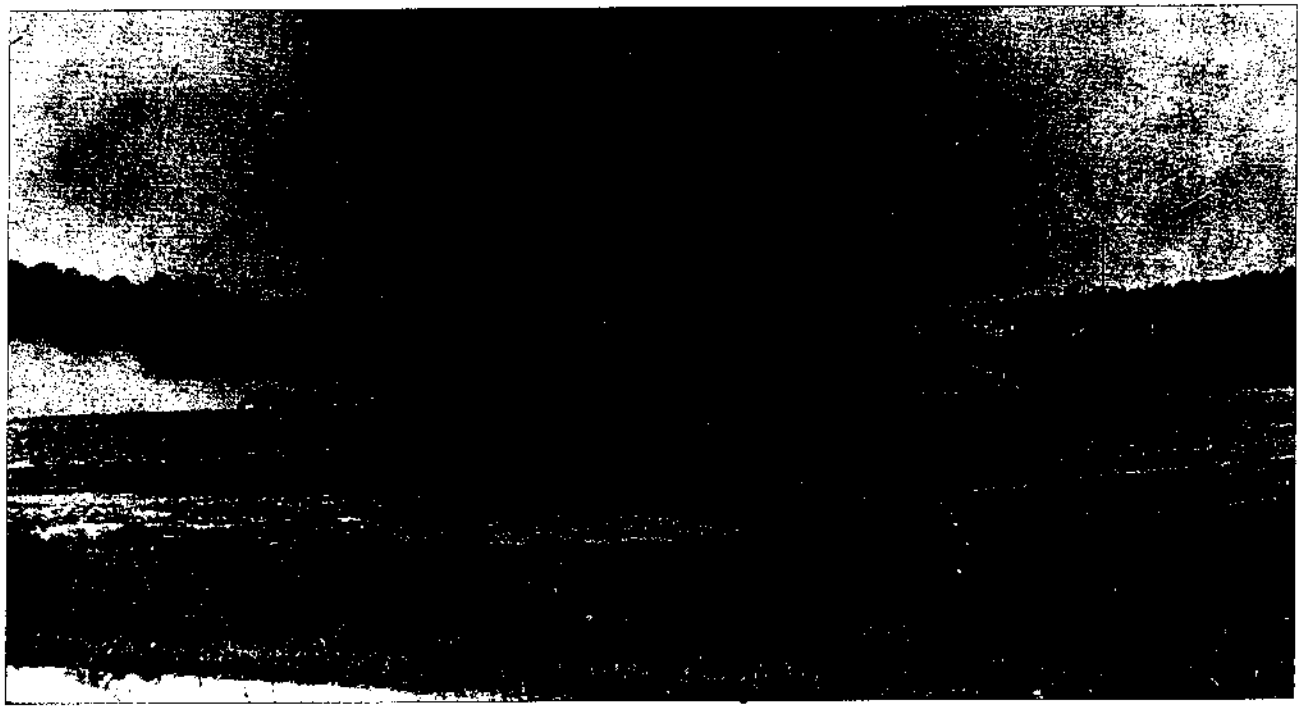
The inability to interpret nature through observation can lead to another effect. The author chaperoned a camping trip of suburban kids in woods relatively far from civilization. A small pond against a dam was discovered dating from the last century. Here the children wanted to fish and eat their catch until one of them exclaimed "....but the water is polluted!" – which ended all the fun. It amazed me that these kids "saw" pollution where I saw a pristine natural setting of unusual cleanliness. How to "un-train" the biased eye? These children simply saw what they had heard about.

Seeing Versus the Seen

Confusion arises here as a result of the inability to separate the act of seeing from what is seen. We have set the stage to pass back and forth in understanding parts vs. wholes. A new holistic view of nature attempts to re-form the approach based on recognizing how intrinsically involved cognition is with perception of parts. Ihde (1986) expresses it as follows:

Acts of consciousness and objects of consciousness are essentially interdependent: the relation between them is an "internal" and not an "external" one. That is to say, one cannot first identify the items related and then explore the relation between them; rather, one can identify each item in the relation only by reference to the other item to which it is related.

It is important not to misunderstand these points. In the southern Georgia scene, a "quaint, rural" scene was presented to the eyes. In addition, a small eco-disaster was evident. We may romanticize the scene in a celebration of rural living or see something totally different. The two views appear incommensurate with each other, but do not replace each other, nor is one "right" and the other "wrong". They are different ways of seeing the same phenomena. Cognition is intimately



involved in the seeing and it can not be imagined how we would see without cognition already involved, as the Ihde quote indicates. Modern science and the empiricism it is based on falsifies the relationship of data and knowing, and this falsification or rather misunderstanding of understanding is intimately connected with the success of reductionism – indeed it is required for it. Overcoming reductionism in farming or any other field will never be accomplished so long as we remain caught in the loop.

Part vs. Whole: The Hermeneutic Circle

Here is our hermeneutic circle, after Gadamer (1976), in graphical form. We may imagine that the arrow goes endlessly around – what is the beginning and what is the end is strictly found from the departure point in

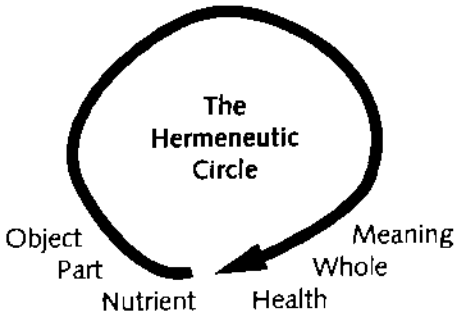


Figure 3

which you place yourself into the situation.

The diagram creates a dilemma because it does not itself resolve itself. It is not alone enough to say that parts cause meaning any more than it is to say meaning leads us to recognize parts. Both are instantly true. Failure to recognize this cycle leads to misunderstanding of the process of perception.

To summarize, we are dealing with two types of complementary knowing:

1. "Reductionistic" = linear, additive: generalizing properties from parts
2. "Wholistic" = unified, participatory: emerging properties not reducible

By way of contrast, we will build a view of soil going from reductionistic to holistic in three steps, as follows:

In the diagram above, we have on the left (A) only parts or nutrient element data and we do not know the relation of these parts. Of course, the fact that they are seen together may be purely a coincidence. However, in (B) we recognize that the parts appear together because the circle is there – they are radii defining the whole, and here the whole has to do with "soil fertility". On

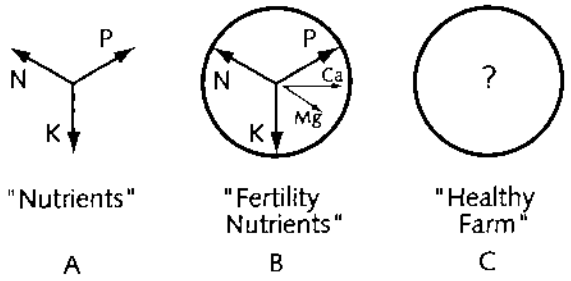


Figure 4

the right (C), we have only the whole circle, actually the very same one, only now the parts are not visible at first. Perhaps, in fact, parts N, P, and K are there, only there are so many parts we can not distinguish them alone, separate from the rest. In our example it is, in fact, not necessary to first see parts 1, 2, or 3 in order to recognize the whole, – we know this because we are looking at it. The whole is now a "farm" that is "healthy" because we know it is, regardless of seeing all the parts that make it up. In all three scenes we are observing all the same "data" differently.

In this example the scientist is trained to look for the parts in the whole and once he finds them he is content with them –in fact, he may be lead to conclude they explain the whole – after all, they are perfect radii, as in B above. On the other hand, the layperson may see only the whole – the circle in (C); and can not recognize the parts – being untrained or lacking analytical equipment. We say such a person is unequipped or even naive and does not realize that the parts are there, and that these parts explain the whole – which is of course an illusion. Just so we go back and forth, and the problem with modern science may lie in this: it asserts it has the "superior" view, the "defined" or the "correct" view contained all the identified data, as in A. If this is the case, then the scientists presented with the scene in figure 1 or figure 2 sees only soil, plants, and a telephone pole or dust. But another sees a dying landscape. The alternate whole view is correct, and the scientist is not wrong, either. But we may argue that the scientist certainly saw a lot less than the holist did, but ironically the holist saw no "data". Thus, in this way we scientists with our "data" see more, but less.

Soil Fertility as "Emergent Property"

The simple effect on fertility of adding manure or compost to soil is not necessarily additive, as many studies suggest. That is, it can not be deduced in the sense of summing up the nutrients contained,

Long Soil Fertility As "Emergent" From Management With Added Manure
(after Bouldin et al – 1984)

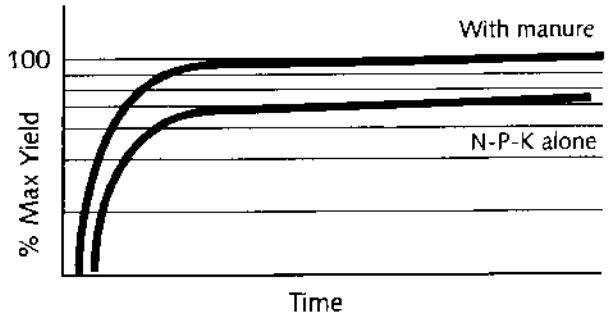


Figure 5

Apparently, other factors are present. Bouldin (1984) gives examples from longterm research which reveal that there is a quality present in manure which aids soils in attaining levels of productivity higher than what is possible from equivalent mineral nutrient additions alone (see figure 5).

This leads to the realization that the property of soil being fertile may be viewed as emergent. You can perform studies and measure various and numerous parts and not arrive at a full picture. A quality of fertility "emerges" over time.

It may simply be a result of abstract thinking in agriculture that we imagine we can produce or understand fertility by only adding individual factors or nutrients. Another way of looking at it is to picture a simple nutrient black box scenario of fertility (figure 6). In the ordinary modern system (A) productivity is represented by soil + NPK = X under relatively sterile conditions. But when compost is put into the system (B) everything changes, and the confines of the box model are violated in several ways. Now, yields in (B) are no longer predictable from the ingredients additively, or certainly can not be easily measured, not even

Soil Productivity: Black Box" and Emergent Productivity

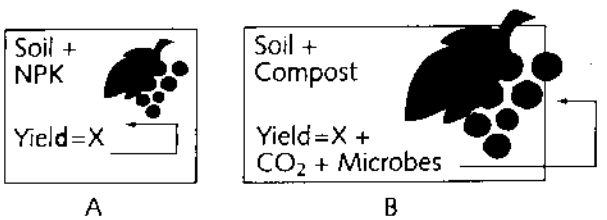


Figure 6

with the best of tools. Consider that now we have CO_2 produced by microbes which indirectly exerts a yield-increasing effect via its action on photosynthesis. Additionally, the microbes impart yield-enhancing properties that may be a combination of allelopathic effects and disease reduction effects, also very difficult to measure. Of the latter, it has been shown that compost induces systemic disease resistance, internal to the plant, and in this way builds on the plant's abilities to defend itself. A reductionistic model of the system is not able to predict its properties. This might appear frustrating to some researchers.

From the point of view of this approach, we can achieve a quality of health and wholeness without delving into all the parts by working within nature's organic context. It would not be possible – at least not very easily – to design a system, as in (B) above that works well, based on quantitative data alone. When we find disease control, do we have a single microbe involved or several? Studies reveal that even when individual microbes associated with positive effects are extracted and reapplied, the effects are not as great as when they were added in the context of a compost or other natural system. It is the agent and the environment of the agent that seem to be requisite to the full positive effect. This is a quality of wholeness, of emergent properties.

Farm Management and Animal Health Emerging

Nowhere is the quality of system integrity more evident and more supportive of a wholeness perspective than when we examine animal health. Many studies have appeared, especially in Europe, which examine different levels in intensification of farming in relation to the animal health. University of Hannover Veterinary School and the Linz Agriculture Experiment Station (Austria) have developed a picture of farm systems and their effect. The stimulus for the studies is the observed disturbances of fertility, mostly because sperm quality in breed farms has been steadily declining over recent years, in proportion as farming has intensified. Is there a connection the researchers asked, and what explains it?

In a four year study, the effect of farm management on quality of bull semen is revealed. Fertility is rated here as the number of days sperm maintains seventy percent forward motion. Four (4) days was considered little enough and a decline on intensive chemical managed farms to one day, is viewed as a very poor result. After conversion to organic management, however, the

Sperm Quality of Bulls During and After Chemical Intensive Farming

(Source: Ähnelt (1984) Hannover Veterinary School)

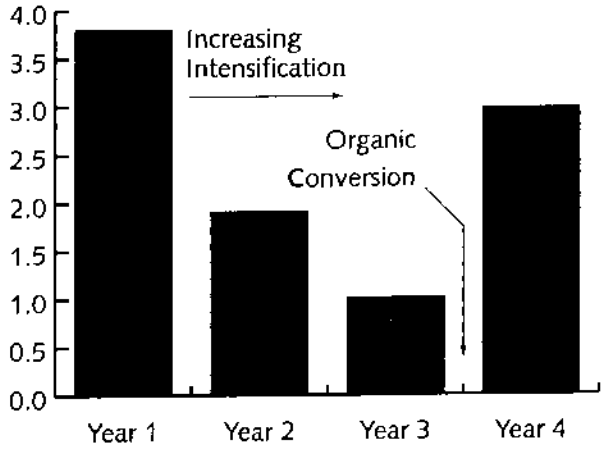


Figure 7

scientists observed sperm quality increased immediately, tripling in one year, as the diagram shows (figure 7).

After this study, researchers attempted to isolate some factors responsible. Towards this end, they obtained forage-foodstuffs from differently managed farms, and fed it to rabbits in controlled studies. The results are seen in Table 1 and indicate widely varying indexes of fertility resulting from feeding these various forage materials. Clearly, a property exists in the forage derived from the farm that imparts positive or negative factors to the animals. These affects appear to be hormonal in nature, but have not been analytically tied to hormones alone. Rather they emerge with other factors and make their presence seen in the animal fertility.

Table 1: Emergent Fertility Traits of Rabbits After Feeding From Farms of Varying Management

Fertilization of Carrots	Experimental Group		
	NPK – 300 units N	NPK – 100 units N	Biodynamic
Uterus musculature in cm	3.1	6.0	7.3
Ovulation periods	6.2	10.2	11.7
Number of egg cells	4.8	5.7	11.0
Uterine glands	19	31	42

Conclusions

Today's farming systems are based on modern science with a reductionistic underpinning rooted in naive empiricism. Newer observations reveal "emergent" properties, similar to wholeness, that have been missed in scientific models. The whole farm is more than its components. Biodynamic farming and some forms of organic farming arise out of different modes of thinking than conventional farming, though all are evolving. A different kind of thinking and seeing are needed to understand them.

To grow into a more modern, wholistic knowledge requires us to go beyond mere agricultural sensory "data" while remaining within the actual, living elements. Important, progessive steps can be made through carefully applying principles of wholeness to the understanding of living and non-living systems. We can recognize several key steps:

- Health of a farming system can not be deduced from either individual or summative traits alone.
- Abstract intensification of farming changes the flora, fauna, and mineral composition in adverse directions.
- Reductionist soil fertility models must be eventually supplanted by associative, unifying forms.

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Will Brinton is the founder of the Woods End Research Laboratory and a frequent contributor to *BIODYNAMICS.* This article is based on a talk presented at the conference "Animal Health and the Farm Organism," held at Lake Morley, Vermont.