

GEORGE M. WOODWELL, called as a witness in behalf of the plaintiffs, being duly sworn, testified as follows: * * *

THE WITNESS George M. Woodwell. * * * (777)
Bay Road, Brookhaven, New York

DIRECT EXAMINATION by MR. YANNACONE:

Q. Dr. Woodwell, you submitted an affidavit of your qualifications together with an affidavit on the merits of a prior motion here. I show you this and I ask you if that is the same list of qualifications that you put in that motion?

A. It certainly is.

MR. YANNACONE: I would like to offer that in evidence, Your Honor, in lieu of the witness reciting his qualifications at length, sir. Counsel has a copy. Do you object?

VOIR DIRE EXAMINATION by MR. CORWIN:

Q. Doctor, I detect in the resume a lapse of some four years between 1953 and 1957. What were you doing then? (778)

A. I was in graduate school at Duke University.

Q. Did you conduct any studies while you were there.

A. Did I conduct any studies?

Q. Or write any papers?

A. I was a graduate student, and I did all of the things that a graduate student does in those years.

Q. So that some of the literature that is associated with your name was done during that period?

A. I believe none of the papers here was published in that period.

Q. What is the significance of the "with tenure" as far as the present position is concerned?

A. Well, tenure in an academic position means that your appointment is not continually reviewed; that the organization intends to continue you on their staff, as opposed to a term appointment. (779)

Q. Thank you.

MR. CORWIN: I have no objection to the introduction. Your Honor.

THE COURT: Now, counsel, may I make a suggestion? * * *

If I am wrong, you tell me. As I understand it, one of the claims made by the plaintiff is that it was the DDT that caused the death or disappearance of birds and certain animals? * * *

I think the doctor who conducted the test up at Hanover, he did have or did give testimony that they did check these birds that he found dead and/or some animals that he might have found dead; and that they did find either the trace or the effects of DDT in that these birds were unsteady and eventually died. Now counsel for the defendant has asked your witness two or three times, "Can you say that it was from DDT?" * * * (780)

Now it behooves you to have as strong a case as you can possibly get that in fact certain work was done on these birds or these fish and for you to show they did have or did die from DDT. * * * Because he is going to make a motion, and he is going to say that there is no proof that DDT was the killer.

MR. YANNACONE: Your Honor, Dr. Wurster said categorically---

THE COURT: Dr. Wurster did say it. He is the only one so far.

MR. YANNACONE: We have Dr. Woodwell now, Your Honor, and if you will bear with us, and let us put in our case---

THE COURT: Counsel, I am bearing with you with the patience of a saint.

MR. YANNACONE: I know, Your Honor. (781)

THE COURT: I am just bringing to your attention something your adversary is going to do, as sure as shooting. In fact, I will give you odds he is going to do it. So you might just as well bring these things out.

MR. YANNACONE: Your Honor, this particular witness, I think, will open and close a number of doors in this particular case.

THE COURT: All right. Go ahead.

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(The qualifications of Dr. Woodwell were received in evidence and marked as PLAINTIFF'S EXHIBIT 11.)

DIRECT EXAMINATION (continuing) by MR. YANNACONE:

Q. Now, Dr. Woodwell, have there been any changes in that resume or list of qualifications since it was written?

A. As times goes on, I suppose there are changes. I am now vice president of the Ecological Society, and I think we have published one or two other papers. (782)

Q. What is your title at the present time?

A. At the Brookhaven National Laboratory, my title is ecologist.

* * *

Q. And by profession and training, you are an ecologist?

A. That's correct.

Q. Now, would you tell us just what ecology is?

A. Well, the word derives from two Greek words meaning house and study. Ecology has come to mean in English the study of the relationship between environments and organisms and especially the study of natural communities.

Q. Now, when you refer to natural communities, will you tell the Court what you mean? Will you tell the Court just what you mean by the word "communities" in the ecological sense?

A. Yes, indeed. All organisms have evolved into someplace on the surface of the earth. They have indeed evolved with other organisms. We find them together with these organisms in collections of species which have intrinsic patterns, and these patterns of collections of organisms we call natural communities. They are forces, fields, communities of algae and aquatic situations, marine situations. (783)

Q. Does ecology include the study of the environmental relations among the communities of insects within this field?

A. Yes, indeed. It certainly does.

Q. And does it relate them to the entire natural community in which they are found?

A. It certainly does.

Q. Now, is ecology concerned with the study of or the problem of environmental contamination?

A. A very big concern of the ecologist in the field. That is a part of ecology.

Q. Now, before we get into the subject of environmental contamination generally and DDT in particular, would you expand a little bit on the discussion of communities, natural communities, and tell us about the kind of communities that are found?

A. Yes indeed. I will be glad to do this. I think we have to recognize that not only have organisms had an evolution, but so have the biological environments, the communities that they have evolved into. So we can think of Darwin's struggle for existence as occurring not only at the organism level but also at the community level. (784)

Now, I can show the implications of this, I think, best by a little example which is drawn, in fact, from Darwin's own studies in the Galapagos Islands. He observed there in the Galapagos----

MR. CORWIN: If the Court please, I don't know how to say this, and I am interrupting, for which I am sorry. * * *But I am objecting to this. I feel now that it is irrelevant at this point. I think we are getting to the point where it is repetitious, and it is cumulative.

THE COURT: What are you trying to prove? What happened in the island?

MR. YANNACONE: Your Honor, we are talking about the effects of DDT in food chains and in food webs. It is important to get on the record in this case just what this whole business about food webs and food chains and their relation among themselves and ultimately to man is.

MR. CORWIN: I am perfectly willing to make a concession.

THE COURT: How are you going to connect it up?

MR. YANNACONE: I am going to connect it up by showing that there are parallel patterns of community evolution, and that what may be found in a community in Maine or in Texas or in California or Upstate New York, if there is a similar habitat and a similar food web in Suffolk County, the same relationship should hold. Now if counsel wants to concede that, I will do without it or if the Courts wants to take judicial notice of this as a scientific fact. (786)

THE COURT: I think he will concede that where habitat is the same. Certainly, there can be no other answer to that.

MR. YANNACONE: Your Honor, if the court will take judicial notice and if counsel will accept as a fundamental ecological law that where habitat and similar food webs are found, that similar relations exist; then we can eliminate a lot of testimony.

THE COURT: There can be no question about that in my mind. * * * If the conditions are the same, you are going to get the same results.

MR. YANNACONE: All right, Your Honor.

THE COURT: That is conceded. Now, go ahead.

Q. Now, will you discuss the matter of diversity within systems? (787)

THE COURT: First, do you mind explaining that to me? I don't know whether your adversary understands that. What does that mean?

THE WITNESS: Yes, indeed. Ecologists think of diversity simply in terms of numbers of species per unit land area. Now, the simplest example I could draw here would be say in traveling from the arctic to the tropics, we go from an area where we have rotunda vegetation, very limited number of species, to tropical rain forests, where we may have 100 tree species in an area of one acre.

THE COURT: I understand that too.

THE WITNESS: From a place of limited diversity to a place of high diversity.

THE COURT: All right. I get it.

THE WITNESS: Now, there are several corollaries that go along and which apply here. As we move from a simple community to a complex community, from one low in diversity to one high in diversity, the characteristics of the community change from those of a community characterized by rapid changes in population size. (788)

For instance, in the arctic, the lemming populations fluctuate according to some predictable patterns. They go from high levels to low levels.

We go then to a very diverse ecosystem such as the tropical rain forest. We go to a community which is to a very high degree stable in the sense that the populations don't change rapidly.

Now, this concept is really a very rich concept to ecologists, because it also applies along a successional gradient. Succession simply refers to the changes that take place in communities with time. (789)

THE COURT: Counsel, that is apropos of what?

MR. YANNACONE: Again, Your Honor, this is apropos of the specific relation of all the various studies on the damaging effects of DDT to the Suffolk County ecosystem.

* * *

THE COURT: Wait a minute, hold it. As I understand this, I am being told--and again I am an embryo in this type of work, and I must understand it and learn--as I understand it, if you have birds in a particular area such as the arctic, if you will, you will have few types of birds. As you go down into the tropics, where you have lush vegetation, more feed, and where more is available twelve months of the year, you have a far greater number of types of birds.

Now, aside from that, what does it tell me?

MR. YANNACONE: To get back where we are going, Your Honor, we (790) are going to talk about the effect of reducing this diversity within a given ecosystem. If the Court wants me to jump directly to it, I will put the question just that way.

* * *

THE COURT: Wait, please. Let me finish with my question. Assuming that you do, how does that tie up with DDT?

MR. YANNACONE: We are going to show that DDT diminishes the diversity within an ecosystem, and this causes damage. It is going to be with reference to the Suffolk County ecosystem. * * * Your Honor, this is the whole crux of all this type of testimony. We are going to show that the ecological re- (791) search does not necessarily answer that specific question, nor does it need to. Now, it is either going to come out on cross-examination or direct examination.

THE COURT: Tell me, so that I will understand it as you are going along. You are using terms that I never heard of in my life. I have to interrupt you to find out what those terms mean.

MR. YANNACONE: We are going to try and develop this whole study of the ecology to show how ecological data is relevant to the study of DDT in Suffolk County proper. That is the whole purpose of this preliminary testimony with Dr. Woodwell, Your Honor, before we talk about DDT.

THE COURT: All right. I am overruling the objection. Go ahead.

Q. Now, to phrase the question directly, Dr. Woodwell: What is (792) the relationship between diversity as you have described it and the establishment of the ecosystem?

A. Well, I think I can answer that best by pointing to the changes in diversity that take place along successional gradient.

Now, Your Honor, I can explain what I mean by succession in this way: If we abandon a garden on Long Island, your garden perhaps, and we abandon it to the weeds that one would ordinarily hoe out of the garden, then in the first year we would have crabgrass and a variety of other pernicious weeds, and in two or three years we would start to get Andropogon, broom sage a grass community, and in five or six years pine trees would start to come in; then in 25 years we would have a community of pine trees, a pine forest. A few years later we would have oak trees, and this would move on progressively, according to predictable patterns. The species present, their relative abundance, in a very high degree are predictable. This sequence of communities is what ecologists call succession, and it tends to move toward a mature stage which an ecologist might refer to as a climax. This is a community which (793) doesn't change with time, materials, species or composition.

Now, here on Long Island we would reach climax community in perhaps 150 years. There are very few such communities around, because we tend to disturb the vegetation axle. Consequently, it is hard to find a climax community.

This means that most of the communities around us are successional communities. Diversity along one of these successional gradients leading up toward climax is thought by ecologists, at least, as to increase. We go from the simple community of the old field or the few weeks of the garden through a series of stages in which we have in general increasing diversity, increasing numbers of species per unit land area, toward the climax which we think of as being most diverse.

Now, several other changes occur along one of these successional gradients. There is, of course, the change from herbaceous species to woody species. This means there is a change in the length of the life cycle of individual organisms, increasing life cycles in the forest, increasing length of life cycles. (794)

There is a change in the total amount of photosynthesis that goes on, the total amount of energy fixed by the chemical process that fixes the sun's energy. There is an increasing amount. A change in the total amount of energy stored in the community, a much greater amount of energy stores in the community, tends toward climax.

There is a change in the total pool of mineral nutrients held within the system. It takes more nutrients to keep a weed community in a garden going.

All of these changes take place in one of these successional gradients.

We think of the early stages of succession as being particularly unstable in the sense that populations can change rapidly in terms of numbers. We can get an entire field taken over or a large patch of it taken over by this crabgrass within a relatively short time, whereas it takes a long time to get the standard tree.

Q. Now, will you tell us the effect of interfering with the diversity of a given community? (795)

A. Well, we do this, of course, all the time by disturbing communities. The net effect in terms of the little story I have just given you is to move the successional stage back down a notch or two. If we disturb one of these mature forests, we then get a forest which is a successional forest in some earlier stage.

Actually, in forestry in the northeast, we do this all the time. We don't really try to maintain climax communities. We like to maintain one of the intermediate stages, this pine stage, because this particular stage has a very high rate of growth. It puts on a lot of wood in a short time. The rate at which it accumulates energy is very high indeed. This makes it a productive community from the forest industry standpoint. It has much lower diversity. So when we disturb these communities, we decrease the stability, decrease the diversity, decrease the pool of mineral nutrients cycled within the community through a whole host of things to these natural communities. (796)

Now, by and large, in order to keep one of these earlier successional stages, man has to put in energy. We put in energy from fuels, of course. We mow our lawn regularly. If we didn't mow our lawn, we would move into these successional stages of a climax forest.

Q. Now, you have seen the exhibit representing the various ecosystems in Suffolk County. Can you tell the Court what effect on the overall system any interference with an element of the food web might accomplish?

A. Well, certainly. If we introduce a general poison such as DDT, for instance----

MR. CORWIN: When you say we, do you mean society?
 THE WITNESS: We, man, society, yes.
 MR. CORWIN: You don't mean the Suffolk County Mosquito Com-
 mission, do you?
 THE WITNESS: If they introduce DDT, yes.

* * *

Q. Tell us what happens when there is an introduction of the systemic-type poison?

A. Well, if we introduce a general poison into the environment, then the net effect is to reduce the diversity and increase the degree of instability (797) seen in these natural populations.

Now, by and large, we favor populations of small organisms, organisms which have a very high reproductive potential, a high capacity for reproducing themselves.

Q. Such as insects:

A. Insects, yes, indeed. Certainly algae, unicellular organisms, decaying organisms, any organisms with a short life cycle. This is favored when there is a breakdown or a reduction in the diversity of the community. It certainly is true.

Q. And does this general effect hold true for all the communities that have been described so far present in the County of Suffolk?

A. It certainly is true. (798)

THE COURT: Counsel, can we say this, or Mr. Witness, can we say that if you disturb any one of the elements that you have in this community, that if you disturb one, you will disturb all?

THE WITNESS: That is a little difficult to say.

THE COURT: Well, then they don't belong in here unless that is so, as I see it.

THE WITNESS: No, I don't believe so. I don't believe that we would require that every organism be directly, totally, measurably related to every other organism. I would not claim that we could prove that that is so.

* * *

THE COURT: All right. As I understand it, this is exhibit 9. (799) If, for example, you use DDT, and then any one of the fish got it, and I could start with the bass or is it the bluefish, I'm sorry. Isn't it a fact that what this was meant to show to me was that if you disturb one, the very disturbance of the cycle will disturb all the others?

THE WITNESS: Well, now, you have asked a slightly different question in that you have said we are disturbing it by introducing DDT.

THE COURT: Introducing it with anything---a poison, and not DDT. Just by merely introducing a poison.

THE WITNESS: All right. It is possible to disturb one population without having really catastrophic ramifications throughout the ecosystem. It is possible to disturb them.

THE COURT: Well, as I understand this exhibit 9, it was meant, at least to my mind, to say to me, "Here, Judge. You look at that, and if you (800) put poison into any one of these elements of this chart, that it will in effect disturb the balance".

THE WITNESS: That is certainly true.

THE COURT: Before you didn't say that.

THE WITNESS: No, we have to separate putting poison in from disturbing. We can disturb mechanically simply by going in and taking out a few of the organisms. This has a relatively minor----

THE COURT: No, I don't care about that, because they proved that in New Hampshire. I mean here, where I put poison into the ground, the garden web worm or any worm that you want.

THE WITNESS: That is the general catastrophe which has ramifications throughout this entire web.
THE COURT: It would affect all of them?
THE WITNESS: Yes.
THE COURT: At one time or another? (801)
THE WITNESS: It has some effect.
THE COURT: Or eventually?
THE WITNESS: Yes, very widespread effects.
THE COURT: All right.

Q. Now, let us continue with that. Will you please tell the Court what kind of a poison, to use the Court's word, DDT is vis-a-vis other types of poison?

A. Well, the environmental hazards and really serious damaging and catastrophic effects of DDT arise from the fact that it is a general poison. It is a broad-spectrum pesticide. As people who deal with pesticides can tell you----

THE COURT: And it is long-lasting?
THE WITNESS: It persists. It is long-lasting.
THE COURT: All right. Go ahead.
THE WITNESS: It quite literally lasts an indefinite time in certain places. It does not break down apparently significantly in a matter of ten years.
THE COURT: We have had all that. (802)

Q. Dr. Woodwell, would you tell the Court what the effect of a long persistent broad-spectrum pesticide like DDT has on one of those communities as opposed to a short-lived relatively less broad-spectrum pesticide?

MR. CORWIN: I'm going to object now, Your Honor, on the ground of irrelevancy, because he is talking about chlorinated hydrocarbons generally and not DDT.

THE COURT: No, what he is trying to show in this case, as I understand it, is that they could use something else to as good an advantage; that there will be less deleterious effects. Is that right?

MR. YANNACONE: Your Honor, we are trying to show that DDT and its relatives that are long-persistent and broad-spectrum have a differing effect on the ecosystem than the short-lived pesticides.

THE COURT: Different or greater effect? (803)

MR. YANNACONE: Well, I don't want to testify as to whether it is greater. I would like the witness to testify.

MR. CORWIN: I will concede.

THE COURT: What are you trying to prove?

MR. YANNACONE: I want to prove greater.

THE COURT: All right. Go ahead and ask him the question.

Q. Now, to get back to the question, Dr. Woodwell, . . . Can you state with a reasonable degree of scientific certainty whether or not the application of DDT or a similar broad-spectrum, long-persistent chlorinated hydrocarbon pesticide will have any general effect on the ecosystem shown in exhibits 3 through 9, which are representative of the ecosystems of Suffolk County?

THE COURT: You mean an ecosystem such as we have?

MR. YANNACONE: Now in Suffolk County.

THE COURT: On the chart? (804)

MR. YANNACONE: On the chart.

A. I certainly can.

Q. Well, will you tell us that, please?

A. I believe that it has a generally deleterious effect resulting in some hazards to organisms which feed at high levels in the trophic pyramid. These would be top carnivores in particular.

Q. Can you state with a reasonable degree of scientific certainty what the effects of elimination or serious reduction of the top carnivores' food web will do to the general ecosystem?

A. Well, it is certainly true that it introduces a number of instabilities. It simplifies the system. It moves successional stages in the pattern of things, which I have discussed, back farther down toward the earlier stages.

Q. Dr. Woodwell, does it permit the more quickly reproduced elements of the systems, such as insects and starlings and other general nuisance elements to increase at a greater rate? * * * Does the elimination of the top carnivores in those systems permit lesser elements of greater reproductive capacity to increase in a greater rate? (805)

A. This is a generalization which is true.

THE COURT: I still don't follow that. Give it to me again.

Q. If you remove or seriously reduce the number of the top carnivores of those food webs-----

THE COURT: Such as the falcon and the like?

Q. Such as the peregrine falcon, the osprey, or the kingfisher, is it a general ecological expectation that the lower elements that reproduce more quickly in those chains, such as insects and certain nuisance birds, like starlings, will tend to increase?

A. Certainly, it is true. These communities that we have been talking about have built into them in an evolutionary area sense controls of population size. The carnivores are one of these controls. There are many others. Ecologists, indeed, are just learning the kind of controls that exist. (806)

THE COURT: Doctor, by the same token, if you take these same state of facts that he gave you, wouldn't the better bird also increase?

THE WITNESS: We have to define what we mean by better birds.

THE COURT: The Robin.

THE WITNESS: Robins indeed, I think, have increased.

THE COURT: That is what I mean. As I understand it, that is why I asked the question twice or three times. If you increase the top birds of your charts, if you decrease them---it was decrease, wasn't it, counsel? * * * If you decrease them, then the starlings or what I may call the trash bird will increase? That is so, isn't it, if you haven't got a couple of these falcons darting around and grabbing them and eating them? If that weren't occurring, I suppose they would increase, isn't that so? (807)

THE WITNESS: Well, what we can say in general, and what any ecologist can say is that if we disturb this system by removing a vital part of it, they way we are introducing instability into the community.

THE COURT: All right. Go ahead.

Q. Now, Dr. Woodwell, can you give us an opinion with a reasonable degree of scientific certainty as to whether or not the continued use of DDT in the County of Suffolk will have any effect on the food web and the natural resources present now in the County of Suffolk? Can you give us that opinion?

A. I certainly can.

Q. Have you formed that opinion?

A. I have, indeed.

Q. Will you give us that opinion, briefly.

A. Well, I believe that continued use of DDT in the County of Suffolk will damage these natural resources we have been discussing irreparably.

Q. Can you form an opinion with a reasonable degree of scientific certainty whether or not it makes any difference to your opinion that the Suffolk County Mosquito Control Commission, the defendant herein, may use limited amounts of DDT that may be considerably less than the total amounts that is injected into the Suffolk County environment during any given year? Can you form an opinion as to that? (808)

A. Well, any application of DDT is limited; it is finite. I don't believe that we can now introduce more DDT into these natural cycles that we have been talking about with any degree of---I think we cannot do it at all. I believe that we have reached the point now where we cannot introduce more.

Q. Is it important to stop even a limited use of DDT being put into the ecosystem?

A. In my opinion, that is correct.

Q. Can you tell us or give us any information about the general persistence of DDT in the environment? Say the soil.

A. . . . Yes, indeed. (809)

Q. Just briefly tell us, without going into detail, do you have an opinion as to how long DDT can remain in its regular toxic state in soil?

A. Well, DDT and its decay products, which we will call DDT residues---DDE in addition to DDT--persists in soil for, well, it is safe to say a minimum of ten years. It probably persists a lot longer than that in certain organic soils.

Q. Does DDT in its present use persist with any other elements for general environment?

A. Well, certainly. These residues are propagated through these biological cycles we have been talking about through food webs. There are residues which are moved through water, apparently relatively efficiently, even though the concentrations in water at any time are seldom, in fact, never higher than one part per billion unless there has been something else applied to make an emulsion.

THE COURT: Doctor, let me ask you a question: How can you attribute the decrease of the number of species as counsel said by the development of area, the removal of feeding grounds, and the like? (810)

THE WITNESS: Certainly. The development of an area changes the community. It does this thing I have talked about in terms of succession.

THE COURT: All right. Not now, but let me know, if you will. For example, alongside of my house there is a tremendous corn field. We used to have Canadian geese come in there by the hundreds. It is no longer a corn field. Houses have built up around there. Now there are no more Canadian geese. When we see them, they are a mile in the air going over. Now, you take the rabbit. He is being exterminated by cats, among others. When you take a count, how do you distinguish between those that disappear by reason of their having their feeding grounds taken away, and the like, and DDT?

THE WITNESS: Well, the answer is this: In some cases, you wouldn't. In other cases, you count in such a way that you eliminate the effects of development. You don't count marshes that have been developed for marinas. You don't count areas where houses have been or where the vegetation has changed. (811)

Now, Mr. Puleston has studied his marsh down below his house over a period of twenty years. In that period, there has been no substantial change in the physical area of his marsh.

THE COURT: But by the same token, take Coral Gables, and I remember going there not so long ago and walking on the sidewalk. Like as not, you walked over a nice big fat snake that would be across the sidewalk. I got to the point that I would be afraid to go for the eggs. Well, when the developer came in with these buildings and brought his civilization to Coral Gables, you don't see any more snakes down there in that area now. Now, I don't think they fed them any poisons. I don't think they fed them any DDT.

THE WITNESS: Well, I think with the DDT problem, Your Honor, it is really quite a different thing. DDT is a general poison which we are introducing into the environment and which moves through diverse circles. Diverse circles really build in a biological sense and in an evolutionary sense to these communities. (812)

Now, it is a general poison which affects the reproductive capacity. It has the potential for removing entire species by hitting them where it counts.

THE COURT: Now, we have had a very learned discourse on that, and I can understand that phase of it.

THE WITNESS: But I also want to explain the other phase. That helps that count along. (813)

THE COURT: You say there are so many things that have disappeared. Incidentally, here you have the grouse. I haven't seen a grouse on Long Island, and I have been born on Long Island. There were some in the old days, but they are gone. I don't know that DDT did it, but they are gone. However, I will bet you that the red fox did a lot more than the DDT to get them. Now, do you have any more to say to this witness?

MR. YANNACONE: I have no further questions, Your Honor.

THE COURT: All right. The reason I am asking these questions again is that I want to understand a certain phase of this case, and I can only do it by asking questions of thing that I don't understand.

* * *

AFTERNOON SESSION

(814)

GEORGE M. WOODWELL resumed the witness stand and further testified as follows:

* * *

CROSS-EXAMINATION by MR. CORWIN:

Q. Doctor, when you were talking about the persistency of DDT in the soil, you made a rather general statement about the length of time that it would stay there. You recognize the statement that you made was quite general? (815)

A. That's right. It is true.

Q. It would depend upon the Ph in the soil and a lot of other factors, wouldn't it?

A. We really don't know the factors that influence the persistency of DDT in the soil

Q. Isn't it a fact that the actinomycetins have some relationship to breakdown of DDT?

A. Yes.

Q. That is a fungus, isn't it?

A. Yes, it is a group of fungi.

Q. What would you suggest we use if we are going to ban DDT, and if you believe that some insecticides might be beneficial to man as part of this benefit-risk equation? What would you suggest we use instead of DDT?

A. Well, speaking as an ecologist from the standpoint of the best kind of pesticide to use, the minimum disturbance to these natural communities we talked about would be caused by a pesticide which was very specific in its activity. (816)

Q. I'm not talking about some hypothetical pesticide. I am talking about---

A. And one which would decay rapidly. Now, by and large, we don't have specific pesticides--ones which will tell the mosquito not to bite people, but still leaves the mosquito niche filled with mosquitos. Ideally, this would be the way to control mosquitos.

We do have pesticides which break down. We do have all the alternative techniques for controlling mosquitos. We can simply disturb the water with a stick and drown the wigglers. We can oil the water. We can use pesticides such as malathion, for instance, which has a much shorter life in the environment. It lasts for a relatively short time compared with DDT. It breaks down and does not move the way DDT does through these various important fundamental cycles we have been talking about.

Q. Is that as complete and specific an answer as you would want to give to the question? (817)

A. I can certainly amplify that answer if it would help the deliberations of the Court.

Q. Doctor, you know what the New York State Pesticide Control Board is, don't you?

A. I think I do.

Q. Are you affiliated with it?

A. I am an advisory member of the New York State Pesticide Control Board, which by law has an ecologist on it. I am that ecologist.

Q. Since this action was started, you have been to three meetings of the board, haven't you?

A. I don't think so. Three meetings, no.

Q. You meet quarterly, don't you?

A. We meet quarterly.

Q. You went to the last meeting, to the last three meetings, didn't you?

A. I have been to the last three meetings.

Q. You expect to be going to one this week, don't you?

A. I'm going to one this week, assuming I live that long.

Q. God willing. What do you understand the purpose of the board (818) to be? Is it funny? You are laughing. Do you think the board serves any useful purpose?

A. I do indeed think the Board serves a useful purpose. As you know, the board has spent its past year and a half or two years of existence in studying the problem of pesticide pollution of the environment. The board exists, because there is this problem. That is the reason the board exists. If there were no problem, there would be no such board. So by its existence, it acknowledges that there are secondary effects of pesticides that are serious and require the consideration of the New York State Government and the advice of scientists, such as me. That is why the board exists. Now, the question remains how we are going to do something about it. That is quite a different problem.

Q. The meetings that you have had so far of the different departments, you have had an opportunity to communicate with one another on grounds where heretofore there was not such communication, is that a fair statement?

A. That's correct. (819)

Q. You are getting acquainted with one another?

A. That's correct.

Q. Agriculture and markets is getting acquainted with health and education and some of the others that are concerned, is that right?

A. Yes.

Q. But all the members of the board have an opportunity to recommend controls for the use, among other things, of pesticides, including such chlorinated hydrocarbons as DDT, is that not true?

A. It is indeed.

Q. And have you in the course of your attendance at any of these meetings ever made any recommendations?

A. I certainly have. At the last meeting one of these recommendations was adopted. * * *

* * *

It is important to understand that the New York State Pesticide (820) Control Board is a very broadly representative body in the sense that it has the commissioners of the various departments of the state represented on it. These departments deal with pesticides in the sense that they have certain practical problems that they have to solve with chemicals and do solve with chemicals. They use them all the time.

The Board also has various other representatives: Agriculture, veterinary college, a representative of conservation interests, a representative of (821) the commercial applicators, a representative of the pesticide industry, the manufacturing industry, and an ecologist.

This board then is really very heavily weighted by the people who use pesticides, and by and large these people have so far controlled the use of pesticides, claiming that they use them wisely. I think they don't. These people dominate the board. I have specifically introduced various kinds of suggestions for the adoption of the board, and I have been very much pleased to see the board move rather strongly in the direction that I have suggested.

At the last meeting the board adopted this statement, which I wrote, and I am reading an abridgement of it: "The board is convinced that the secondary hazards of pesticide control at present can be reduced. Reduction of hazards requires: "First. Restraint in the use of chemical pesticides. This is dif- (822) ficult to realize in practice, because many pesticide control programs rely on routine applications to prevent the development of a pest. Restraint requires

knowledge of the condition of the pest population. Acquiring data might well involve trapping and counting insects in several areas. Such a project is costly by present standards, yet seems indicated if restraint is to be meaningful. Certainly, ways of avoiding routine spraying are required.

"Second. A reduction in the use of broad-spectrum pesticides. Pesticides that are lethal to many species reduce competitors and predators of the pest and may affect other desirable species as well, including man. An ideal chemical pesticide would affect only the target species, possibly not killing it, but only shifting its behavior pattern away from that part of its activities that made it a pest. This type of control would be especially desirable, because the pest niche would be kept at least partially filled, but by a non-pest, thereby reducing the possibility of replacing the original pest with another of similar niche requirements." (823)

Q. Excuse me for interrupting, Doctor, but while we are on that subject, and in view of what you testified to on direct examination, isn't it a fact--and I will give you an opportunity to answer the question.

* * *

Q. Isn't it a fact that if you take one species out of the ecology rather than having it there, that may be irreparable in the sense that you don't have that species around any longer, and isn't it a fact that some other species fills the vacuum, so to speak? * * *What happens?

A. The resources that were used by that organism that we have removed with some very specific technique, which is what we have been talking about, do indeed become vacated. The evolutionary process, the process of evolution which we have talked about tends to fill that niche probably with an organism very similar to the one which we eliminated. (824)

Q. Well, all right. I guess we were talking about semantics. That is what I thought was the case. I think we agree.

A. I don't understand how we agree.

THE COURT: All right. I will tell you how you agree. He used the broad term that it will be filled, the niche will be filled by some other organism, meaning any one of them. While you were being more specific and said that it will be filled, but with one of similar type. Is that right?

THE WITNESS: That is in general true, but it takes a long time for the evolutionary process to adjust, and in the interim there are very many disturbances in other populations.

THE COURT: I understand that.

* * *

A. "There is need for development of chemical pesticides of this or similar type which are specific in and not broad-spectrum. The research required to develop them is great, possibly replacing such substances beyond the capabilities of commercial development. (825)

"Third. Reduction in the use of persistent chemicals. Many of the secondary effects of pesticides are due to persistency of the pesticide or toxic decay products of the pesticides. Emphasis should be placed on using pesticides that decay within hours or days to non-toxic substances.

"Fourth. Primary reliance and pesticide controls should be placed on natural controls. There appears to be need for increased emphasis on cultural techniques and biological controls of pests, especially in agriculture. There are, moreover, instances where chemical controls are used unnecessarily.

"Fifth. Encouragement of the additional research at agricultural experimental stations and elsewhere on (a) ways of recognizing and measuring hazards from pests; (b) biological controls of pests; and (c) chemical techniques involving pests that degrade rapidly in the environment and have specific effects as opposed to the broad-spectrum persistent pesticides currently in use." (826)

This is the end of the quotation, and I think that you will all agree that this is indeed a large concession on the part of say, for instance, the representatives of say a pesticide producing concern, a chemical company that produces pesticides. By and large, they have been unwilling up until now to make even this type of concession. That is why I feel rather optimistic that the board is moving rather rapidly in the direction in which I think it should move.

Q. This is an example of politics and democracy in action, just like what you have been talking about is evolution in action, isn't it?

A. Yes, indeed. On the other hand, I don't-----

Q. Doctor, you talked about-----

MR. YANNACONE: I'm going to object. Let him answer the question.

* * *

A. In the context that these persistent pesticides, in particular DDT, are general poisons that are moving now in the environment and are in biological chemical, and physical cycles which carry them all over the world. These (827) other specific effects which we have talked about, such as dredging and other mechanical modifications of the habitat, are very, very localized effects as opposed to the general deleterious effects of a persistent poison.

Q. Doctor, that statement has been repeated almost ad nauseum in this case. Now, you spoke about the natural controls. Do you mean that we should import bats which carry rabies to eat the mosquitos?

A. I certainly do not.

Q. What did you have in mind?

A. I would suggest that in the case of the mosquitos, for instance, that we not use DDT, because for one thing, it kills a fish called Fundulus, which eats mosquito larvae. The accumulation of DDT residues in marshes along the South Shore does indeed reduce the populations of organisms that would help to control the mosquitos themselves. (828)

Q. Doctor, you don't have any objection to some control or change of the ecology, do you? You are perfectly willing that man should control his environment to a degree?

A. Yes, indeed. I believe in house air-conditioning, all kinds of environmental controls where we can do it wisely.

Q. And four-lane highways between communities?

A. In some instances I agree with four-lane highways. In many instances I don't.

Q. Doctor, the medical profession is represented on the Pesticide Control Board, isn't it?

A. Yes.

Q. So that man's interests are being taken care of?

A. If you mean man's interest in a narrow toxicological sense, yes, by the medical people. (829)

MR. CORWIN: Thank you, Doctor.
Your witness.

REDIRECT EXAMINATION by MR. YANNACONE:

Q. Dr. Woodwell, do you have any specific evidence of whether or not there is any DDT present in the environment of the County of Suffolk at this time?

A. I do.

Q. Do you have any evidence whether this DDT that is present is in areas that have been sprayed or otherwise treated with DDT by the Mosquito Commission, such as the salt marshes?

A. I do.

Q. Will you give us a brief summary of that date?

MR. CORWIN: If the Court pleases, I am going to object to this. I think it is improper redirect.

* * *

THE COURT: All right. The objection is overruled. (830)
You may proceed, Doctor.

A. We have recently sampled a salt marsh at the mouth of Carmans River on the southern shore of Long Island in Brookhaven by a sampling technique which I have developed and used in the past. We sampled four different areas, from each compiling a composite sample.

In one of these areas, spartina mat, there was 2.69 pounds per acre of DDT.

In another area 9.23 pounds per acre of DDT.

In another area there was 7.86 pounds per acre of DDT.

In another area there was 32.57 pounds per acres of DDT.

In a drainage ditch adjacent to this spartina mat, and this would be along the edge of the drainage ditch, the drainage ditch specifically introduced there to control mosquitos, and there is in one zone 4.63 pounds per acre of DDT.

In another zone there is 1.10 pounds per acre.

In another area off the marsh in a zone which is permanently submerged, (831) and this would be below the low tide level, the bay bottom submerged, we found 2.81 pounds per acre of DDT in the bay bottom.

THE COURT: Is it 0.281, Doctor, rather than 2.81?

THE WITNESS: It is 0.281. What did I say?

THE COURT: You said 2.

THE WITNESS: I'm sorry. It is 0.281 that I have, and I have the tabulation here. That is almost three-tenths of a pound per acre in the mud of the bay bottom.

Now, these samples ranged in depth from 0 to 20 centimeters, and in some cases, 0 to 40 centimeters. Most of this DDT is in the upper four systems of the soil, as shown by this graph, where we have plotted depth of the soil against DDT in milligrams per square meter.

Certainly, 90% of the DDT is in the zone less than 4 centimeters. This is the surface of the soil in that instance. (832)

Now, while we are on this topic of residues in the marsh along the South Shore, let me point out what some observations of the effects of various concentrations of DDT on wildlife were.

* * *

Q. Hold that a moment. Let me ask the next question. Dr. Woodwell, did you have any occasion to acquire any data with specific reference to DDT and Suffolk County wildlife?

A. I did, indeed.

MR. CORWIN: I object, Your Honor, on the ground that this is improper redirect.

* * *

THE COURT: I am going to allow it. Go ahead.

A. I did, indeed.

Q. Will you give us a summary of these results? (833)

THE COURT: Counsel, will you do me a favor in the future? Please complete your primary case with a witness. Please finish. Don't go into anything, unless it is purely rebuttal. Now this could have gone in on the direct case. Counsel is absolutely correct on this, but the only trouble is, so far as his objections are concerned, I need it.

MR. YANNACONE: This is essentially rebuttal, Your Honor.

THE COURT: This isn't a leg-off case or an arm-off case. This is a technical case, and I have to get as much information as I can get on it.

MR. YANNACONE: Your Honor, he gave his opinion on direct, and this is essentially and basically rebuttal information. Perhaps it should have gone in on the direct case.

THE COURT: Do that next time, will you please?

MR. YANNACONE: Yes, Your Honor, and I'm sorry. (834)

Q. Go ahead and give us those results.

A. I have taken a list of a number of samples which we have taken from the Great South Bay. These are samples ranging from plankton, through bay shrimp, through the Fundulus killifish, through the Fundulus, through the herring gull, through the double-crested cormorant, and other gulls.

Q. Do you have a copy of that?

A. I do, indeed.

* * *

(The paper was marked as
PLAINTIFF'S EXHIBIT 10, for identification.)

MR. YANNACONE: May I ask that that first exhibit that he referred to, the first sheet, Your Honor, that that be added to this, and that together they be marked as a single exhibit? We have given counsel a copy of this. (835)

* * *

(The two papers were received in evidence and marked as
PLAINTIFF'S EXHIBIT 10.)

Q. Now, Dr. Woodwell, I don't think there is any need to read each item on that list, as counsel has a copy and the Court has a copy. However, would you discuss the significance of those findings, please?

A. Yes. We had sampled in some broadly representative group of the organisms from the Great South Bay, and I have arranged them here in their list according to the concentrations of DDT in them as determined by Dr. Wurster at Stony Brook State University.

Q. Hold it a moment. Did you do this work in conjunction with Dr. Wurster?

A. I did, indeed.

Q. Did you have anybody else helping you?

A. We had a student assistant during the summer. * * * His name was Mr. Peter Isaacson. * * * Mr. Isaacson has a bachelor's degree, and (836) I'm not sure whether he has a master's degree--yes, he does have a master's degree.

Q. And you did this in conjunction with Dr. Wurster, and you are familiar with the date he developed, as well as the data you developed?

A. That's correct.

Q. Will you continue and tell us what the significance of that list is?

A. In this list, I have arranged these according to concentrations of DDT only. That is the only criterion for arranging them in this list. If we start at the top of the list, we find plankton with 0.04 of a part per million, wet-weight basis. We go down through the list, and we get to a few parts per million, 3. parts per million, for instance, we were sampling terns and herons.

At 5. parts per million, we had one tern, a herring gull.

At 6. or 7. parts per million, we had other terns and gulls. (837)

At 26. parts per million, we had a double-crested cormorant.

THE COURT: There is no use reading that complete, Doctor. Let me ask you this: What does this report that you are reading from signify?

THE WITNESS: I am getting about telling you this. There is a range here from 0.04 parts per million to 93.40 parts per million in different organisms. If we look at this list and try to establish some ecological meaning here, then we go from the primary producers, the plants of this bay, single-celled organisms by and large, plankton and cladophora, which is a filamentous algae that grows in the bay plants which are at the bottom of the list, and we note the highest concentrations are these top carnivores.

Now, if we compare these concentrations of 93.40 parts per million wet-weight, total weight of the bird considered here, with the concentration in the water, the maximum concentration that can occur in water if the DDT is dissolved in water, that is a concentration factor of 93,000 times. Probably, DDT is not present in this water at concentrations greater than half of that or even one-tenth of that. (838)

Q. When you say that, what do you mean?

A. Making this concentration factor 100,000 to 200,000 times easily. Now, we have gone here through three orders of magnitude, from 0.04 parts per million to 93.40 parts per million. That's 4.

Now you might ask why do we not see one more figure to the left of the decimal point?

I don't think we could. The organisms would be dead right now. They aren't there. In my opinion, this represents a food chain which is carrying as much DDT as it can carry and still be present.

Now, we don't have other top carnivores, because they aren't there. (839)

THE COURT: Will you answer just one or two questions for me?

THE WITNESS: Yes.

THE COURT: Take the toadfish.

THE WITNESS: All right.

THE COURT: What does 0.17 signify?

THE WITNESS: Yes. That is 0.17 of one part per million DDT in its total body tissues.

THE COURT: Did you check to find out whether in fact this DDT was in the tissue of this toadfish?

THE WITNESS: That is exactly what we determined.

THE COURT: How did you do that?

THE WITNESS: We collected toadfish. We took them to the laboratory, and we put them through the analytical procedure for DDT, just as Dr. Wurster testified here in this courtroom.

THE COURT: And this signifies the amount as compared to the weight of the toadfish?

THE WITNESS: That's right. It is on a wet-weight basis. (840)

THE COURT: All right. I now have it, and I hope you have it, Mr. Corwin.

THE WITNESS: Now, Your Honor, there are several more aspects to this which are even more significant than this.

Q. What are they?

A. We here have presented this on a parts per million of wet-weight basis, total body weight DDT. We prorated the amount of DDT over the whole body of the organism, assuming it was equally distributed throughout the body of the organism. It is not equally distributed throughout the body of the organism.

THE COURT: Does it make any difference whether it is or isn't in this case?

THE WITNESS: It does.

THE COURT: In what way?

THE WITNESS: Because 93.40 parts per million probably means that most of that DDT was in the fat of this ringbill gull. Assuming that the ringbill gull had 10 parts fat, then that gull probably had something in the range of 1000 parts per million in its fat. When it utilizes this fat in a period of hard times, when food is not available, that DDT is flushed into its system and----- (841)

THE COURT: Into the alimentary tract?

THE WITNESS: No, probably into its blood system and carried to the brain. This causes the death of the bird.

Now, this kind of thing has been well documented in fish, where a so-called late kill from spraying DDT for the spruce worm, in this particular instance, is very well known. There is an immediate kill due to the acute effects of DDT. Later in the season, there is another mortality in fish in the lakes and in areas which have been sprayed this way.

THE COURT: All right. Go ahead. I have it now.

THE WITNESS: And that is from the mobilization of DDT residues which were absorbed into the fat of the fish when that fish was used later on in the fowl.

Q. Now, with respect to those gulls or birds there, at what time (842) or in what season of their lives do you expect this need to draw on the fat to occur?

A. Well, it depends on what bird we are talking about. Migratory birds in the period of migration use up fat reserves.

Q. What about local resident birds?

A. The local birds have lot fat reserves at the time they are reproducing.

Q. Now, tell us please, if you will, about the general significance of the quantities of DDT you found present in Suffolk County areas?

THE COURT: Come again with that.

Q. Tell us about the general significance to the natural resources of this county of the amounts of DDT you found present in your research?

A. Well, let me do this by comparing these data on residues in the marsh, which average for the spartina mat 13.6 pounds per acre with published literature on the effects of DDT on wildlife. I have a list here, and I am just (843) going to read this list. Each one of these items can be documented from the literature, and we have the documentation.

THE COURT: Why can't you tell it to me generally?

THE WITNESS: All right. I certainly will. 0.1 of one pound per acre, for instance, nearly eliminated crayfish.

0.2 of a pound per acre substantial mortality of fish shrimp.

0.3 of a pound per acre, 10% to 40% reduction in blue crabs. 0.3 of a pound per acre repeated three to ten times per year, 95% to 97% reduction in blue crabs.

0.5 of a pound per acre completely eliminated young salmon. This is in New Brunswick and in the Miramichi, which is extremely well studied in this respect.

0.5 of a pound per acre reduced woodcock reproduction.

1.0 of a pound per acre, heavy loss of wood frogs. (844)

0.8 of a pound per acre produces heavy mortality of killifish. This is a Fundulus. It is also a predator on mosquito larvae.

1.7 pounds per acre, severe bird mortality in Urbana, Illinois.

MR. CORWIN: Judge, there are millions and millions and millions of species and animals. He can pick out those that are most significant in connection with DDT, and he can read for the next five hours. I don't want to hear it, and I think it is irrelevant.

THE COURT: He is an expert and qualified in this area. I will take it. You may continue.

THE WITNESS: 1.9 pounds per acre, which was the concentration in the study of birds in Hanover, New Hampshire, and which you heard here about.

2. pounds per acre eliminates fiddler crabs.

THE COURT: All right. I think we have it now.

MR. CORWIN: I would like the Court to know that my objection continues.

THE COURT: Counsel, we are dealing with professors right now. Let us have a little latitude.

MR. CORWIN: There has been altogether too much latitude in this case, and it continues over my objection.

THE COURT: All right. Relax, and take it easy.

MR. CORWIN: I am relaxing.

THE COURT: We don't need all this, Doctor. We have enough for the record now.

THE WITNESS: Your Honor, these range from very few parts per acre to 1. and 2. pounds per acre, and they document a very serious effect on the wildlife, particularly aquatic life.

THE COURT: All right. We understand that, Doctor. That has been drummed into us. (846)

THE WITNESS: Now, Your Honor, we have in the marsh out there an average of several pounds per acre. It is well documented, in my opinion.

THE COURT: All right. We have got that.

MR. CORWIN: This whole case is well documented.

THE WITNESS: Thank you.

MR. YANNACONE: I move for a directed verdict.

THE COURT: All right. Go on to the next question.

Q. Dr. Woodwell, is that amount of DDT--and I'm talking now about the amounts you found in that marsh--is that sufficient to account for the mortality or the loss of several elements of the food web described by Mr. Puleston, Mr. Cooley, and others in this area?

A. It certainly is.

Q. Is it of sufficient magnitude from a scientific point of view to virtually eliminate other potential causes other than complete destruction of habitat? (847)

A. It is, in my opinion, the cause of a substantial loss in wildlife values in Suffolk County.

THE COURT: And you attribute this to DDT?

THE WITNESS: DDT residues in the marshes along the South Shore of Long Island.

THE COURT: All right.

Q. Did you hear, and I think it was Mr. Williamson who testified, that to the best of his knowledge his agency was the only group that sprayed the salt marshes with DDT? Please answer that yes or no.

A. Yes.

Q. Do you feel the spraying, as he described it, was sufficient to account for those residues over the period from 1945 to 1963 to 1964?

THE COURT: You had other reasons too. You had the run off from the land as used by the farmers. You also had the run off. * * * Wait a minute, hold it. You also had the run off from these--not cesspools--but these catch basins. So you had it from other things too. (848)

MR. CORWIN: I would like to hear the answer, Your Honor, unless he withdraws it.

THE WITNESS: I will be glad to answer it.

Q. Would you answer that, please?

A. These residues by and large, these average residues are larger than what Mr. Williamson says are safe to apply. He mentioned 0.5 pounds per acre. This would indicate that perhaps as much as 0.5 or maybe even 1. per acre will be applied annually to these areas. Perhaps more than that in some places, inasmuch as they have used DDT for about 20 years, and we have 32 pounds per acre in one area.

Q. Now, Dr. Woodwell, in the course of your research, did you have occasion to analyze or examine the ecosystems from which you took that data with specific reference to what the Judge mentioned--sump and agricultural areas?

A. I did, indeed, yes. This is remote from agricultural uses of pesticides, and I really don't believe that there has been any run offs from the land of DDT.

THE COURT: Let me give you a typical example (849)

THE WITNESS: Yes.

THE COURT: I operate a farm in the Village of Nissequogue, St. James, and it is quite hilly there. Right after this case, I dashed home and the first thing I did was run into the barn and see whether I did have DDT, and I had enough to kill an army, after listening to you, Doctor.

MR. CORWIN: Judge, I object to all this.

THE COURT: No. And we get run offs that comes down off my pastures down into a little creek when we have quite a rain, and it goes into the St. James harbor, which in turn empties into the Long Island Sound.

So here I am only one person. We use it on fruit trees, all purpose sprays containing DDT. So you see, wouldn't that be an additional source of DDT?

THE WITNESS: It certainly is an additional source of DDT.

THE COURT: I promise I'm never going to use it again, but I (850) have used it.

THE WITNESS: No question about that, Your Honor. In this particular marsh, I think that source is not in issue.

THE COURT: Well, I am starting to worry in that I remember we used to have blue crabs in there by the hundreds, but I haven't seen one in some years now. I was just wondering whether I was the culprit. I'm beginning to get a guilty conscience, and perhaps they will have me in the district attorney's office. However, go ahead.

MR. CORWIN: I just wish the rules of evidence permitted me to interrupt and interrogate him in the middle of something else. Are you through?

MR. YANNACONE: Yes, I am through.

MR. CORWIN: Thank you. (851)

RE-CROSS-EXAMINATION by MR. CORWIN:

Q. So that the basis that you took of the Carmans River is not typical of what you might find in many, many other places in Suffolk County, isn't that so?

A. That is not so. I think this is a very good representative marsh, and it was selected specifically because it was representative and because in this case we would isolate the DDT spraying from other possible sources of DDT.

Q. When you say it is representative, do you mean it is representative of a contribution that the Suffolk County Mosquito Control Commission made to the total DDT into the waters that you might find somewhere else?

A. That's right.

Q. Now, you talked about taking these birds, fish, species in the food chain--By the way, did you take these? Were they dead birds when you made your tests?

A. They were not dead. They were dead when we made the analysis, I hope to tell you.

Q. They were alive when you took them? (852)

A. They were alive when we took them.

THE COURT: You more or less performed an autopsy?

THE WITNESS: Well, not exactly.

THE COURT: How did you do it?

THE WITNESS: We removed the feathers from a bird, for instance, and we grind it up.

Q. So that the bird with all this DDT in it, 4 parts per million, which you say is a very, very significant and high amount, was alive?

A. That's right

Q. And living?

A. That's right.

Q. Was he healthy?

A. Yes, that's right. I can't measure his health---

THE COURT: He made him unhealthy.

MR. CORWIN: I guess he did.

Q. Doctor, when you got the bird into the laboratory, you said that you used standard procedures for analysis. Were you using a gas chromatograph?

A. That's correct.

Q. What column did you use? (853)

A. I would have to refer to Dr. Wurster to answer that question. He did these analyses, and you have had extensive testimony as to specifically how they are done.

Q. You don't know?

A. That's right.

* * *

Q. Were you here during all of Dr. Wurster's testimony?

A. Not for all of it.

Q. Did you hear him testify to or make any reference to any published paper with reference to the analysis that you are talking about now?

A. I'm sorry, I don't understand your question.

Q. I will try to make it more understandable, but I don't know how I can.

A. All right.

Q. When I asked you about what column you used---

A. No, you were asking me whether Dr. Wurster has published a paper on the methods of DDT analysis. (854)

THE COURT: No, he is asking you whether you have read any of these publications which might have formed a basis for Dr. Wurster's opinion.

MR. CORWIN: No, that is not quite it either.

THE COURT: All right. I did the best I could.

MR. CORWIN: What I am asking him is this: He said--Let me just make a preliminary statement in an effort to clarify the question.

* * *

MR. CORWIN: Dr. Woodwell said that when I asked him what column was used in the gas chromatograph, when they were making these tests, the paper of which I would like to refer to by exhibit number, * * * Plaintiff's Exhibit 10, and I asked him what column did he use. He said, "I didn't do it. Dr. Wurster did it," and he intimated that he testified about it. Now, I was here during Dr. Wurster's testimony, and I don't believe I heard him testify one word about this particular study. I am asking him if he heard such testimony or if he can refer me to any literature with this study in it that would indicate what column he used in the gas chromatograph within the making of these studies upon which this exhibit was made. (855)

MR. YANNACONE: I'm going to object. Dr. Wurster is the most competent witness to answer that question. He is asking Dr. Woodwell on direct examination whether he worked in collaboration with Dr. Wurster when he was making that.

THE COURT: Well, he could put the man on the stand if he wanted to. He has a right to make him his own witness.

MR. YANNACONE: All right, Your Honor. I will let the witness answer the question.

THE COURT: You have Dr. Wurster for rebuttal, if you want him, and you can put him on. (856)

MR. YANNACONE: All right, Your Honor.

THE COURT: He is asking this witness some questions, and he has a perfect right to ask him.

MR. YANNACONE: I will withdraw the objection, Your Honor.

* * *

A. I don't know what column Dr. Wurster used, and I don't care.

THE COURT: That is brief and to the point.

MR. CORWIN: No further questions.

REDIRECT EXAMINATION by MR. YANNACONE:

Q. Dr. Woodwell, this material is available, is it not? If you went home tonight and you wanted to consult with Dr. Wurster and put this altogether for tomorrow morning, you could come up with an answer to the question, such as what column was used?

A. Oh, I certainly could. I think that we could ask Dr. Wurster (857) if it is an important issue at the moment.

Q. And this is a paper that is in the process of publication right now?

A. That's correct.

Q. And it will be co-authored by you and Dr. Wurster, is that correct?

A. That's correct.

Q. And this will be treated in the normal course of scientific papers and periodicals, such as Dr. Wurster testified to in his testimony?

A. That's correct.

Q. And part of the review of this paper by the scientific journals will be a consideration of how the analyses were done?

A. That's correct also.

MR. CORWIN: Judge, we are now talking about the future. If he has a crystal ball and is going to tell me what is going to happen with this paper, which he hasn't written yet, is reviewed by somebody who may or may not review it, I think we have gone far enough, and I object to this entire line of questioning. (858)

THE COURT: No, your objection is overruled.

Q. Dr. Woodwell, with respect to this to-be-published paper, the data is all in?

A. The data is all in.

Q. And the data is being prepared by you and Dr. Wurster in the regular course of your scientific and professional work?

A. That's correct.

Q. And as part of this, you will have numerous conferences on the presentation of this data for publication, won't you?

A. With Dr. Wurster, yes, indeed, and with others, without doubt.

Q. Now, do you have an opinion with a reasonable degree of scientific certainty on the validity of those analyses?

A. I certainly do, or I would not present them here.

Q. Will you tell us what that opinion is?

A. I think they are perfectly valid analyses and correct in the same (859) degree, to the greatest degree that we can make them correct. I think they are right. There is no question in my mind.

THE COURT: All right, Doctor. Thank you.
Next witness.

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