Dr. Verne Rockcastle

A History of the Cornell Science Leaflet

Paul Spector [introducing the speaker]:

... As a professor of science education he has worked with students of all ages. He has spent a lot of time developing science programs, texts (some of which are on display in the library) and is also the author of many of the Cornell Science Leaflets, a form of the Nature Study leaflets, which he will talk about this afternoon. Verne is now retired, but like so many enthusiastic, vibrant people he is probably busier now than when he was a professor. I hear about his schedule, and I get tired !

Listening to our panel earlier, talking about their relationships with students, it also goes the other way. It's an honor to be able to work with and introduce former teachers; Craig Chase (who is in the back) was my advisor in graduate school, and Verne Rockcastle [undergraduate advisor] at Cornell. It's a real pleasure to introduce him to you this afternoon. Verne? (Applause)

Verne Rockcastle:

I don't generally appreciate the umbilicus that ties me to a podium like this, and I may leave it from time to time. In fact, I am sure I will and go to the the chalkboard, which nobody used this morning, but which I can't be in a room without resorting to. I am going to give you a very brief overview of the Cornell Rural School and Cornell Science Leaflets. Then I am going to reflect a little bit. One of the prerogatives of the elders is that you have earned the right of reflection.

While many of the reflections this morning are anecdotes and looks to the past, I want to reflect with an eye to the future. It just occurred to me this morning that 9/10ths of our time was spent on what happened years ago. In fact I wrote down here--someone mentioned a piece of the past, and I wrote, "NO, a push toward the future". I think there is a difference between those two. So, I am going to reflect a little bit on the past, but I hope to put most of my emPHASIS on a different sylLAble, which will be something else.

Just very briefly, on the chronology of the Cornell Rural School leaflets, which incidentally did reach a lot of people. This leaflet is an old one; it's no longer in print. But you might some how be able to get one of these . Every once in a while in schools, I turn up a supply of old leaflets. This gives a chronology of the Cornell Rural School Leaflets up to 1956, at which time I entered the scene and wrote them until their demise.

It seems as if I am always "demising" something, and the leaflets were one.

In 1896, Liberty Hyde Bailey (going back to the father of nature study again), wrote an article, a story entitled "How a Squash Plant Gets Out of its Seed". This is probably one of his most famous, most-referred-to writings. He had twelve more titles in a series of leaflets, dealing with common things which could be put in the hands of teachers, and, when desired, of pupils as well. And he wrote, "We have preferred that these these little texts be not read to the pupils as stories, but that they will answer as suggestions to the teachers, which shall have the children perform the simple experiments, and make the direct observations which are indicated."

In 1899, the Nature Study Bulletins were issued. There were nine pamphlets, plus nine teacher's leaflets. Bailey, in the first issue wrote, "Our entire movement in nature study is for the benefit of the children"(unquote). Uncle John Spencer, who was referred to, was in charge of the Junior Naturalist's Club. Now this was right at the turn of the century. So here it is, almost ninety years ago that these things were being done. In 1898, there were 35,000 members in the Junior Naturalist's Club. This spread like wildfire, particularly in rural schools. Alice McCloskey was brought to Cornell in 1898 to help with the club effort, and the Junior Naturalist's Monthly was the official journal of the clubs until they went out of existence in 1908.

About that time, Mary Roger Miller started the home nature study courses. These were leaflets she mailed for studying nature at home. There were questions to answer, and things to look at. In 1903, Mary Rogers Miller left Ithaca, and Julia Ellen Rogers, her sister, took over until 1911. In 1906, Ada Georgia joined Julia Ellen Rogers to help with the home nature study correspondence courses. By the way, at that time, the people at Cornell were corresponding with teachers and with pupils. There was a lot of letter writing back and forth. Letters then were three cents, not twenty-five (laughter). Post cards were a penny, and the mail was delivered the next day, or two days later. The horses were faster than the--. Well, there was a lot of this personal correspondence; it was a very personalized kind of nature study movement back in those days.

The Cornell Rural School Leaflet under Alice McCloskey began in 1907. In 1911 was the publication of Comstock's "Handbook of Nature Study", first edition, now in its twenty-second printing of the 1939 edition--twenty-second printing! This material was largely taken from the home nature study courses, which were assembled in book form.

In 1911, Edward Tuttle joined the staff. In 1912, Edward Tuttle became co-editor with Alice McCloskey of the Cornell Rural

School Leaflet. So this leaflet goes back a long time. In 1915, Alice McCloskey died, leaving the the Cornell Rural School Leaflet in the hands of Edward Tuttle. During the war, one year, in 1918-1919, professor Stewart, of the Department of Rural Education, was responsible for the Cornell Rural School Leaflet. Just a word about the Department of Rural Education. You heard this morning about the movement of people from the farms to the cities. This caused a great deal of concern in New York State, and the Department of Rural Education was begun in order to educate rural people to the joys of living on the farm, to counter this movement to the cities. It was around, I think, in the late 1960's that was still the Department of Rural Education. The leaflets, when they were being done at that time, were published under money from the state. They were free to communities of less than 2500; there aren't many communities of that size, today.

In 1919, Dr. E.L. Palmer--Eph Palmer--took over responsibility of the Cornell Rural School Leaflet, and he headed it up until 1956. From 1919 until 1956 was a long time. He deemphasized agriculture, which Liberty Hyde Bailey had emphasized. He deemphasized homemaking, and also correspondence with readers. One of the reasons that he couldn't keep up the correspondence with readers--the issue of the Cornell Rural School Leafllet was fifty thousand per issue, three times a year, plus an issue of twenty-five thousand of the teachers number. With that kind of readership you cannot keep up with correspondence. He increased the breadth of the program to make it more than biological science; he put in some physical science.

Now, a word about Eva Gordon. Eva Gordon isn't even mentioned in the Cornell Rural School Leaflets until I think the late 1940's. The chances are, according to those who knew her, and worked with her, that she did considerable of that writing. She came to Cornell, as nearly as I can find out, in the late twenties; and if I had to guess, I would say of the leaflets that I have seen, 60 percent of them were written by Eva Gordon, maybe 40 percent by E.L. Palmer. But E.L. Palmer's name was on the leaflets. Now this is not to take anything away from Eph Palmer; he was a driver, he was a pusher, he was the organizer, he got people to work. What people didn't realize was--we're talking about the dark side--that people worked FOR him. And Eva Gordon was one of those people who worked and worked and worked and worked and got very little credit for it.

By the time I came to Cornell in 1952 as a graduate student, her name was apppearing on these things, and she had almost sole responsibility for these leaflets, even though it was under the editorship of Dr. Palmer. But she fell behind in her writing. She was teaching, she had graduate students; she was a gentle person, she was meticuluous, she was hard working, and her publication schedule got behind. I remember her sitting at her

desk one day, and looking through her glasses, not over them as Eph Palmer would, and saying to me, "Would, would you be interested in perhaps writing one of the leaflets?" I allowed as to how I would might be interested, and I wrote one called "Air Laboratories"; it was my first fling writing for publication.

One of the reasons I wrote that was that my father was one who believed everything that was in print. If it was in print, it had to be true; otherwise it wouldn't have been printed. Well we had argued at one time, almost to the point of family separation, about a temperature that was reported at Tupper Lake, in New York, where we have a summer home. In the village, the temperature was reported as one thing, and my father read another thing on the thermometer, at the camp. I tried to point out they could both be correct. "Nonsense, if the thermometer says it's so and so, it's got to be so and so." When I wrote "Air Laboratories", I wrote that the temperature could be different things in different places, and this was printed. And I think this was the first minor heart attack my father had. (laughter)

I wrote the Cornell Science Leaflet from 1956 until 1969. I guess I felt, "To everything a season, everthing in its time, and when its time is past, it should go". There came a time when the connotation rural school didn't cut much ice in New York City, and it didn't cut much ice in Rochester or Buffalo. Cornell Science Leaflet seemed to be more appropriate [than Cornell Rural School Leaflet] So soon after 1956, I changed the title. I thought, science, really, is not just biological; the nature study leaflets have got to combine physical science and biological science. So I began to write two issues for living things, two issues for dead things. I tried to make it biological and physical, and incidentally that seemed to be what the public wanted.

They were well accepted; they were a dollar a year for four issues. Even in 1969, when we discontinued this; they could not be published for that price, and the College of Agriculture and Life Sciences told me they could not give a subsidy for the leaflets anymore; we had to be self supporting. I could not write them, distribute them--the mailing, the production costs--no way could we do that for a dollar a year for four issues. Besides, books were coming out in four color. A lot of sales staff were on the road. The leaflet was one-person operation; one person wrote them, one person distributed them, one person handled all the correspondence, one person did everything. It was just, simply, too much. After fifteen years, I said "That's it!", and decided to write textbooks instead.

An interesting thing was, that in the year after the demise of the leaflets, I got a lot of correspondence in asking, "Why did you discontinue this? These were the most valuable things

we've used". I wanted to write back, and say, "Why didn't you tell me that last year, or the year before, or ten years ago?". They had been discontinued, and once an effort is discontinued, you just don't start it up again. So that was the end of the Cornell Science Leaflet, from 1908, until 1969; sixty-one years of continuous operation. I have some of the last issues here. Some of these are still available by the way--I'm not selling these, I have nothing to do with them anymore, but I will pass out these if you wish to see what titles are available. There are twenty titles for four dollars; that includes mailing, so I guess it's still a pretty good deal.

As I said before, I'd like to depart a little bit, and make a few comments relative to these leaflets. What goes into the writing of something such as the Cornell Rural School Leaflet, or the Cornell Science Leaflet? Three things: [A], One is some sense of need, what you feel people want; B, an expression of what is needed; some tangible evidence that this is what teachers or environmental centers want; and C (this is probably the most important) the interest of the writer. If you have something you are really interested in, you will write regardless of the need. One famous professor at Cornell that I know wanted to write poetry, and he published at considerable expense to himself a volume of poetry--not very good poetry. He distributed, I don't know--a hundred copies?--of these to his friends. He would write, he couldn't write, he did write, and it's sort of like, who was it said about the house sparrow? It's a bird that cannot sing, but will sing, and should be persuaded not to try to sing. (laughter) People will write, and God bless them, because some of these things really catch fire and go.

When does one phase out a publication? Well, when the need is removed; when the interest of the writer wanes, or when costs exceed income. I guess those three things happened in the case of the Cornell Rural School Leaflet.

I'll tell you one little thing about the writing of these things. I'm kind of a maverick, I guess, I don't like to be channeled, I don't like fences, I don't like convention. We had an editor who was VERY conventional (I guess the editors in most agricultural schools are quite conventional). For example, if I wrote that "Some people think that-" she'd scratch out "people" and put "persons". And I would say to her, "People sounds right--" "No that's not correct. Persons!", and so she'd put "persons." So I thought, I'm going to get the best of her, somehow. I volunteered to take the edited manuscript to the printer. When I did I'd scratch out persons and put people. When I'd take it back to her it was-it was in the galley, it was all ready to go, and she wouldn't scan it that closely, then she began to scan the galley, so I volunteered to take the galley back. And I ALWAYS got my way. I would get the best of her.

For example, there's a leaflet on--I can't remember the title now. Maybe it was "Underwater", about water sources and energy. I was talking about a possible dam across the Bay of Fundy, and I thought I'm going to get her". I talked about "and when they let out the dammed water" (d-a-m-m-e-d) it was perfectly okay, there was nothing wrong with it. I knew if she called it to my attention, she was the one thinking bad thoughts, not I. So it got through, and it's in there. In the leaflet on measurement, I was having the kids get diameters of various things, and, I guess I was in kind of a nasty mood because she had hacked up certain things, and one of the questions I asked about the children, was measuring around cans, getting a circumference, and then finding out how far it was across the can. And so, at one place, I gave the question, "What's the diameter of your can?". (Laughter) I liked to just jab the needle everywhere I could.

Some other thoughts that came to mind this morning, as you were talking. We were talking about how things used to be, and I guess, honestly, I get a little annoyed at this. And I wrote this down, "But dad, things are different today. I'm not a youth in your day, you're an old man in my day !" (Laughter) I think that's how we have to look at some of these things; it's nice to reminisce, it's nice to go back to these people and listen to what they said and what they wrote, but confound it, this is not 1908, it's not 1918, it's not even 1950, it's 1988, and there are things that have to be done out there. And I must confess, I saw all the high power that's here, all the experience that's here, the expertise, and I thought, "How sad that this isn't marshalled right now to cut ice for the future." That we are NOT generating directions to take, specific moves to make, so that tommorrow is a better day than today. So while I don't want to press you not to look back, you'll look back for one reason only, and that's to look ahead.

I wrote down here, Cabots and Lodges, reminiscing. I told some of you, I was going to take some jabs today. I sometimes think that when we meet as nature study groups that it's the Cabots and the Lodges coming together to talk, and the Smiths and the Joneses out there are the ones we should be talking to. I hope we don't forget that, it's an extremely important message. However, I'm gonna reminisce for a minute, having said that.

When I first went to Cornell, to interview, I was interviewed by Dr. Palmer at his house. I'm telling you this because it illustrates a point. I had seen a picture in Life magazine--Life magazine had its back page at that time, "Speaking of Pictures", and there was a full page of some dramatic picture. This one page showed a window-screen, with drops of water in the little squares of the screen. A photographer had taken a picture of his son through the water drops, and in every water drop was his son, shown right side up. I fired off a letter to Life magazine and

said, "The photographer must have gotten his negative in the enlarger upside down, because water drops invert pictures, as any photographer knows." Then I said, "Just to check on this, I photographed my wife standing on her head out in the front yard. Sure enough she was upside down." (laughter) Then I put a p.s., "What a traffic jam there was outside!". (laughter)

Well, Life magazine called me, and they said, "Send us the negative". (laughter) I didn't have any negative, I was just so sure of what would happen. So I tried to get the negative; she went out, she stood on her head out in the front yard. I put some water on the screen and looked through the water droplets and doggone, she was upside down. Well I was non-plussed at this because I'd written Life and said she was right side up. So I began to experiment. I spent one whole day with window-screen; I hammered it, I squirted it, I greased it, I did everything to it. Finally, in the living room of our house, (which is a sort of a cathedral ceiling living room) she laid out on the floor, made sure she was appropriately dressed underneath, and pulled her skirt up aways. I got up on a step ladder, put the screen horizontally, put a water drop in each square with an eye-dropper, and photographed down through this and I got her reversed.

I wrote the whole story to Life magazine. What happens is that when water runs down the screen, it pulls enough water out of each square to make the water droplet a concave lens, not a convex lens. If you've never done it, try it. I was embarassed- I had signed my first letter to Life, "Professor of Science, Brockport State University". Well, I wrote the whole story to Life, and they decide not to publish it. I was kind of disappointed, but I thought "Oh well, it was an experience."

I went to Cornell the next couple of days, and was interviewed by Dr. Palmer. When I got to his house, he was sitting at his typewriter writing a letter to Life magazine. If any of you knew Dr. Palmer, his letter was going on, "I've never seen so many errors on one page". He was calling every little photograph an error. I said, "Dr. Palmer, you better not send that letter. He said, "Why not?". And I said, "Because, you know, you're not right." He said, "Of course I'm right, I know how water drops work." And I said, "I don't think you do". And he said, "Well I sure do. I've seen water drops more years than you have young man", like this. I said, "Dr. Palmer, go get a glass a water, and come to the front screen door, and throw the water through the screen." So, he did. I always carry a hand lens attached to my keys. I gave him my hand lens, he got down on his hands and knees, and began to look at the water droplets. He looked all over, and after a while he got up, and he said, "Young man, you've saved my life!". (laughter) I got the job at Cornell! (laughter)

I mention this because it is one of those physical science phenomenon. You see water drops, you see raindrops; I'm sure you have taken pictures of dew drops on a spider web. That doesn't mean you know water drops! And it didn't mean I knew water drops. I've done a lot of work since then with water drops; I was embarassed by them. Now, I think I may know water drops better than most of the people in this room. They are as natural as the song of a bird, and so are many other things out there. The forces of the lines on a spider web. We don't deal with the forces on the web, we don't deal with vectors. My gosh, they are right there in front of you on that web. Isn't the catenary of the lines of the spider web as natural as a snowflake?

This, I think is something that we in the American Nature Study Society, and in interpretive centers better get on the ball doing. Because we're missing 50 percent of the whole area of nature study. This includes geology, Ruth, it includes astronomy, it includes all of those things that are not living. They're not moving around, they're not bearing young, you know, they're not warm blooded, they don't move, you can't pin them up, and so we don't study them. Nature is not just plants and animals, it's just as much forces, radiation, and electromagnetism, as it is birdsongs. I wish all of you could appreciate that you are in a veritable sea of electromagnetic waves. What could you do to appreciate that? How do I know that? Because you could turn on a radio anywhere in this room and if you had enough transistors, you can hear Moscow. I think it is as much a part of our environment as maple trees-- it's there. There are many people who don't even sense this kind of thing and I wish they did.

Some time ago, I wrote a little activity called, "Sink in the Snow Coefficient"--some of you have seen it. I had taught tracks and tracking, and we had seen deer tracks, and rabbit tracks, and we talked about which way the rabbit was going and so forth.

Then it occurred to me, at the end of a socialization action experience?--How many of you know what I mean when I say that ? You do things, and it is supposed to increase social awareness in the group. One of the things they have at PEEC [Pocono Environmental Education Center] is a plank, and there's a story about how you have to cross the poisonous swamp on the plank. You have to get ten people on the plank. Well the upshot is that you're standing on the plank holding on to each other and trying to move along this plank. When it was all through, I said to one of the people at PEEC, "What was the point of all this, what was the objective?" She said, "Well, to get from A to B, using this plank, and only ten people." I said, "But why did we do this? What was the point?" "Well,"she said, "to go from there to the end, using the plank". I thought, "I won't pursue this anymore."

Not once during that time was anything about pressure, or the force on that plank mentioned. I thought, "How sad." Here are ten people (writing numbers on chalkboard) averaging say 160 pounds each, that's 1500 pounds on a plank that was maybe 10 inches wide, and maybe 8 feet long--we'll call it 100 inches. Nothing was ever mentioned about what were the pounds per square inch on that plank. Here are 1500 pounds on 1000 square inches. Gosh, that was only one and a half pounds per square inch; that wasn't so much. And yet, people were [saying],"Wow, all that weight on the plank--my gosh." I was thinking, "Wow, how little force." We were at completely different wavelengths, and it [the subject of force] wasn't being used at all.

I thought, "Why not apply this to tracks?" To determine this sink in the snow coefficient the kids trace their foot on square paper, find out their weight, and find out how much weight there is per square centimeter of their foot. It turns out that for humans its about .2 kilograms per square centimeter. I give them a deer track; they they find out what it is for a deer. For a deer it turns out to be about 2 kilograms per square centimeter. So the deer sinks 10 times as far. I give them a snowshoe hare track, they find out what it is for that, and it comes out to be about .02 kilograms per square centimeter, which means the snowshoe hare sinks only 1/10 as deep as we do.

Now, when I did this in Newark, New Jersey, not far from a place called Zeure's Bog(sp?), one girl said, "You know, when we go to the bog, why don't we take snowhoes? It will make our sink in the bog coefficient less, and we can go nearer the open water." I thought that was beautiful--that was beautiful.

Then one day, not long after this, I saw some kids with their ten speed bicycles on the Cornell track. They looked for a summer evening when they could ride on the track with nobody there, because they're not allowed to ride on the track. So I thought, "Why not try this with the kids on the track?" I picked off one of these kids, and I said, "That's a nice bike you have there." He said, "Yea, it's a pretty good bike." I said, "High pressure tires?" "Yea, high pressure tires." "Well, it must be fast." "Yep it's real fast." I said, "How much do you and your bike together weigh?" Well, we talked a little bit, he weighed about 125 pounds; he figured his bike weighed about 25 pounds--150 pounds for bike plus rider. I said, "Well, that's not bad. How much pressure do you carry in your tires?" And he said, "100 pounds." I said, "You mean your tires weigh 100 pounds?" "NO-no-no-no"; he said, "That's the pressure of them." I said, "What do you mean, 100 pounds?" He said, "100 pounds per square inch". "Oh. Well how many square inches do your tires put on the track?"

Well, we discussed this a little bit, and we figured it out. One and 1/2 square inches; 150 pounds, at 100 pounds per square

inch, means 1 1/2 square inches, enough to hold up the bike and the rider; or 3/4 of a square inch on the front wheel, 3/4 of a square inch on the back wheel. I said, "Wow, that's an awful lot of pressure on this track". "Oh", he said, "150 pounds, that's not so much". I said, "But look, I weigh 150 pounds too, and when I run on the tips of my toes that's about 6 square inches. I weigh 150 pounds; 6 square inches, that's 25 pounds per square inch, and your putting 100 pounds per square inch." He said, "Those football players weigh 250 pounds." I said, "But they have big feet!". So we figured it out, that a 250 pound football player with a 10 square inch shoe, that's not very much-that's still only 25 pounds per square inch. He's putting four times as much sink in the track coefficient as I am. He said, "Yea, that's right. I've never thought about that before. Come on you guys, let's go." Now that's nature education; it's a change in behavior that comes about because they're educated.

Let me give you another one. Suppose you gave each child a six inch square of aluminm foil, and a week to destroy it. You do anything you want to with that aluminum foil; you can heat it, you can fry it, you can try to burn it, you can put it the fire place. Report what you do, and how much you have left at the end of the week. See if the kids don't think twice before they discard aluminum quite so matter of factly. They know that that stuff isn't going to disintegrate. That's nature education too. You see what I mean, by putting some of the physical science with this?

I'll leave you with a last little thought, because to me it's kind of important. Again physical science: here's a cup of water--I wish I could have done this before lunch. [Writing on chalkboad] I don't know to how many of you that name [Avogadro] means anything. I'm not even sure it would mean something to Dr. Palmer, or to Liberty Hyde Bailey. An Italian scientist, who, by some very clever calculations and experiment, figured out that [writing formula] in one gram molecular mass of a substance, there are that many [6.02×10^{23}] molecules. We won't go into how he figured it out, but it means that in something like H_2O, which has a molecular mass of 18; in 18 grams of water there are that many molecules of water. It means that in this cup of water, which is about a little more than five times 18 grams. There are more molecules than there are cups of water like this in all the water on earth. All the oceans, all the groundwater, all the atmospheric water, the works. Five times as many molecules there as there are cups of water in the whole earth.

Now, if I were to pour this water into the water system, and it was thoroughly mixed (in time it will be), and I dip out a cup of water sometime in the future; in that cup, ought to be about

an average of five molecules out of the cup I poured there. Which brings up something like this, and nature poetry is again one of the things I dabble in.

The cup of water you're about to drink
Deserves a second thought, I think,
For Avogadro, oceans, and those you follow
Are all involved in every swallow.

The molecules of water in a single glass
in number at least five times, outclass
The glasses of water in stream and sea
Or wherever else that water can be.

The water you are about to taste
No doubt represents a bit of the waste,
From prehistoric beast and bird--
A notion that is not absurd.

The water in you is between and betwixt,
And having traversed is thoroughly mixed,
So someone slaking a future thirst
could easily drink what you drank first!

(Laughter)

The fountain spraying in the park,
Could well spout bits from Joan of Arc,
or Adam and Eve and all their kin,
You'd be surprised where your drink has been!

The water you cannot retain,
will someday hence return as rain,
Or be beheld as the purest dew,
Though long ago it passed through you!

(Applause)

Avogadros's number might seem to have no place in the American Nature Study Society, or in an interpretive center. I claim it has a very real place in those centers. For people to get the idea, maybe what you should do is take a cup of kidney beans, and several pounds of navy beans. Mix these together, maybe count these. Mix them together, and take out a cup of the mixture and sample some of that stuff. So that concept is internalized: "I cannot misuse water anymore, because, by golly, it's going to come back to me." That's a very real internalized concept, and an important one.

I'll show you how simple some of these things can be. Birds have been singing out there, and you will hear them this afternoon. They sing at certain frequencies, they have certain

resonances; these are resonant frequencies. There's a resonance in the song of a bird. I don't think that means a lot to some people. But I have my students, back at Cornell, even graduate physics students, start with a piece of chalk, and they . . . . . [make sounds with the chalk]. You can see a certain _____..... A chalkboard at Cornell is just filled with marks like this. Want them closer together? .....(screeching sound).....that's very close together. Want them farther apart? . . . . . We learn about the things that cause resonance. We can deal with resonance--there isn't one of those people who internalizes this concept of resonance, who can't go out and listen to a bird singing and have that song mean more to that person, after he or she knows something about resonance. It's a physical concept, and it's as natural as the song of a white throated sparrow.

Anyway, that's the kind of thing that was started in these leaflets. The leaflets had their day, and they have been phased out; other things are coming along that are better. We in American Nature Study Society have to pick up that ball, carry it a step farther. As I tell my students, if the new people don't carry the whole thing a step farther than we came, education is at a standstill. It has to go farther in the young people than the "Gathering of the Elders" realized in their day. Or we've lost it. Thank you very much. Can I answer any questions? (applause)

Ruth Melvin: I would like a copy of your poem. I didn't absorb it all.

Verne Rockcastle: I could send you a copy. I thought about a number of poems; I've got a big file of poetry that no one's ever seen.

Helen Ross Russell:You gave us two for the water issue, but you didn't give us that one.

Rockcastle: I didn't give you that one? Okay.

Russell: So why don't you send it? That will take care of everybody.

Verne Rockcastle: All right. There are a number of others.

Phyllis Busch:

I think Verne is to be congratulated for so many reasons, but especially because he seems to express even better, my ideas. (Laughter) No, I believe they're original with him, but he says it so much more clearly. He stresses the physical aspect, which we don't, many of us can't. I cannot do it anywhere nearly as well as Verne can. But he understands and has explained it to you what I meant by teaching basic science, environmentally, and

with a message. That is what he has done, and we must do this with the biological part as well as for the physical. I talked with him before, and he said he is doing a book on just that kind of material, which I think will be most invaluable. I wish he would hurry up and get it done.

Verne Rockcastle:

Two years. I'd like to give you an example of physical science related to an environmental program. In New Hampshire, the children were looking at a stream and a pond, and the point was made that the pond acts as a kind of dam, a check dam if you will, for high water. The lake is less likely to flood if the pond is there, than it would if it had no pond. At one point, I asked the kids, "Well, how long would it take the stream to fill up that pond?" "I don't know." "Well, how could you find out? Suppose I put a hundred dollar bill down here, and said the first person that can find out approximately how long it takes to fill that pond, has a reasonable solution, gets a hundred dollars. How would you go about it?"

They didn't have the foggiest notion, but we discussed it. After a lot of playing around, it came down to getting the area of the pond, if we had a map, and put a grid on the map and count the little squares in the grid. I said, "Is there any other way? Suppose this was a great big lake--it's Lake Superior, and you want to find out the area? You can't put a grid on Lake Superior." We finally decided we could make a sketch of the pond, put it on paper, cut out that sketch, and put it on a balance, and weigh it in grams. I don't care what the shape of the pond is, just whatever it is, weigh it. Then, using the scale of our sketch, we could cut out one unit; suppose one inch equals (represented) a hundred feet. We could cut out one unit, and weigh that, and the ratio of those weights is the area of the pond.

Well, we did it, and it was fun. Now they've got the area. "But that doesn't tell you how much water is in the pond. What do you have to know?" "Well, we'd have to know how deep it is." "Well, how can you tell how deep the pond is?" "Gee, we don't know--we could wade out there." "Well, you can't wade out there; it's cold, you can't wade out there today. Suppose I offered you money, how would you find out the depth of the pond?" We finally decided you could get some stones, tie strings to the stones, put little corks, one foot apart, on the strings, count...

[End of tape, side A]

Audience Member:

Boeing redesigned the runway in some of the first jets, and

found they were getting compressions in the aluminum walkways. They found it was caused by hostesses' high heels; so now, hostesses wear a compact heel.

Rockcastle:
My wife was an airline stewardess, and she was on DC-3's. She would look at passengers getting on, and would say to those with high heels, "I think you would be more comfortable in the lower heel." What she meant was they were afraid they were going to go through the floor.

Incidentally, one thing I've done many times and this is always kind of fun; it's kind of dramatic too. Bring in a glass of urine--real honest to God urine, and you can actually have people decide [passing the glass around], is it or isn't it? (laughter) It's best to have it in a drinking glass. Pour this glass into a bucket, and fill the drinking glass from a pitcher, with water. "Would you be willing to take a sip of this now?"

Glidden Baldwin: No thank you.

Rockcastle: You bet your boots, nobody would. So you pour that out and refill the drinking glass with water. Now would you take a sip of this?"

Baldwin: Sure.

Rockcastle:
You're unusual (laughter); that's because he's Glidden. Most people wouldn't touch it with a 10 foot pole. So you pour out that glass and refill it for a third time. I have yet to find a person in most audiences who would take a sip out of that water. But the dilution in that cup--and I thought we pushed this kind of math now. [Writing on chalkboard] Figure it's 1:10,000, because about one drop of urine is left in this when you pour it out. When you refill it with water the dilution is 1:100,000 or $1:10^{4}$. But I'll tell you what-we'll be kind, and say it's 10^{3}. That's being very conservative. After the second refilling, it's $1:10^{6}$, after the third filling it's $1:10^{9}$, and I'll tell you what; most of the toxins that you take in through your drinking water are far more concentrated than that. And yet people won't take a drink out of the third glass. It brings up this quantitative thing and brings it home personally to people. I think this kind of thing is worth doing.

Paul Spector: Thank you very much. Okay, let me tell you a little bit about--

[End of taping]