IN THE UNITED STATES DISTRICT COURT
FOR THE MIDDLE DISTRICT OF PENNSYLVANIA

TAMMY J. KITZMILLER, et al., Plaintiffs	:	
	:	Case Number
vs.	:	4:04-CV-02688
DOVER AREA SCHOOL DISTRICT; DOVER AREA SCHOOL DISTRICT BOARD OF DIRECTORS, Defendants	:	

MORNING SESSION

TRANSCRIPT OF PROCEEDINGS
OF BENCH TRIAL

Before: HONORABLE JOHN E. JONES, III

Date : October 14, 2005

Place : Courtroom Number 2, 9th Floor
Federal Building
228 Walnut Street
Harrisburg, Pennsylvania

COUNSEL PRESENT:

ERIC J. ROTHSCHILD, ESQ.
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For - Plaintiffs

PATRICK T. GILLEN, ESQ.
ROBERT J. MUISE, ESQ.

For - Defendants

I N D E X

WITNESSES

THE COURT: Good morning to all. We are at the point of cross-examination, or are we still on direct?

MR. HARVEY: Yes, Your Honor, we just have some more direct.

THE COURT: I apologize. I thought we had finished him.

MR. HARVEY: No need.

DIRECT EXAMINATION (cont'd.)

BY MR. HARVEY:

Q. Good morning, Mr. Stough. Do you have in front of you the exhibit that's been marked as P671? You can take that binder and put that to the side, that one. Please open up P671. This exhibit consists of a chart and a series of letters to the editor behind it. Isn't that right?

A. That's correct.

Q. And these are letters to the editor from the York Daily Record?

A. That's correct, for the period June, 2004, through to September, 2005.

Q. And I want to focus on those letters to the editor for just a minute, and we'll talk about the chart after we talk about the letters. How many letters to the editor are there in this P671?

A. For the York Daily Record, there are 139 letters to the editor.

Q. And, I mean, what do these letters to the editor relate to, what subject matter?

A. These letters relate to the controversy in Dover.

Q. And when you say "the controversy," can you tell me what you mean by "the controversy"?

A. What I would mean is they deal with the biology textbook adoption, they deal with the appearance of the reference book *Pandas and People*, and they deal with the final adoption of the biology -- or revision of the biology curriculum of October 18th.

Q. And so they are letters to the editor that address any of those subjects. Do I understand you correctly?

A. Yes, yes.

Q. And are these, all of the letters to the editor, on those subjects between the period June, 2004, and September, 2005?

A. I think it's very difficult to say that it's all -- yes, it's all of them.

Q. Now, how do you know that it's -- or how do you believe that it's all of them?

A. Well, originally I read these letters contemporaneously with their publishing. However, Hedya Aryani of Pepper Hamilton assisted me and she did a sweep of -- a search of all of the articles and then did a second sweep to make sure that we had all of the articles.

Q. If you would just go to your other notebook which I promised you wouldn't have to look through, but now I'm going back on my word. And in there there's a document that's been marked as P670.

MR. HARVEY: Your Honor, just so you know, this P670 is an affidavit that the witness is about to explain. It's from one of our legal assistants. And the other side has indicated they have no objection to this affidavit, the use of this affidavit as opposed to calling our legal assistant to the stand.

THE COURT: All right.

MR. GILLEN: If I may, Your Honor, I have no objection to the affidavit and, for that reason, I believe it's rather pointless for the witness to explain the affidavit of another person.

THE COURT: So this is an affidavit, for the record, P670, which indicates -- and this is a paralegal employed, Mr. Harvey, by your firm indicating that this paralegal collected the letters

after a search utilizing different search engines. If you would scroll down, please. And, in addition, collected editorials from the subject newspapers and that the trial exhibits, as listed on the affidavit, are all of the editorials and the letters found from the York Daily Record and the York Dispatch during the enumerated periods. Fair statement?

MR. HARVEY: That is exactly correct, Your Honor. And the purpose in putting that affidavit in is, the witness wasn't the one who actually went through and used the computer search engines to make sure that we had all of the exhibits, he relied on assistance from our legal assistant to do that actual function. So the affidavit is just intended to attest to that fact.

THE COURT: Then I would agree with Mr. Gillen that the affidavit speaks for itself as an exhibit and as summarized by the Court, and there would be no need then -- the import, I guess, of Mr. Gillen's comments is there's no need for you to further examine the witness on that point.

MR. GILLEN: Correct.

MR. HARVEY: Perfectly acceptable. We just did everything I intended to accomplish.

MR. GILLEN: Correct, Your Honor. He has no

personal knowledge of what she did. She's attested to it. I told Mr. Harvey that I'm willing to accept that.

THE COURT: All right. Well, then having established that, let's move to the next area.

BY MR. HARVEY:

Q. Okay, Mr. Stough, so we've just established, I believe, that all of these letters to the editor were between the time period, and we believe that they're all of the letters to the editor that relate to the subjects that you mentioned.

Now I'd like to talk to you about the chart that's on top of Exhibit P671. Can you tell us what this chart is?

A. This is a chart that basically summarizes and answers some questions that I generated regarding these articles.

Q. Did you create the chart?

A. I -- the chart was my responsibility; however, I was helped by Pepper Hamilton in terms of its format and typing.

Q. So, in other words, you are responsible for the correctness of the information in the chart, but you didn't actually create the chart?

A. Yes.

MR. GILLEN: Your Honor, just for the record, to make sure -- this is a little twist on the hearsay objection and the personal knowledge objection I made at the outset of his testimony. I want to make it clear that although the chart reflects his reactions, I object to that evidence based on the underlying hearsay.

THE COURT: You're objecting to the underlying evidence being the articles or the -- I should say the editorials or the letters that he viewed?

MR. GILLEN: That's correct, Your Honor. As I've tried to state -- and I don't want to belabor it or hold up the examination -- my view is that Mr. Stough, if I'm saying it correctly, thank you, has no personal knowledge. He's offering a state of mind based on hearsay evidence. That state of mind is not admissible. That's my point. And this chart seems to be the way --

THE COURT: The state of mind is admissible.

MR. GILLEN: Well, it's admissible to show a state of mind but not to prove the facts that produced the state of mind.

THE COURT: I don't think it's being offered for that purpose.

MR. HARVEY: You are correct, Your Honor.

MR. GILLEN: Okay. Then I'm uncertain as to what purpose, but so long as --

THE COURT: Well, we've been -- and I understand you're preserving your objection, and certainly I'll grant you that, but we've been down this road. You believe that testimony of this nature on the effect prong necessarily implicates the truth of the matter asserted.

I'm not at all certain that it does. I'll grant you that you may have an argument that you may want to reserve at the conclusion of the case. I'm going to take the testimony on the effect prong based upon, in this case, this witness's examination or review, contemporaneous review, it would appear to me, of the letters and the editorials.

I understand your objection is that he's referring to something which colorably is hearsay if it's utilized for the truth of the matter asserted. I don't see that that's what they're doing, but go ahead.

MR. GILLEN: I understand. And that is my purpose right now, is to make clear that his state of mind is also like the underlying hearsay, not admissible to prove the fact that he's basing his

state of mind on.

THE COURT: I'm not sure that I understand that.

MR. GILLEN: Let me try and be more precise, because it is difficult. We've gone around it. If you'd like to reserve discussion of that until after Mr. Harvey is done, I'll do that, or I'll give you more information now.

THE COURT: Are you going to cite to a case?

MR. GILLEN: Not a case, the rule, Your Honor.

THE COURT: Go ahead.

MR. GILLEN: Okay. The state of mind exception to hearsay is found in Federal Rule of Evidence 803(3), and it does provide a limited exception for state of mind, a statement of the declarant's then existing state of mind, and it provides for admissibility.

But it specifically provides "but not including a statement of memory or belief to prove the fact remembered or believed, unless it relates to the execution, revocation, identification, or terms of declarant's will."

So what I'm getting at is, his state of mind is not admissible to prove the facts, any facts, that

support that state of mind, including the effect of the newspaper article.

MR. HARVEY: Your Honor, hearsay is a statement offered -- out-of-court statement of the declarant offered to prove the truth of the matter asserted. We are not offering these letters to the editor and the other letters to the editor and editorials that I'm going to discuss in just a few minutes for the truth of the matter asserted.

We are offering them, as you have correctly perceived, on the effects test. So they're not hearsay at all. They, I believe, would also be, even if they were hearsay, they'd be admissible as to this witness's state of mind, but we don't need to go down that road.

THE COURT: See, the problem that I think we're having here is that on the effects test -- and I'll say this to Mr. Gillen -- you make the assumption in citing me to 803 that necessarily, on the effects test, the truth has to be established. I don't think it does. I think it's a subjective test, and it's how he receives it.

I don't have to find, on the effects prong, necessarily, that the matters that were written about in the letters -- and, indeed, you know, they're

opinion letters and they're editorials in this case -- that they have to be established on the effects prong.

So you take it, I think, a step too far. You're arguing, I think, in effect, that they're getting back-door hearsay in, but I don't think that's the case. For the effects prong -- I firmly believe that it's his subjective impression which fits, I think, squarely within 803, and I think he can testify under 803.

I recognize that, for example, for the purpose prong, it could be back-door hearsay if I utilize that to establish a fact on the purpose prong. But I don't think the effect prong militates or the analysis of the effect prong, as I've seen in the various cases, that analysis doesn't militate in favor of the interpretation that you're putting forth.

MR. GILLEN: You've said, Your Honor -- and I don't mean to belabor the point -- that you're turning in that direction. I know we're going to have a ruling here at some part. And as we approach that, you know, I'd like to have maybe a sidebar and discuss how we could best approach that from the standpoint of helping you reach the right decision.

THE COURT: No, and I understand that, but I would ask you this question before we do it, and then

we'll move ahead with the examination. If my interpretation isn't correct -- and it's evolving, certainly, and we'll talk about it further -- then how do you ever get to the effects prong? I think that places almost an untenable burden on the effects prong.

People, lawyers and judges, have struggled with the *Lemon* test, as you well know, and will struggle further with it in this case as we grapple with this issue. But on the effects prong, I believe it is a highly subjective portion of the *Lemon* test. And --

MR. GILLEN: And I don't want to revisit all the issues here. I mean, from our perspective, as you know, we think that the primary effect of curriculum change is the effect on instruction. That we think is the appropriate effects test.

With respect to what you're looking at now, I think that it's what the objective observer, we think in a classroom -- if you decide to go broader, that is your decision -- the objective, reasonable person reasonably informed, if you go that way. Now, Your Honor, but there's still -- that has to be demonstrated through admissible evidence.

I think -- and I agree with you entirely

that when you look at the cases, it's not clear, but what I believe the better reading of the cases is, is that they're looking at things about which they can take judicial notice. And that is essentially what they have done in many instances. So far as I can make out, they're looking at legislative history, which is a public record, and they're also looking at facts surrounding a forum about which they can take judicial notice.

I don't see -- and I don't want to put it too strongly because it is a sensitive issue. The *Lemon* test to the establishment clause is not a wholesale repudiation of the Federal Rules of Evidence. I think that the effects have to be shown by evidence that is admissible under the rule.

THE COURT: I understand your point, but I would say, just to close this off or end this portion of the discussion, that legislative history could, in itself, be hearsay.

MR. GILLEN: I agree. Unless it fits within one of the exceptions, you are right.

THE COURT: How do you fit it within the exception? How do you fit a statement by a legislator on the floor of the House of Representatives or the Senate or in this case a member of a school board, how

do you fit that -- and it may be an admission here, of course, because they're party defendants, but in the case of another legislative history. And that's what I struggle with in this case. And when you use the word "objective observer," that's not the way it's described in every case, and I know you're aware of that.

MR. GILLEN: I agree with you entirely, Judge. When you start to look at this sea of case law -- and you know and I both know there's language from the United States Supreme Court saying don't read these opinions as if they're a piece of legislation because we use words variously in different cases.

It does create a problem for us trying to find out where the line is here. And I don't want to rehash it, but I would say, I think, that the proof of effects has to be proved via admissible evidence.

THE COURT: I understand that, and the objection is noted on the record. We'll take the testimony subject to the objection, and we'll revisit that at a later point in time.

Mr. Harvey, who properly has been on the side lines while we've had that interesting dialogue, quitting while he's ahead, can proceed now with his examination.

BY MR. HARVEY:

Q. Mr. Stough, you told us when we were together on Wednesday that you are an avid reader of the local newspapers. Is that correct?

A. Yes.

Q. Remind us, please, what are the local newspapers for the Dover community?

A. The York Daily Record and the York Dispatch.

Q. How often do those papers come out?

A. They come out daily. The York Daily Record is the morning paper, and the York Dispatch is the evening paper.

Q. So is that --

A. I'm sorry, no, they don't come out -- they come out daily throughout the week. There is one paper on Saturday, a morning paper, and then there's the Sunday News which is published by the York Daily Record.

Q. And is that all of the newspapers that serve the Dover community in addition to whatever national or statewide papers there may be?

A. Beyond the local -- like, we have a Community Courier that really doesn't carry any kind of newsworthy material. It's just things that are happening in the community, advertising. Beyond that,

those are the two.

Q. Now, these letters to the editor that are contained in P671, have you read them?

A. Yes, sir.

Q. When did you read them?

A. I read them contemporaneous with their publishing, and then I was given a stack of them after the first search, and I read through all of them at that point in time. And then when we finally got everything put together in the notebooks, I read through them again.

Q. So you've read most of them three times?

A. I've read every one of them two times, most of them three.

Q. Now, please tell us how this chart, P671, was put together. What did you do to be responsible for the information on this chart?

A. Okay. The letters to the editor are, first off, arranged chronologically, numbered. And as you move across the chart, you'll see that they are dated. The next column would be the title of the article, and beside that would be the author, if the author's name was available.

Then the next column says, Subject of letter relates to the controversy at issue, and you'll find

that every one of these says "yes." Because what I was looking for was, did this deal with the controversy as I described it earlier.

Q. So you noted that -- you made sure the date of the article was reflected correctly on the chart, you made sure the title of the article, the author, that all of that was correct. Do I understand you?

A. Yes, sir.

Q. And then in addition, you made sure that every single one of these related to what you referred to as "the controversy"?

A. Right.

Q. And then did you do anything else?

A. I also then, during the reading of the article, tried to determine whether it discussed religion. And I looked for key words. I looked for "creationism," I looked for "religion," I looked for "theology." And I also looked a bit at -- I looked at the content of the letter to see if it really dealt with religion.

Q. What if it just discussed intelligent design, did you treat that as discussing religion?

A. Well, first off, so I can be clear, I do believe that intelligent design is religion. However, you would get letters that would say -- they would

treat intelligent design as science. They would say it's science because of this, and it would cite scientific evidence. There would be no mention of religion. And if I did find something like that, you would find in the column "no."

Q. Now, for the ones that you determined discussed religion, did you put down a quote in your chart just to illustrate why you considered it to discuss religion?

A. Yes, I did. And sometimes I actually put two quotes down.

Q. Give us an example of a -- pick one off your chart, one that discusses, in your mind -- of a quote that illustrates that it discusses religion.

A. Number 2, Buckingham wrong on text. Creationism is religion plain and simple. Or, Number 1, Creationism is not science. Religious beliefs have no place in public, government-funded classroom. Creationism is nothing more than faith.

Q. And so you did that so somebody could check your chart and see that you had, indeed, correctly determined that these articles discussed religion?

A. Yes.

Q. Now, the final thing, did you note whether it was pro or con the Dover Area School District Board

of Directors policy?

A. For my own curiosity, I was wondering if the writer -- and this was very subjective at times -- if the writer was in favor of what the school board had done or if they were against it. If they were, I noted that as being pro, and if they weren't, I noted that as being con.

Q. And can you tell us, did you count up the number of letters in this chart, this P671, that discuss religion in the context of what you referred to as a controversy?

A. Yes, I did.

Q. And of the 139 letters to the editor from the York Daily Record that are in this binder, how many of them discuss religion?

A. 86.

Q. And then were there, in fact, some letters that were pro-Dover Area School District Board of Directors?

A. Oh, yes, yes, absolutely.

Q. And were there some that were con?

A. Yes.

MR. HARVEY: Your Honor, that's all I have for that exhibit. We have three other binders I'll try to move through quickly.

BY MR. HARVEY:

Q. You have with you P674. Please tell us, what is P674?

A. P674 would be a collection of the editorials from the York Daily Record for the period June, 2004, through to September, 2005.

Q. And do these -- are these editorials that discuss what you called "the controversy" before?

A. Yes, they are, yes.

Q. And, again, did you make sure that you had all of the editorials for the York Daily Record that discuss the controversy for the time period you mentioned by using the services of our legal assistant?

A. Yes, we used the same process.

Q. And have you read these editorials?

A. Yes, I've read every one.

Q. And when did you read them?

A. Again, I read most of them contemporaneously with their publishing. I read them after the 10th of September. I don't know if earlier I said the 10th or the 20th. And then I read them once more once we had the notebooks put together.

Q. And did you do with these articles -- these editorials, excuse me, what you did with the letters

to the editor that we just discussed, in other words, verify the information that's on the chart that's been marked as P674?

A. Yes, I did.

Q. And did you, as with the letters to the editor, did you identify quotes to show that where you indicated that it did discuss religion, that somebody could look at it and see that you were right, that it was discussing religion in the context of this controversy?

A. Yes, I did.

Q. Can you give us an example, please?

A. Sure. Number 4, What do you think, creationism and evolution? Yes, I believe that creationism should be taught in schools because evolution is only a theory, and the Bible is God's word, which has stood the test of time. Remember, God created all things.

Q. And how many editorials were there for the York Daily Record that discussed what you've called "the controversy" for the period June, 2004, to September, 2005?

A. 43.

Q. And of those 43 editorials, did you make -- did you count up how many discussed religion?

A. Yes, I did.
Q. And how many was that?
A. There were 28.
Q. Now, if you turn to Exhibit P672. Now, we've got to give equal time to the York Dispatch. Did you -- what is P672?
A. P672 would be the letters to the editor for the York Dispatch for the period June, 2004, through to September, 2005.
Q. And this is very similar to what was done with respect to the letters to the editor for the York Daily Record?
A. Yes.
Q. How many letters to the editor were there that related to the controversy for the period June, 2004, to September, 2005?
A. 86.
Q. And did you --
A. I'm sorry, Mr. Harvey, did you ask me related to the controversy?
Q. Yes.
A. 86, yes.
Q. And have you read these letters?
A. Yes, I have.
Q. When did you read them?

A. Again, I read them as they were being published. I read them when I got a stack of them after September 10th, and I read them again once we had put the notebooks together.

Q. And did you verify the information on the chart and follow the same protocol that you did for P671?

A. Yes.

Q. And did you -- can you give us an example of a statement that you quoted to prove that the letters to the editor were, in fact, discussing religion as you indicated?

A. Sure. Number 5, Wilson would not approve. Creationism and its cousin, intelligent design, are devoid of scientific facts.

Q. And, again, you treated the word "creationism" as a reference to religion?

A. Correct, yes.

Q. And of these 86 letters to the editor, how many did you count up that discuss religion in the same context?

A. 60.

Q. And please, finally, turn to what's been marked as P675. P675 is a very similar exhibit except it's for the editorials for the York Dispatch from the

period of June the 1st, 2004, to September the 1st, 2005.

A. That's correct.

Q. And did you follow the -- did you read these editorials?

A. Yes, in the same fashion.

Q. And how many editorials are there?

A. There are only 19.

Q. And these are 19 editorials that relate to the controversy, as you described it?

A. That's correct.

Q. And you believe this is all of them for the same reasons?

A. Again, yes, we followed the same process.

Q. And of these, did you follow the same protocol for determining whether they discussed religion in the context of the controversy?

A. Yes, I did.

Q. And of these 19 editorials, how many discussed religion in the same context?

A. 17.

Q. Now, Mr. Stough, I would like you to just put those aside. We're done with that. And I'd like you to tell us, please, whether you believe that you have been harmed by the actions of the Dover Area

School District Board of Directors as it relates to the change to the biology curriculum.

A. Yes, I believe I have been harmed. And I believe, by extension, my daughter has been harmed, also.

Q. Tell us how you believe you've been harmed.

A. I believe that the actions of the school board in adopting this policy including intelligent design have usurped my authority to be the one in charge of my daughter's religious education.

Intelligent design posits an intelligent designer, which for me they're talking about God. It is a more literal translation of the Bible than I would accept and I plan on teaching my daughter, that type of non-literal interpretation.

And even if it didn't hurt me, if I didn't have a problem with the intelligent design, there are other individuals in the community that I think it does affect. I think it's an affront to the Constitution. I think their actions and their comments --

MR. GILLEN: Objection, Your Honor, to the extent he's offering his opinion about how it hurts others in the community.

THE COURT: Mr. Harvey.

MR. HARVEY: Your Honor, he's testifying about the harm to himself, and if he perceives that this is a harm to other people in the community and that, in turn, harms him, I think he can testify to that.

THE COURT: Why?

MR. HARVEY: Because it's relevant to the harm that he has suffered here.

THE COURT: How is that relevant to the harm he suffered? It's his own claim. He's a party plaintiff. How does that help your case if he talks about how he perceives that it's harmed others?

MR. HARVEY: If he believes that there's another member of the community that's being subjected to someone else's religious views by a governmental authority and that bothers him because as a citizen he believes in the Constitution and he says, that really bothers me when I see somebody who's a member -- who doesn't share the views of the religious majority in this community and is being singled out and made to feel that they're not a part of this community based on their religious beliefs, I think he can testify about that.

THE COURT: Is that actionable?

MR. HARVEY: I believe that's a sufficient

basis for standing, yes, Your Honor.

THE COURT: I don't think it is. I'll sustain the objection. I'll stand corrected if you can give me some authority, but I don't think that's actionable. He couldn't bring a claim independent of his own claim on behalf of others who he perceived to be harmed. I don't see that.

MR. HARVEY: Your Honor, we've looked at P127, and we see that the school district published its intelligent design policy to the entire community and is advocating intelligent design to the entire community, and on that basis, I believe that he does have standing.

THE COURT: You're conflating two things, though. My analysis would be, again, back to the *Lemon* test, how it was disseminated and how it was received. And when we get into the reasonable observer, I understand that. But when we're talking about -- you're into harm to him of a constitutional nature, and I just don't believe for that purpose -- you've gotten testimony in as to things that were received in the community generally, and those things will be utilized for that purpose. But when he gets into others in the community who he perceives to have been harmed, I just don't see it.

MR. HARVEY: Well, I will make one more comment without belaboring the point, Your Honor, and that is, if I was a member of the majority in the community and I believed in the -- I was a member of the religious majority and I had the same religious views but I was offended because it was being forced upon my neighbor who was not the same member of that same religious majority, I believe that I could have a claim on that basis.

THE COURT: What's the religious majority?

MR. HARVEY: In this case, Your Honor, the religious majority is the people -- is the school board's advocating a position here and endorsing a message that is held by, presumably, the majority in the community because they're the elected officials.

THE COURT: Well, you have numerous plaintiffs. All the plaintiffs were found to have standing by my prior orders, so you have plenty of plaintiffs. I just don't see it. I'll sustain the objection to that portion of the testimony.

If you can cite me to some authority that I'm not aware of as to his ability to testify to harm that he perceives has befallen others, I'll stand corrected. But for the moment, I'll sustain the objection.

MR. HARVEY: Understood.

BY MR. HARVEY:

Q. Mr. Stough, you testified on Wednesday that your daughter is in ninth grade right now at the Dover Area High School. Isn't that correct?

A. Yes.

Q. And she's taking biology right now?

A. Yes, she is.

Q. Have you considered how you are going to deal with the board's curriculum -- the biology evolution policy, the intelligent design policy, when it comes up again in, I believe, January?

A. Well, at this point -- and this has been a subject of discussion among -- between my daughter and I. We're going to wait and see what happens here in the court. It may not be an issue. However, I think at this -- I believe at this point she will probably step out with the teachers while the statement is being read.

Q. If she's going to step out of the classroom, or that's your view, how are you harmed by that?

A. I'm harmed by that, she's harmed by that because she's no longer part of the accepted school community. She's being told that she's being removed from the classroom.

Q. Mr. Stough, do you have in front of you P702?

MR. GILLEN: Your Honor, this is a fresh piece of hearsay not subject to our standing objection.

THE COURT: What is 702?

MR. HARVEY: Your Honor, it was something that was sent to Mr. Stough in the mail, and it's not offered for the truth of the matter asserted, Your Honor.

THE COURT: Let's have him identify it, and then I'll take any objection that you have.

MR. GILLEN: Okay.

BY MR. HARVEY:

Q. Do you have P702?

A. Yes, I do.

Q. What is P702?

A. On September 29th, when I went back to my school, I went to my mailbox, and there was a letter addressed to me at my school address, and this is a copy. I have the letter with me. It was basically half sheets. That's why it appears the way it does on the paper that I copied it on.

But this is a letter that I received in the mail. There was no return address on the envelope,

and there was no signature on the piece of mail.

Q. And you received this in the mail at your home or your work?

A. At my work.

Q. And I noticed that the bottom right-hand corner is cut off. Do you actually have a better copy of this?

A. I have the letter.

MR. HARVEY: Your Honor, we'll substitute a better copy of this after he's done testifying, if that's okay with you and defendants' counsel. And I have no further questions on that document.

THE COURT: Do you want to interpose an objection?

MR. GILLEN: Yes. It's along the lines of what I've discussed with you, Judge, and I don't want to belabor the point, but, again, it's --

THE COURT: It might be different. We don't know who wrote it.

MR. HARVEY: That's correct. It was, I believe, an anonymous letter received by him.

THE COURT: Are you going to seek to have it made part of the record?

MR. HARVEY: Yes, Your Honor.

MR. GILLEN: Your Honor, I object. It's not

admissible evidence.

MR. HARVEY: Mr. Gillen keeps using the word "admissible." It certainly is admissible if you offer to show the harm to this plaintiff here. It's not offered for the truth of the matter asserted, so it's not admissible for that purpose, but it is admissible for another purpose.

THE COURT: I think this is a little different, and perhaps we're being more clinical here. But to the extent that he read editorials and letters which it appears beyond dispute were printed in the local paper, that's fine. I understand that he has testified, the witness, that he read this.

I am concerned that we have an article, we don't know the source of the article, we don't know what it was published in. It's got handwriting that appears to be of different types on it. That raises a flag with me.

I understand why you're presenting it, but I am -- you have the testimony on the record that he received something in his mailbox. I'll let you ask additional questions, if you want, on this, but I'm loathed to admit this. I may not admit this. I'm not so sure that I want to admit this.

MR. HARVEY: I was just going to ask the

witness his reaction to the letter.

THE COURT: And that's fine. I'll allow you to do that.

BY MR. HARVEY:

Q. Can you please tell us your reaction to this letter that you received, Mr. Stough?

A. That's a tough question. I was amazed that it came to my work. I thought someone had crossed a line. If you want to say that this isn't a religious issue, this says it all. There's a lot of emotion in here. I don't know if this applies at all, but this certainly to me doesn't -- a person that is professing to be a Christian, you don't only have to talk the talk, you've got to walk the walk.

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

THE COURT: All right. Thank you, Mr. Harvey. Mr. Gillen, are you going to cross-examine?

MR. GILLEN: Sure.

THE COURT: You may proceed.

MR. GILLEN: Brief cross, Your Honor.

CROSS-EXAMINATION

BY MR. GILLEN:

Q. Good morning, Mr. Stough.

A. Good morning, Mr. Gillen.

Q. We met at your deposition. I've got a few questions just for the record. To be clear, you did not attend any board meetings prior to December, 2004?

A. December 1st, 2004 would have been the first.

Q. So you have no personal knowledge of what occurred at these meetings?

A. No, I do not.

Q. You've indicated you talked to your daughter Ashley. You think at this point that she will opt out?

A. Yes, sir.

Q. You recognize she'll have a choice, to opt out or not?

A. I assume. As it stands now, yes, I assume.

Q. You understand that Ashley is using the Miller and Levine text in her honors biology class?

A. Yes.

Q. And that she'll be taught evolutionary theory in her honors biology class?

A. Yes.

Q. You understand that apart from the mention of intelligent design in the statement that would be read, if she chose to attend the class while it was

read, intelligent design will not be mentioned at all?

A. Beyond that statement, yes, I understand that.

Q. You understand, I believe, that the book *Of Pandas* is in the library?

A. Yes, yes.

Q. And you have no objection to the book being in the library. Correct?

A. I don't feel that I can object to the book being in the library because that would be short of censorship, but I certainly don't think it's an appropriate book to be in a high school library for several reasons.

Q. But you have no objection?

A. I don't think I can object.

Q. Now, you've testified that you believe the intelligent designer is God.

A. Yes, sir.

Q. Would your opinion as to intelligent design change if I could demonstrate that intelligent design theory does not rely on reference to God to prove its claim of design?

A. I'm not sure I can answer that hypothetical. I'm not sure how you could prove that one way or the other.

Q. I understand that.

A. I know what your question is. I just am really -- I've heard that question before. I just --

Q. Sure. It's not a trick question. What I'm saying to you is, for you the intelligent designer is God. Correct?

A. I think that it's assumed that it is. I know what you're saying. They do not say it's God.

Q. Right. In fact, do you have any understanding concerning whether they insist that it's a supernatural cause?

A. You mean in terms of --

MR. HARVEY: I'm going to object, Your Honor, on the grounds that it's quite ambiguous as to who the "they" in that statement is.

MR. GILLEN: I'm simply asking him his knowledge of intelligent design theory.

THE COURT: He used the word "they," and I think we ought to probably establish who "they" are. I think his question parroted the answer that he got. Let's ask the question.

MR. GILLEN: All right.

BY MR. GILLEN:

Q. Mr. Stough, for the purposes --

A. Stough.

Q. Stough. Again, forgive me. For the purpose of this question, I want the "they" -- you and I to come to an understanding that the "they" are proponents of intelligent design theory.

A. I understand.

Q. Good enough. And what I'm saying is, would your opinion of intelligent design theory change if I could demonstrate that the proponents of intelligent design theory do not insist that the source of design is God?

A. No.

Q. Why is that?

A. Because it is not a well-tested theory. The testing is based on -- or the tests that they point to, the hypotheses that they point to are simply used to negate evolution. They don't provide support for intelligent design as a theory.

Q. That's your understanding of intelligent design theory?

A. That's my understanding of the concept of intelligent design.

Q. You've referenced a notion of testability.

A. Yes, sir.

Q. Based on that criteria of testability that you've described in brief, you believe intelligent

design is not science. Is that correct, Mr. Stough?

A. Yes, because it does not allow for falsifiable hypotheses to be generated.

Q. So, again, my question is, based on that notion of testability that you've advanced, is that the basis for your understanding that intelligent design is not science?

A. That's correct.

Q. Would it change your opinion if I could demonstrate or it could be shown that intelligent design is testable in the same way that evolutionary theory is testable?

A. If you were to show me valid and reliable testing that supports intelligent design as opposed to negates another theory.

Q. That's a yes, I take it, if that could be shown?

A. Given those conditions, yes.

Q. Okay. And in truth, you don't know whether all of the theses advanced by evolutionary -- or the proponents of evolutionary theory are testable in the manner you've described. Correct?

A. Only because my knowledge of that is limited.

Q. So you don't know?

A. I don't know.

Q. Now, you're also not familiar with work that's being done in the area of intelligent design theory. Correct?

A. If there is work being done, no, I'm not aware of it.

Q. But you believe that the evidence will never point to design. Is that correct, Mr. Stough?

A. "Never" is one of those absolute words that I avoid. So would you ask me the question again, please?

Q. Sure. I'm asking you, and you can -- I'm asking you if your testimony today is that you believe the empirical evidence could never point to design.

A. I can't say that I believe it will never point to design.

Q. Okay. You have testified to at least reading about the use of the term "creationism." Correct?

A. Yes, yes.

Q. And you associate creationism with Genesis. Correct?

A. Yes, creationism with Genesis 1, yes.

Q. Do you understand intelligent design to be creationism?

A. I understand it to be special creation, yes. It calls for an abrupt beginning, it calls for some supernatural causations.

Q. And in your judgment, that's creationism?

A. I believe that's special creation in the form of creationism, yes.

MR. GILLEN: No further questions, Your Honor.

THE COURT: Any redirect?

MR. HARVEY: No, Your Honor.

THE COURT: All right. Sir, that concludes your testimony. You may step down. Thank you. Exhibits --

MR. HARVEY: Your Honor, may I make a suggestion before you begin that?

THE COURT: Yes.

MR. HARVEY: That is that we have an expert witness, Dr. Padian --

THE COURT: And you're going to tell me you want to get moving?

MR. HARVEY: That's a dangerous thing to say to the Court.

THE COURT: No, that's fine. I know you have an expert and you want to get moving on the expert. So you want to reserve the argument on the

exhibits until later?

MR. HARVEY: Exactly, Your Honor.

THE COURT: I'll rely on you then to remind me so that we get those in, and let's take your witness.

MR. WALCZAK: Your Honor, plaintiffs call Dr. Kevin Padian.

KEVIN PADIAN, PH.D., called as a witness, having been duly sworn or affirmed, testified as follows:

THE CLERK: If you could state and spell your name for the record.

THE WITNESS: My name is Kevin Padian, P-a-d-i-a-n.

THE COURT: You may proceed.

DIRECT EXAMINATION

BY MR. WALCZAK:

Q. Good morning, Dr. Padian.

A. Good morning, Mr. Walczak.

Q. Where do you live?

A. I live in Berkeley, California.

Q. What do you do there?

A. I am Professor of Integrative Biology at the University of California and a curator in the Museum of Paleontology.

Q. I'd like to direct your attention to what's been marked as Plaintiffs' Exhibit 292. Matt, could you put that up. Do you recognize this document?

A. It looks like my CV.

Q. Is this a reasonably accurate representation of your professional experience?

A. I believe that's a recent one, yes.

Q. I'd first like to focus on your educational background. And you have a bachelor's of arts degree from Colgate University?

A. Yes, sir.

Q. And you have a master's of arts in teaching. Is that correct?

A. That is right.

Q. What does that mean?

A. It means that I have permanent certification in the State of New York and several other states to teach life science in grades 7, 12. And for this training, you take postgraduate courses in education and your subject major, whatever it happens to be, and you do intern teaching and you're certified to teach.

Q. And what was your subject major?

A. I majored in natural sciences at Colgate, and so I'm certified with life sciences.

Q. And have you ever used that degree to teach

elementary or secondary school biology?

A. Yes. I've taught seventh-grade life science and biology, and I've taught two years of sixth-grade process science.

Q. And when was that?

A. That would be in the years '72 to '75.

Q. And after that, did you go back to school to get your Ph.D.?

A. I went to Yale for my Ph.D. after that, which I got in biology in 1980.

Q. And did you write a dissertation for your Ph.D.?

A. I did. That's required.

Q. And what was the topic of your dissertation?

A. The topic of my dissertation was on the evolution of flight and locomotion in the flying reptiles called pterosaurs, which lived during the age of dinosaurs.

Q. And where was your first professional appointment after graduating?

A. I went to Berkeley right after that as an assistant professor, and I've been there ever since.

Q. And what's your position there now?

A. I am a professor and curator, so a professor in the Department of Integrative Biology and curator

in the Museum of Paleontology there.

Q. And what do you teach, Professor Padian?

A. I teach a variety of courses over 25 years. Some I don't teach anymore because the curriculum changes, but currently I teach and coordinate half of our upper division junior/senior course in evolution. I teach an upper division course in the evolution of vertebrates. I teach a number of freshman seminars usually on dinosaurs. I teach a number of graduate seminars on topics that range from macroevolution to the history of evolutionary thought. Currently we're doing Darwin's *Origin of Species*.

Q. And you said a moment ago that your background and expertise is in evolutionary biology and paleontology. Could you tell us what those specialties involve?

A. Sure. Evolutionary biology is a broad field that ranges from the study of the changes through time of molecules to the changes in time of the whole history of life as it relates to the changes of the planet Earth through time, the whole solar system. And my specialty in this is what we call macroevolution. Within that, I focus principally on how major new adaptations begin in evolution.

Q. When you say "major new adaptations," what

do you mean?

A. Well, about things like flight or how, for example, dinosaurs took over the earth. That's a great big change in evolution that happened about 225 million years ago. I work on problems like that.

And I also work on problems involving dinosaurs and general things about reading their footprints, their locomotion, again, how the age of dinosaurs got started. And I'm interested in the history of evolutionary thought, how people have conceived of the idea of evolution and how it's developed over time in the past 200 years.

Q. And is some aspect of what you just talked about paleontology?

A. Paleontology is the study of life of the past, generally put. And so when I say that I work on macroevolution, these are large changes that happened at a scale above the population level. So we usually have to look at them through time.

Q. And do you look at something called the fossil record?

A. Fossil record is where I spend a lot of my time.

Q. And what is the fossil record?

A. The fossil record is the record in the rocks

of the remains of organic beings through time. It can take the form of bone shells, footprints, trace fossils, all sorts of things.

And what we do is, we don't -- I mean, when you look at television documentaries, it normally focuses on people going out in the field and parking the truck and walking out in the Badlands and, you know, stumbling over bones someplace and finding that it's interesting in digging up and getting a skeleton and putting it in plaster and taking it back to the lab.

That's the first stage of what we do, but that's just the beginning of the science. The science is asking the questions about how life evolves, how the changes in life have happened through time.

Q. It sounds like you have to have knowledge in many different fields.

A. Well, my department is called integrative biology for a reason, that we actually look at problems in a rather integrative way. That is, my work involves physiology, bone histology, which is the tissue form of bones and mechanics of growth, as well as fossils and geologic change through time.

So, yeah, the questions you ask could be pretty complex and integrative, and different kinds of

evolutionary biologists and paleontologists work on different aspects of these problems.

Q. And are you still involved in research?

A. Oh, yes. Berkeley is a premiere research institution like Harvard or Yale or Penn State, and basically most of what we do is research and teaching. So as part of my job, I'm expected to produce a lot of peer-reviewed articles and books and things on a regular basis.

Q. And you've been doing research for 30 years now?

A. Yeah, roughly.

Q. And this is all on evolution and paleontology and the fossil record?

A. Oh, yes.

Q. And you mentioned that you've --

(White noise.)

MR. WALCZAK: Is that a hint, Your Honor?

THE COURT: No. Inadvertent button push.

BY MR. WALCZAK:

Q. You mentioned that you've published peer-reviewed research. Let me direct your attention to the top of Page 2 of your curriculum vitae, or I guess about a third of the way down. Now, it says there, Publications. What do you mean by that?

A. These are -- the list that I enclose with my CV here includes what we call peer-reviewed publications. And so these would be publications that have been sent out to our professional journals and, in some cases, to books that are edited by professionals again.

I don't know if you've gone through the concept of peer review much in the court, but by "peer review" we mean that if you publish -- if you have some research that you've produced and you want to get it published, you send it to a journal in the field, and the editor, who is an expert in the field, takes your manuscript and sends it to several experts that you can't choose and you don't know who they are. And --

Q. So you, as the author, don't know who is reviewing your articles?

A. That's correct. This is the anonymity of peer review. Ordinarily you don't know who these commentators are.

Q. What's the purpose of that?

A. Well, it's basically so that they can give a frank appraisal of what you're writing without worrying about whether they're going to offend you and, if you're a senior scientist, whether you're

going to get mad at them or something. I don't know. But it's been a habit that's always been the case in the scientific field, certainly.

And the reviewers who look at your papers then decide whether you've followed the right procedures for going about the science, whether the methods you use are up to date, whether you've cited all the literature that's relevant, whether you've inferred or speculated on more than you should, or whether it's basically within the grounds of what is acceptable science.

And they will propose changes, major or minor. If they don't think that your paper is very good, they'll suggest it be rejected, and the editor takes that into consideration.

Q. And so is everything that is submitted to a peer-review journal published?

A. Oh, no. A lot submitted to peer-review journals isn't published. It depends on the journal. On the journals on which I've been an editor, you have an acceptance rate of anywhere from 50 percent upwards or downwards to 30 percent, for example, in the ones I'm familiar with.

Q. And is there a -- what you might consider a hierarchy of journals for publication?

A. Yes, there are certain journals that pretty much every scientist in the world reads every week. Two of them in particular are *Nature*, which is published in London by Macmillan Journals, and *Science*, which is published in Washington every week by the American Association for the Advancement of Science, which is our sort of central public science organization in America.

Everybody reads those journals because they contain good review articles, but mainly the hottest sort of new research in all fields. They will also include news about new scientific developments not just in science but in education, industry, technology, even this court case, for example.

Q. And do they have a high rejection rate?

A. Oh, yes, they have a very high rejection rate. No more than about 10 percent of what's submitted to them even gets considered for publication.

Q. Now, is there something called -- is it an impact factor?

A. Yeah, there's a -- the Institute for Scientific Information produces a measure of how important journals are basically to the fields. Journals like *Nature* and *Science* have a very high

impact factor. But they're general journals that everybody reads, and they're highly selective.

Some fields are smaller fields, they don't have much of an impact because they're not cited very much simply because the fields are small, but within the fields they might be very important. So you could have an impact factor that is relatively low, but in the field it's high because it's cited a lot for that field.

Q. And the way they measure this impact factor is to see how many times an article from that publication is cited thereafter?

A. That's basically it.

Q. And what journals have you published in?

A. Well, I've published in a lot of journals. My colleagues and I try to -- you know, you always try to go for the best journal in the field that you're writing for the people who would be the most interested in the research.

Sometimes I'm writing about dinosaur footprints, and I might try to publish in a journal that publishes a lot of footprint work. Other times, for example, when we've done our work on how fast dinosaurs grow, learning about this from the fine structure of their bone tissues, we've gone to *Nature*,

we've gone to *Paleobiology*, we've gone to *Journal of Vertebrate Paleontology*, again, sort of the best journals in the field that we can target, depending on the scope and interest of what we're trying to do.

Not all the papers are gems, not all are Nobel prize quality. Sometimes they are very general, and sometimes they're a very specific interest.

Q. Now, I note that by my count, you've got eight pages of peer-reviewed publications listed here in your curriculum vitae. Do you know how many peer-reviewed publications you are either an author or coauthor on?

A. It's 8200. I don't keep a correct count.

Q. And have you included in this curriculum vitae nonpeer-reviewed publications?

A. I believe the copy that I gave the Court may have only the peer-reviewed ones. I have about another eight or ten pages of things like book reviews and popular articles, things in *Scientific American* and stuff like that. But I didn't include all those here. I may have included some of the books that I've authored or edited.

Q. Let's turn to -- I believe it's Page 9. And you've got a heading on books. And you are either the author or the editor or a contributor to these nine

books?

A. Yes.

Q. And just pick one. Tell us about your contribution to, for instance, the *Encyclopedia of Dinosaurs*, and what is that book?

A. The *Encyclopedia of Dinosaurs* was published by Academic Press, I guess in 1997. It's a standard reference work for the field. And my job, along with Phil Currie, my coeditor, was to organize and solicit the contributions to make sure all the relevant entries were covered, to read the manuscripts when they came in from the authors, if they needed changes, to suggest them or to make them.

And, in fact, as it turns out, I wound up writing about a sixth or a seventh of the book before publication just because of filling in the parts that were needed, as inevitably happens with reference works.

Q. And this is a book that would be found in your public library or your school library as a reference text on dinosaurs?

A. Yes. This book is cited by other scientists in their publications. It is in libraries for ordinary people to read. We tried to write it at a level that somebody that would have a general

understanding of dinosaurs would do it. And then for the dino fans and freaks, they're going to pick it up, too, and enjoy it as much as the rest of us.

Q. Now, does something become science or accepted in science because it's published in a book?

A. Well, it depends on the book. When books are published, they may have a seminal influence, but simply because something is published in a book doesn't mean that it's science. I think that that's a question of its reception by the scientific community.

If somebody writes a book and nobody reads it, is it influential? And the answer would be no. And if somebody writes a book but claims it's science and it's not cited by scientists, it doesn't stimulate scientific research and the ideas in it are never brought to peer review, then the answer is probably not much, because we depend on peer-review discussion of ideas and research results in order to further the progress of science.

Q. So anybody can write a book and proclaim that they have a new scientific theory, but the test really is whether it's ultimately accepted by a large part of the scientific community?

A. Yes. And here I think the term "theory," again, has to be looked at the way scientists consider

it. A theory is not just something that we think of in the middle of the night after too much coffee and not enough sleep. That's an idea. And if you have a hypothesis, it's something that's a testable proposition, you can actually find some evidence that will help you to weigh it one way or the other.

A theory, in science, as maybe it's been pointed out in court, I don't know, in science means a very large body of information that's withstood a lot of testing. It probably consists of a number of different hypotheses, many different lines of evidence. And it's something that is very difficult to slay with an ugly fact, as Huxley once put it, because it's just a complex body of work that's been worked on through time.

Gravitation is a theory that's unlikely to be falsified even if we saw something fall up. It would make us wonder, but we'd try to figure out what was going on there rather than just immediately dismiss gravitation.

Q. Is the same true for evolution?

A. Oh, yes. Evolution has a great number of different kinds of lines of evidence that support it from, of course, the fossil record, the geologic record, comparative anatomy, comparative embryology,

systematic, that is, classification work, molecular phylogenies, all of these independent lines of evidence.

Q. We're going to talk a little bit more in detail about some of those concepts in just a couple of minutes. Your expertise has been recognized by professional societies and scientific journals in a sense that you have been an officer or a committee chair on a number of prominent scientific associations?

A. Yes, if that's a measure. My work is published in the organs of scientific societies, their professional journals. I've served as an officer in a couple of societies and committee member, and I've been on the editorial board of a number of peer-reviewed journals in our field.

Q. Matt, if you could turn back to the first page of Dr. Padian's CV under Professional Service. Now, it appears that you've been an editor on the editorial board of more than a half a dozen journals. Can you tell us what it means to be an editor of a journal?

A. It generally means that when manuscripts come in, the chief editor will send them to you either for review yourself or for deciding whether they

should be reviewed by people. Or if you send them out to review, you might gather the reviews from the referees and determine the merits of the manuscript in question.

Often, of course, with general editorial meetings you're looking at where the journal wants to go, what kinds of papers and research it wants to solicit, sort of things like that.

Q. And I note that you've had a couple of stints as editor of the *Journal of Vertebrate Paleontology*. Is that a prestigious journal in your field?

A. That is, in our field of just those paleontologists that run around the rocks and look for the remains of old animals with backbones, yes, that's our primary international scientific organization. *Paleobiology* is probably the premiere journal in the field of paleontology that works on macroevolution, which is one of the things that interests me.

Q. And you were the editor of *Paleobiology* for six years?

A. I was one of the editors on the editorial committee, yes.

Q. And you were also on the editorial board of *Geology* and the *Proceedings* of the Royal Society of

London?

A. Yes.

Q. Dr. Padian, have you had any experience with high school or elementary school curriculum development and teacher training?

A. Yes. Since I've been in California, since the mid 1980s, I've worked in several capacities for the State Department of Education in California on various panels and committees.

Notably, I guess, I was one of the people who wrote and edited the state science framework for K12 schools in 1990. And this is the central document that embodies science education for the state. It's the document against which districts and other organizations will develop their curricula locally.

And my role there was to write about guidelines for the -- explaining what science is, the nature of science, explaining the goals for K12 in the life sciences and for some of the earth sciences and several other parts of that.

In addition, I guess I've served three times on what we call the instructional materials evaluation panel as a scientific member. California is an adoption state, which means that it's one of 23 states for which the state actually selects which textbooks

can be used by local districts and for which state funds can be spent.

And so it's kind of a quality control that educators and content area specialists like scientists or historians or mathematicians will get together and evaluate textbooks and things submitted. And then the question is whether these are -- which ones pass muster and which ones don't, and that's what you can use state funds to buy.

Q. And you've been involved in that for several years?

A. Three times.

Q. And do you have familiarity with creationism and intelligent design?

A. Yes.

Q. And just tell us a little bit about that. What's your history of involvement?

A. Well, California has an interesting history with respect to the creationist movement, I guess we might call it creation science and related fields.

The Institute for Creation Research in Southern California has been very active since the early 1980s and various kinds of legal and social processes that have come out of objections to the teaching of evolution in California have mirrored

what's happened in other states, as well.

And so early on in the 1980s I was one of a number of scientists who were involved in trying to clarify evolution and related science to the public and to advise the Department of Education and other bodies about it and to talk generally to the public about what evolution was.

And these organizations and sort of committees of correspondence, as they were called then, eventually morphed into what became the National Center for Science Education which I've been president of for some years.

Q. I'm sorry, you said you're president of the National Center for Science --

A. National Center for Science Education.

Q. Dr. Padian, can you tell us a little bit about the history of paleontology and its importance to evolution?

A. Sure. Paleontology, the idea that you're finding rocks that have the remains of ancient life in it, has been around actually in some form or another since the 1500s and 1600s when people first started to understand that these were actually the remains of organisms that were dead and not simply sports of nature or some kind of sculptural-looking accident.

The understanding of fossils really began to mature in the late 1700s when people realized that these were the remains of dead creatures that were not coming back, they were extinct. And the upshot of this meant that ideas about the philosophy of nature began to change as the enlightenment developed.

By 1800, you had people in both England and France developing systems of looking at the order of the rocks through time, moving up through a section, that could be correlated from one area to another. The same sequences of rocks were appearing. These were used in England, for example, by civil engineers to dig canals and to show them where reliably they could find the right rocks to dig canals through.

Part of these indications were by the fossils that they contained which also went up in the same sequence every time. And this resulted in the first real geologic map of England, which was produced in about 1800. So we're already talking about using fossils in a very forensic sense, that is, to help dig canals, but using them as an index for mapping geologic -- we call them strata or outcrops all over England. A similar development of the idea was taking place in France at the time and also in Germany.

So the idea that there was a progression of

fossils in rocks from the oldest to the youngest going up through a section of rocks is really quite old. And it was developed, in a sense, that had nothing to do with any ideas about evolution. It was just seen as the progression of fossils through time.

And then ultimately in the early 1800s people began to understand that this reflected an idea of common ancestry change through time and the fact that in the past the world was not like it is now.

Q. And so what you've just told us about is taking place before Charles Darwin published his *Origin of Species*?

A. Oh, yes. Darwin doesn't publish the *Origin of Species* until 1859. The geologic map of England is being done by 1801, and already by 1846 they have a pretty good idea of the diversity of fossils through time.

Q. So was Darwin trying to explain the history of life or the fossil record?

A. No, he really wasn't. Other people were doing that at the time, including people like Richard Owen. What Darwin was doing was proposing a mechanism for how change through time could occur in a lineage of organisms, and he called that natural selection.

He made an analogy with what he called

artificial selection, which is what breeders do every day in selecting plants and animals for the characteristics that we admire or want to use for various purposes.

Q. Now, we've had, I guess, testimony in this case where people seem to be using terms in different ways. Could you distinguish for us the way science uses the term "natural selection" from "evolution of life"? I mean, is there a distinction?

A. Yes. "Evolution," of course, refers to change through time in a general sense. Darwin's own definition is descent with modification, which is probably still the best one.

Natural selection is a mechanism, a process that accounts for a lot of that change, but it needs to be distinguished from evolution, per se, because there are a number of mechanisms, as Darwin noted, including sexual selection, which is another term he invented, a concept that he invented, as he did so many things, and it's just one mechanism for life to change. It's not the whole thing. Darwin was very clear on that in his writings.

Q. And can you distinguish evolution of life, the term "evolution of life," from the term "origin of life"?

A. Sure. And that's a common conflation in popular parlance. Evolution of life is essentially the whole enchilada. It's everything from the first organisms that appeared right up until the organisms that are alive today. That whole procession of things, all the patterns and processes that are involved in it, we would call the evolution of life.

"Origins" is a trickier phrase. The origin of life we expect, as Darwin said in 1859 -- the last paragraph of *The Origin of Species* refers to one or a few forms being the original embodiment of life. But today we look at the genetic material, DNA, RNA, and its genetic components, and scientists reason from this that they are so complex and so similar that they must have had a common origin. And this is the origin of life question.

That's separate if you talk about, like, origin of birds or origin of mammals or origin of the middle ear. Those things are part of the progression of life that's already established. They aren't something new that happens all over again that's, in other words, abruptly or specially put in there. They're just part of something that's already happening that now is modified to become something else.

Q. So as scientists would use "origin of life," that would be sort of first life?

A. Exactly.

Q. Now, it seems that genes and molecules are getting much of the attention today when you're talking about evolution. Is it still important to study comparative anatomy, fossils, geology, paleontology? I guess another way to say it, are you still relevant?

A. I'm a fossil like everybody else. No, genes and molecules get a lot of press, and deservedly so. The research on them has been amazing over the past half century. The new discovery has just come at an incredible rate. They're just revealing all sorts of new things about the world we never could have imagined. We could have hoped we could have known, but we wouldn't have known how.

But, oddly enough, the most recent great advances in biology are coming with the integration of this new molecular evidence with what we already know from comparative anatomy, from fossils, and from geology.

An example I could give you is like the hottest area in biology today is called evo-devo or evolutionary developmental biology. Evo-devo is not a

rock group. And the thing about it is that the whole premise of evo-devo is that we are now understanding a lot more about the genes that actually code for the development of organisms. That is, we know the genes that make you line up in a front-to-back axis and make your limbs sprout and make you have wings instead of hoofs or whatever it happens to be.

These are under the command of a relatively well-organized system of genes that are universal among a great many organisms. And you can even transplant parts of these into other organisms, and they'll work properly, which is really amazing.

And why paleontology and evolutionary biology is relevant to this is because, for one thing, in the fossil record we see a lot of forms that are not present in any kind of shape today. Configurations of hands and wings and skulls that we can see by examination of the genetic structure and functions of development actually are produced in certain ways and they mimic what we see in the past.

So, oddly enough, paleontology, evolutionary biology are coming back front and center to be integrated in this very hot new area.

Q. So is it fair to say that molecular biology today reinforces what you find in paleontology or

integrative biology?

A. Oh, yes. The molecular biology of the 1960s and '70s was very strongly what we would call reductionists. That is, they were looking for the little, tiny workings, because they were able to do so, of genes and structures in the cells and chromosomes, and that was really amazing.

But, you know, in a sense, all that work is figuring out how the carburetor goes, you know, what are all the parts here. But they don't lose sight of and it doesn't change the importance of, you know, how you drive the car, what the purpose of the car is in terms of running down the road and operating on the internal combustion engine. And that's where the evolution comes in.

Q. I want to ask you one other question coming back to natural selection, and you said that is a mechanism for driving evolution.

A. Yes.

Q. And is that a mechanism that is widely supported by the scientific community?

A. Oh, yes. Darwin proposed it at the same time that Alfred Russel Wallace came up with it in 1858. And since then natural selection has been tested in the wild and in laboratory populations by a

great number of scientists. And there are many books written that summarize this research, and the understanding of natural selection is primary to understanding population biology and evolution.

Q. Now, next week an expert for the school district, Dr. Behe, are you familiar with him?

A. Yes.

Q. He's going to testify. And Dr. Behe has claimed that it is not possible to observe natural selection in the fossil record. And is that true, and, if so, is the fossil record relevant to evolution?

A. Dr. Behe and some of the ID proponents characterize evolution, Darwinism evolution, as they call it, as random mutation and natural selection alone. And natural selection is important, but it's not the only process. Random mutation is a whole other problem in language. But natural selection can be observed in the fossil record in a different way than we'd see it in populations.

When Darwin developed his idea of natural selection, he's looking at individuals running around out there. He's saying that an individual horse is going to be able better to escape a lion than another horse. That horse is going to live longer, produce

more offspring with the same characteristics, and those will be passed on to the next generation. So this is an idea about individuals.

Now, the problem is, when we go out to the fossil record, if we have a nice fossil deposit here of snails or clams or whatever it happens to be and you've got, you know, many local fossils, fossil deposits which you can find things like this, you know, we can't tell whether a particular fossil clam was better adapted than the guy who is dead next to him. We can't measure how many successful offspring he had. We just simply don't know. We don't know anything about the reproduction of fossils, individual organisms. And so in that sense, we're not looking at that level of natural selection.

But as everybody knows, we have a concept in evolution called "adaptation," which is sort of the main thing that drives the origination of new sort of types of organisms, the way that they get around in the world. And this notion of adaptation, by definition, is shaped by natural selection.

And my job is to look at macroevolution, and I focus on how new adaptations get going. So I study natural selection all the time in its ramifications for the development and improvement of all these

complex adaptations that click in piece by piece in fossil animals and are shaped and preserved by natural selection.

Q. So the fossil record, in fact, helps to support the whole concept of natural selection?

A. In fact, it's indispensable to it, because we could look at natural selection in populations today, but our compass for looking at populations today is on the order of years, maybe decades, in some cases centuries.

A trend that we see today might reverse itself. It might be just sort of a drift or a random fluctuation, a temporary change, but in the fossil record, you see change through the big time. This is deep time, we call it. This is like mega history.

MR. WALCZAK: Your Honor, I was thinking about taking a break now. It might be an opportune time.

THE COURT: Why don't we do that. Let's take a shorter break than we've been taking so that we can keep moving with this witness. We'll take a 15-minute break at this point, and we'll return with Mr. Walczak's continued direct examination of this witness. We'll be in recess.

(Recess taken.)

THE COURT: All right, Mr. Walczak, you may continue.

MR. WALCZAK: Thank you, Your Honor.

BY MR. WALCZAK:

Q. Dr. Padian, what is intelligent design?

A. As I understand the definition, intelligent design is the proposition that there are some things, natural phenomena in the world that could not have come to being by natural means and that the design of these structures has a certain complexity and certain features that implies that they must have been produced by what is called an intelligent designer by which is understood to mean possibly some kind of unknown forces or a supernatural being.

Q. And how is intelligent design different from creation science?

A. Well, it has some similarities, and it has some differences. Creation science is a movement that flowered mostly in the 1960s and 1970s. And creation science was an attempt by certain conservative Christian people with some science or engineering degrees to attempt to explain Bible stories or to find scientific evidence for Bible stories or explain them in scientific terms, that is, to attempt to justify them on scientific grounds.

Intelligent design doesn't have as its objective to validate Bible stories or any particular religious or creation stories, but what it shares with creation science, in part, is the insistence that things were designed and could not have evolved. And so over 90 percent of the corpus of intelligent design work has to do with basically trying to undermine the evidence for evolution and the concepts associated with evolution and related sciences.

Q. And we're going to spend a good bit of time talking about the undermining attempt, the undermining of the evolutionary science.

As I understand it, the affirmative argument for design, not the criticism of evolution, but the affirmative argument for design is that it looks designed or it's so complicated we can't imagine that it couldn't have been designed. Is that your understanding?

A. That's my understanding, in an informal sense, that that's what they mean.

Q. What's wrong with this appearance of design analysis from a scientific standpoint?

A. Well, it's not particularly rigorous. Lots of things look designed, but they may not necessarily be designed. Intelligent design looks a lot like

science in some respects, but it's only superficial. It doesn't operate according to the principles of science, so the resemblances are superficial.

And appearances can be deceiving. For all the world, it looks like, you know, to us normal people, that the sun goes around the Earth. And for most people, it wouldn't make a difference whether the sun went around the Earth or it went around the moon, as Sherlock Holmes famously said to Watson. But when the renaissance scholars understood, found out that, in fact, the sun does not go around the Earth but the Earth and the planets go around the sun, it changed the way we look at the whole natural world in a very important and fundamental way.

And so part of the process of science is to discover things that will make a difference to our understanding of the natural world and not simply to reinforce appearances that are very difficult to test in an objective or testable sense.

Q. Let's begin to talk about the problems that you have with how intelligent design represents science, and I want to focus on the areas of science within your expertise. What is wrong with the intelligent design arguments against evolution?

A. Well, there are a number of systemic

problems with the arguments about intelligent design.

Q. I'm sorry, Professor Padian, have you prepared an exhibit to help you explain this?

A. Yes. At your request, I've done some demonstratives that I hope may be of use in illustrating some of these things.

Q. Matt, would you put up the first slide, please.

A. There are certain systemic problems with the way that intelligent design represents the scientific findings of the scientific community. And in a sense, it is really just standard anti-evolutionist special creationism. I will explain why it's special creationism in the course of things.

The ways that scientists have problems with intelligent design literature is, first of all, that it provides some misleading definitions of evolution. In doing so, it sets up a straw man. It also distorts some commonplace scientific concepts, and, as a result, it sows doubt in the minds of students who would understandably be confused, as I am, by their treatment of certain fairly standard ideas. When they --

Q. What kind of concepts do they sow doubt about?

A. Well, they begin -- if you want to begin with definitions of evolution, they define micro and macroevolution in different terms. Microevolution they're fine with. That's evolution in populations. It's just genetic variation. And creation scientists didn't have a problem with that stuff, either.

But when we study evolution, we actually look at it on several discrete levels. Microevolution is what happens in populations at the gene level and among individuals in populations within a species.

But then when populations diverge from each other geographically and genetically to the point where they become different species, different lineages that are not going to have a mixed history anymore but separate histories and diverge further and make more new species, we call this process speciation, and it's a different level of consideration than simply what happens in populations, because now you see we have the situation where we're no longer exchanging genes with each other in a population, we're actually looking at two separate or more separate entities that will be that way historically for the future.

Once we start looking at how these new lineages, new species and new species that they give

rise to, interact in the environment, how they change further through time, how they adapt more to changing environmental conditions, we're now at the level that's called macroevolution. And the reason we call it macroevolution is it's just on a bigger level. We're no longer dealing with populations.

Q. And by "populations," you mean, like, people or horses or --

A. Well, like just groups of organisms. Individual organisms within a species are different populations. You can have a population in this valley, a population in that state, whatever it happens to be.

The way that scientists regard this is much like economists look at microeconomics and macroeconomics. Microeconomics is how you run the corner grocery store, you know, what the economic balance is in the small town's economy, how a company works. But macroeconomics has more to do with things like the Federal Reserve, the international balance of trade. The common thing that -- the thread between this is, of course, money. It's all about currency. It's cash at some level.

And with evolution, we've got genes that are very similar because everything is hereditary. It's

transmitted. And the genetic transmission of this works one way within populations when organisms can exchange genes, but when you get above the species level, they're no longer exchanging genes. We're working at different species disporting themselves through time. And then you get the whole process of the evolution of new adaptations and major groups of animals and plants.

And the intelligent design people define macroevolution as a major change that has to happen to make a major group, and they say that this is a completely different process than what happens at the microevolutionary level. And scientists just don't think so.

Q. And are some of the other concepts that they don't quite represent accurately homology and cladistics and classifications?

A. Yes, the basic principles of classification, the principles also by which you can compare organisms in order to say things in comparative biology are very problematic for intelligent design creationists. They have a hard time explaining these in the terms that scientists use. And so a lot of what they do is to try to cast doubt on the very legitimacy of the basis of doing these things as scientists understand them.

Q. I'm sorry, continue. I believe you were on Number 3.

A. One of the problems with the ways that intelligent design creationists present scientific evidence is that they present only part of it. They present the part that might suit their cause, but they really leave out an awful lot of important research. And in so doing, they say that scientists don't know this or they can't know this. And this creates the sense of ridicule for students.

Now, you know, we'll be the first people to admit that science doesn't know everything and can't know everything. But on the other hand, we would like a fair and accurate representation of what we do know.

I would also like to show in the course of explaining some of these things today that most of the claims that the ID proponents make are directly inherited from the old-time scientific creationism claims in the evolution bashing that they do. Many of the same arguments are used, the same kinds of evidence are used.

And, finally, the conclusion that is raised is that if you can mount some kind of alleged evidence against evolution, which is most of what the ID proponents do, as the scientific creationists did,

then this is evidence for intelligent design. In so doing, they set up this false dichotomy or contrived dualism of religion and science that is disturbing to scientists who have religious backgrounds, as well as to those who don't have religious backgrounds because it isn't part of science to do that.

Q. Now, you said that ID proponents mischaracterize evolution as just a starting point. Matt, could you put up the next slide.

A. Yes, calling macroevolution the origin of new types, this is not a definition that scientists would recognize. Macroevolution, as I mentioned, is looking at the patterns and processes of organisms above the level of species.

So we're trying to figure out a lot of the major patterns of evolutionary change, but the origin of new types, again, that word "origins" comes in, and scientists just don't talk about origins in that sort of cataclysmic sense.

The proponents of intelligent design, as you see here embodied in these quotes from *Of Pandas and People*, claim that it's a mistake to claim from macroevolution the status of fact. And, again, this confuses for students what facts mean in science.

In contrast, from *Pandas*, again from Page 99

to 100, they state, quote, that intelligent design means that various forms of life begin abruptly through an intelligent agency with their distinctive features already intact. And this tells you two things, first of all, that everything was already the way it was when things first appeared, so there's no transitions, and that an intelligent agency did this.

Now, that's a perfectly fine idea, but it's not scientific to claim this in advance of any kind of evidence that could be adduced to the contrary.

Q. But in order for this to be true, you have to show that evolution is false?

A. Yes, or at least you have to exclude the possibility of considering it in advance, which is a philosophical rather than an empirical consideration.

Q. If we could go to the next slide. You say that there are other definitions that intelligent design proponents confuse.

A. Yes. I would just like to clarify what we mean when we talk about speciation, macroevolution, which really differs from how it's treated in texts like *Pandas*. We call speciation what happens when new lineages are formed. They diverge from parent populations. That is, from old species new species bud off, if you will.

And this can happen in many different ways. You can have changes in behavior, in structure, in ecological adaptation, in physiology, in geography, and all these things may lead to the historical differentiation of these lineages. That's how we get new species. It's been happening ever since life was first running around on the planet.

Intelligent design proponents claim, for example, in *Pandas* that when speciation occurs, it actually limits variation, and so it's really unlikely that the kinds of changes we see in populations can actually lead to speciation.

I find this statement surprising because there's no evidence that I know of that when a new species forms, that genetic variability is necessarily reduced. It doesn't seem to be the case. Species that are closely related to each other, you don't find one with a lot less genetic variability than another that has ascribed to this process.

And so we regard speciation, in fact, as the raw material for the big changes through time. It's like births in a population are the starting point for populational change and development and the way that new species are formed. Without new species, we wouldn't get any kind of new developments in

evolution.

Q. And that's contrasted with macroevolution how?

A. Well, the macroevolution -- then the speciation becomes the raw material for macroevolution, because macroevolution would be the study of what happens to those species after they're formed and as they deploy themselves through time, space, and ecology.

Q. And, Matt, if you could turn to the next slide. And you're familiar with the textbook *Of Pandas and People*?

A. Yes.

Q. And do you believe that *Pandas* is a good representation of intelligent design theory or thinking?

A. I think it is. And I believe that the ID proponents also attest to this.

Q. And here we have a slide. We pulled out a passage from Page 85. This is what they say about speciation?

A. Yes.

Q. And could you read the highlighted passage?

A. The whole thing?

Q. Please.

A. It says, Does speciation fit with the theory that species were originally designed? If the intelligent design explanation is true, there may be species on the face of the earth that have undergone no substantial change since their beginning. On the other hand, the idea of intelligent design does not preclude the possibility that variation within species occurs or that new species are formed from existing populations as illustrated by the previous discussion of squirrels. The theory of intelligent design does suggest that there are limits to the amount of variation that natural selection and random change mechanisms can produce.

Q. So according to intelligent design, speciation is what?

A. Well, speciation is, for them, mostly unlikely on the basis of the kind of genetic variation that occurs. They're happy with genetic variation occurring within species. That's perfectly okay with them. That doesn't lead to much of anything. They say that speciation can occur, but it doesn't involve new innovations and that some species have not changed since their beginning. Now, we'll have to examine what we mean by "some."

But they do state that the known natural

mechanisms are too limited to account for the important biological change and the adaptive diversity that we see through time.

Q. And if science's concept of speciation is, in fact, accurate, then that would mean that there's no abrupt appearance of organisms already intact?

A. Well, it certainly would mean that we are not finding new complex adaptations appearing all at once in major groups of organisms with no possibility of their evolution step by step from other kinds of creatures out there, and that's a point on which books like *Pandas* is quite adamant. They consistently say this does not occur.

Q. And is this argument from *Pandas* and by intelligent design proponents similar to the argument that creation scientists made?

A. Yes. It's quite similar in its ramifications.

Q. Could you put up the next slide, please, Matt. Could you tell us what this is, Professor Padian?

A. The slide is some text from a publication from the Institute for Creation Research called Impact Number 43 by Duane Gish. Duane Gish is vice president of the Institute for Creation Research, a famous

creation scientist speaker who has been giving presentations against evolution for several decades now.

And what I'd like to show by this quotation included in the record is that the ideas of intelligent design reflect exactly what special creationists, what scientific creationists, so-called, were saying decades ago.

Here, for example, outlined in yellow on the top paragraph, Duane Gish says that natural selection would be powerless to generate increasing complexity and to originate something new or novel and thus powerless to change one kind of animal into another.

Now, by that is understood, at least, the basis of speciation, and this is very close to what the *Pandas* text says, and I think the idea really conveys the same message. In the bottom paragraph, Mr. Gish notes that such a process could only produce variance within an established kind and could never produce new and novel structures.

Q. I want to start talking about some of the areas of evolutionary biology and evolution that *Pandas* discusses and get your understanding of whether they are accurate representations of current scientific thought.

I've asked you to pick several examples out of *Pandas* where you believe that they do not accurately represent the science. And does the first one involve something called cladistics?

A. Yes. I wanted to talk a bit to explain, if I could, the basis for classification in science.

Q. And when you say "classification," what do you mean by that?

A. I mean precisely how we study the relationships of organisms. The basis of classification, since Darwin, has been the relationships that organisms have to each other.

And the concepts of how classification is done, how we, in other words, understand and construct the tree of life, the whole idea of who ancestors and what ancestors are and the relationships of organisms to each other are problems that works such as *Pandas* really do not reflect accurately the way that science understands these processes, procedures and methods.

Q. And have you prepared a demonstrative exhibit to help explain this?

A. Yes. I'd like to do just a basic showing of what some of the principles are, if I could have the next slide to talk about that. In their texts, intelligent design proponents either do not understand

or they don't accept how scientists establish relationships among organisms because most of this is left out of what their discussions are.

Despite a lot of popular impression, when we try to establish relationships among living and extinct organisms, it's not a never-ending search for direct ancestors. We don't go out in the fossil record, I don't go out looking for dinosaurs or whatever I'm doing in the summer in the field season looking for the ancestor of something else I know. I don't expect to find a direct ancestor of anything. The chances of that are really small. But I want to show you what we do try to look for.

Paleontologists, in other words, are not searching the rocks for the missing links. Instead, when we, like all biologists, establish organisms, living and extinct, whether we work on bacteria or mosses or hoofed animals, it doesn't matter, we all do this according to the same methods in biology, and it doesn't matter whether we use molecules or fossils.

What we do is we look for shared characteristics. These are uniquely shared characteristics shared by certain organisms and not others. And by identifying these characteristics, we identify the pathway of evolution, that is, the order,

the sequence, the genealogy of evolution. We want to find out who is most closely related to whom.

And the reasoning is that if an organism acquires a new trait and passes it on to its descendents, then those descendents will be more closely related to each other because they possess that new trait than anybody else in the world will be. And that's the principle that we use.

And this is a fairly simple concept to get across, and it's revolutionized the way that people do what we call systematics or to assemble the tree of life. But, in fact, this began in the 1960s and 1970s, and so for decades it's been the standard.

There are two concepts of ancestry that are important to point out here. One is lineal, and the other is called collateral. Lineal ancestors are the ones that are directly in your path, that is, your parents, your grandparents, your great grandparents, your great, great, great, and all the times you can say great, those are your direct ancestors.

But collateral ancestors are a little broader than that. They would include your aunts and uncles, your great aunt, your cousin twice removed on your mother's side, and that guy with the funny hat in the civil war picture on the wall in the dining room,

whatever it happens to be. These are what we call collateral ancestors. They are individuals who are not directly in your ancestral line, but they still share so many of your features that they can tell us a lot about who you were -- who you are.

If you know, for example, that your family came from Sweden in the 1800s, you can return to Sweden to the approximate place where they came. Maybe you can't find their bones in the church yard, but you can find the relics and the remains and the museum's evidence for many other aspects of their culture and their biology. You know what they ate, you know what they wore, you know the language they spoke. You may know from photographs and drawings what they looked like, what their features were. You may be able to recognize your ancestral features, as well. All these things are properties of collateral ancestors, not just lineal or direct ancestors.

So when we look to assemble the relationships of organisms, we don't have to find every direct ancestor. In fact, in the fossil record, it's really hard to say that somebody was anybody's direct ancestor, as I mentioned before with the fossil clams. We don't know what offspring any individual left. It's too hard for us to figure out. But we can

still tell a great deal about it. And this is how we assemble the tree of life.

The next slide I have here is a preparation of a kind of diagram that we call a cladogram. And it's very similar to a phylogenetic tree, that is to say a tree of relationships. But the logic of this, I want to point out, is not something that's arbitrary. It's not simply assembled by art or by anything that's subjective. Rather, it is a diagram that reflects the grouping of organisms according to these new evolutionary features, these shared characteristics I mentioned before.

And if you can see the red marks along this -- the basic spine of the hat rack running from the lower left to the upper right -- these things always look like hat racks to me. I don't know what else you'd describe them as. But each one of those red bars represents a feature that was a new evolutionary feature that we reasoned was a new evolutionary feature because it suddenly is something that now all the animals above it share and the animals below it do not share.

So, for example, at the top here, the human and gorilla are united by a great many features, and we've only listed a few here because it would just

really crowd things, and I think it's fairly obvious. Things that the human and gorilla share are a prehensile hand and a large brain. That is not the case for the cow, the lion, the marsupials, and the other animals on this slide.

We reason that on the basis of this and many other shared characteristics that these features were inherited from a common ancestor. It's the best natural explanation we can come up with. And as we go down this diagram even more, what we find is that at each juncture -- and if we can just stop it there for a second -- we find an increasing number of things that all these groups have.

And so if you look at the level put here on the chart that's indicated, there's a shared feature called an amnion, which is a property of one of the membranes of the egg around the embryo, that is shared by birds, marsupials, and placental mammals, but frogs and sharks and fishes don't have it. And so these hierarchically nested sets of features are the logical structure by which scientists establish the relationships of life.

Q. I'm sorry, Professor Padian. Matt, if you could go back just a couple of slides. So you talked about how -- and I guess we read from left to right up

the line is how you read this?

A. Well, all we can say is this is a depiction of how all these organisms are related. We don't look on this as a ladder of life. We don't look at it as fish give rise to frogs which give rise to birds. It's not like that.

Q. But, for instance, where you have the stirrup-shaped ear bone --

A. Yes.

Q. -- and you have that line, so it would be the organisms above that that share that particular feature?

A. That's correct. That would be something that unites them to the exclusion of all the other critters on the slide. And that's the logic of cladograms, pure and simple.

I'd like to stress that we can use physical features like this, we can use them on fossils or on living animals, we can use them on molecules or we can use them on skeletal features or egg shell proteins or anything else that we want to do. Whatever works, we use. It's very practical.

Q. And is this a -- could you say it's a universal approach used by scientists?

A. Since the 1960s, it has become the dominant

form of understanding relationships in the scientific community around the world.

I would go so far as to say that if you were going to apply to the National Science Foundation to ask for money to work on the classification of a group of organisms, whether it was dinosaurs or a group of bacteria or mosses or liverworts, you would have to show the review panel that you understood the principles that I'm discussing here and that you were going to use this kind of analysis in your work if you wanted to convince them that you knew what you were doing.

Q. And is this method somehow validated quantitatively or statistically?

A. Yes. And I'm glad you raised that point, because I've only put a couple of the features on this chart. But, in fact, there are hundreds that are represented in this analysis. And it's obviously too many for us to arrange by hand.

And so all the characters that we're talking about and all the animals that we're trying to analyze, we have ways of putting these into a data matrix and asking the computer essentially to sort this out for us to produce the simplest to the most, basically, complicated trees that you could possibly

get. And we try to start with the simplest trees for further work, which is a principle in science called parsimony.

Q. And do intelligent design proponents use this type of cladogram?

A. I haven't seen them use any type of analysis like this in any of their works.

Q. And if you could advance to the intelligent design slide. Is this a copy of a chart found in *Of Pandas and People*?

A. Yes. This is Figure 4 from *Pandas*, second edition.

Q. And can you tell us what this is?

A. Well, the caption says that it's the pattern of phylogenetic origins, according to the face value interpretation of the fossil record.

Q. And can you make heads or tails of this?

A. I have trouble. I'm not sure -- I guess I understand that time is the axis from top to bottom. That's perfectly fine, although there are no particular periods listed. I understand that they're looking at variation in morphology, and that's perfectly fine. But there are no names of organisms there, so I don't know exactly what they're talking about.

Also, the presence of these bars as straight bars without variation suggests quite strongly that organisms suddenly appear quite recognizable as what they are and do not vary in morphology all the way up through the geologic column until they peter out.

Q. So this chart would show that there's abrupt creation and then there's no change in those organisms throughout their lifetimes?

A. That would be the face-value interpretation that they say the fossil record shows. Now, I just want to point out that this implies that there is no substantial change in any fossil lineages because they have drawn only bars that go straight up with no change, no diversification, no anything.

Q. And if you represented a classification system in a grant application to the National Science Foundation like this, you don't believe you would get a grant?

A. Well, no, but, of course, this is not meant to represent any kind of research, it's meant to be a didactic device for teaching. I should also note that if we're talking about phylogeny in relationships, this wouldn't qualify because it doesn't draw any lines between those lines. It doesn't admit the possibility that any of those lines evolved from any

of the others.

Q. I'm going to talk about the use of the term "irreducible complexity" and "adaptational packages" as it's used by intelligent design proponents.

Can you explain to us how *Pandas* uses the term "adaptational packages"?

A. Well, the last slide showed you lineages of organisms that seem to have a sudden appearance and no substantial change during their histories and of no relationship to any other lineages in this diagram.

This suggests quite strongly, and the *Pandas* authors are making this point, that organisms that they regard as major types of organisms suddenly appear with all their major features intact and that they do not change. These are characterized in works like *Pandas* as adaptational packages, which they say cannot be separated into simpler components without destroying the functional advantage that they provide to the organisms that have them.

And so these adaptational packages for ID proponents represent the concept called irreducible complexity, which means that they can't evolve by known natural means, they're too complex to do so, and so they must be specially created by a designer.

Q. Now, that term "irreducible complexity," is

that one, to your knowledge, that's found in *Pandas*?

A. To my knowledge, the exact words are not found in *Pandas*. I believe the first place where that is really brought out as a major term is in Michael Behe's book *Darwin's Black Box* in 1996. But in 1993, when I believe Professor Behe was working on the second edition of *Pandas*, these concepts are brought out in the second edition of that text.

Q. So Dr. Behe's concept of irreducible complexity is contained in *Pandas* even though that term is not used?

A. Yes. And before, even in the first edition, these adaptational packages are represented. They are essentially one of these ideas that, again, has a long pedigree, that there are such complex forms out there they couldn't possibly have evolved. We've heard these arguments since the 1800s, so they do have a long history.

Q. Perhaps you could help explain to us these adaptational packages and irreducible complexity.

A. Well, there seems to be some conflict among the ID proponents about this. Dr. Behe claims that irreducible complexity applies only to cells and molecules, and that's his specialty, of course, he's a biochemist, and that it does not apply to adaptive

features in organs or to major groups of organisms.

But if you look at the whole corpus of intelligent design work, including *Pandas*, on which Dr. Behe worked, the implications of irreducible complexity are extended time and time again to large-scale tissue and organ adaptations and, indeed, to whole organisms.

And so if we're going to accept this, we have to accept that Dr. Behe had no knowledge that his coauthors were going to take his concept above the cell and molecular level, or irreducible complexity is, in fact, not only a molecular concept and we cannot accept Dr. Behe's view on that point.

Q. And have you identified an example to show how this irreducible complexity does apply above the molecular level?

A. Yes. I'll give a number of them from *Pandas* just to show that they actually are there. The next slide, I believe, shows several quotations from *Pandas* that indicate that it applies to levels above simply molecules. A quote from Page 72 indicates that multi-functional adaptations where a single structure or trait achieves two or more functions at once. This is not restricted to the cell level.

A quote from Page 71 talks about, quote, the

total engineering requirements of an organism like the giraffe, unquote. So here they are talking about the whole organism, a giraffe, not simply a cell or a molecule.

The quote from Page 66 says, quote, It has not been demonstrated that mutations are able to produce the highly-coordinated parts of novel structures needed again and again by macroevolution.

Now, recall here that macroevolution, to intelligent designers, is the origin of new types of organisms, not of new cells, not of new molecules. So they are really looking at the large-scale structural tissue, organ, individual organism level. And, finally, the quotation from Page 25, which I believe is maybe even repeated more or less on Page 99 --

Q. So that's not an error, that is on Page 25?

A. Oh, yes, it's 25, as well.

Q. And this is from the introduction, overview of the book?

A. Yes, it's from the overview of the book. It says, quote, that design theories suggest that various forms of life began with their distinctive features already intact, fish with fins and scales, birds with feathers, beaks, and wings, et cetera. So they are talking about various forms of life, not molecules,

not cells.

And here's an example, just to show you a page from *Pandas*, that does this with respect not to the giraffe as a whole, I've already showed you how they've dealt with the consummate engineering requirements of the giraffe as a whole, but this is just a set of structures in the giraffe's head, neck, and brain.

Q. And could you identify the figure and page number?

A. Oh, yes, I'm sorry. This is Figure 2.5 from Pages 69 and 70.

Q. And that's in *Pandas*?

A. In *Pandas*, second edition. And so they are talking about an adaptational package in the caption that protects the giraffe from hemorrhaging in the brain. And this is all perfectly reasonable. Pressure sensors along the arteries, muscle fibers in the artery walls, heavily valved veins, and the arteries that approach the head they say correctly branch into what's called rete mirabile, which is a network of capillaries that prevents the brain from exploding when it gets a flood of blood coming up to it suddenly.

These are correctly understood by

physiologists as part of an adaptation of the giraffe, but I just want to point out here that this is not a discussion of cells and molecules, this is a discussion of tissues and organs.

Q. Now, I want to turn to the fossil record, and I've asked you to identify from the book *Of Pandas and People* various examples where they claim that certain types of organisms could not have evolved naturally.

Can you show us where you believe that *Pandas* misrepresents the science? I believe you want to start with the Cambrian explosion?

A. Well, I'd like to start with a few examples that are of some concern to scientists because the representation of the science in these pages is really quite different from what scientists understand and understood when *Pandas* was written.

The next slide, I guess, starts with several quotations from *Pandas* about the Cambrian explosion. Now, I should explain that what is meant by the Cambrian explosion is a sudden appearance of organisms that are shelled marine organisms within a geologically rapid time, relatively speaking, 10 to 30 million years as the smallest possible increment, which seems like a long time to us as humans. If my

testimony goes very long, I think it's going to seem like several million years, but --

THE COURT: You're doing fine so far.

THE WITNESS: You know, time to paleontologists means something quite different than it means to ecologists and normal people. But these organisms appear over 500 million years ago. And we find records mainly of these shelled sea creatures, marine invertebrates we call them, snails and clams and their relatives back in that time.

Before this the record is a bit more difficult. It preserves different kinds of fossils that are a little bit harder to suss out. And this has been a really interesting area of study for paleontologists, biologists, geochemists, geophysicists for many, many years.

The way that *Pandas* treats this is to say that organisms appear with these adaptational packages intact at the Cambrian boundary, multicellular life first flowers here. No evidence whatsoever of fossil ancestors.

BY MR. WALCZAK:

Q. Now, I'm sorry, is that a direct quote from *Pandas*?

A. This is a direct quote from *Pandas*, Page 71

and 72. They go on to infer directly that only an intelligent designer could do this. They state, on Page 94 and 95, that the great majority of these animal phyla, by which is meant sort of these major groups of invertebrates, the arthropods and the annelids and the echinoderms and the mollusks and so forth, brachiopods, appear in a remarkably brief period of time, again, 10 to 30 million years.

We'll have recourse to that 10 to 30 figure in a second. But they say they're not connected by evolutionary intermediates, and there's an unexpected lack of fossils bridging the evolutionary distance between these phyla to document evolutionary origins for them.

Q. What does that mean?

A. I'm not sure. There are some code words there. I would agree that the fossil record is not complete. It will never be complete. On the other hand, how many intermediates do you need to suggest relationships, and what do you accept as intermediate?

And in the previous paragraph, there is some text that's even more worrisome because they say that these are adaptational packages that appear at the Cambrian boundary, by which they mean the boundary between the pre-Cambrian and the Cambrian. They say

that multicellular life first flowers there, whatever that means, but they say there's no evidence whatsoever of fossil ancestors.

Q. And is that true?

A. Well, I think the record will show us something different. Before we go to the next slide, however, I want to point out at the bottom that after talking about phyla, groups of phyla, these major divisions of animals that are apparently having no bridges between them and no ancestors, they then go on to say that categories of classification are largely artificial human groupings.

I would agree with that, but it contradicts what they say in the previous passages, because if you treat phyla as somehow real entities that you cannot bridge, then how can you also say that these categories are largely artificial?

The next slide shows a bit of this pedigree, again from scientific creationism. A quote here from Henry Morris, who is head of the Institute for Scientific Creationism outside San Diego, from his textbook of more than three decades ago claiming that all of these kingdoms, phyla and classes unchanged since life began, that things appear suddenly, no incipient forms leading up to them. There may have

been changes within kinds, but they haven't varied since the beginning except for those that have become extinct.

Q. And that's what Henry Morris said?

A. That's what Henry Morris said as a scientific creationist. This language is, I think, identical to what you see in *Pandas*. And, again, the statement from *Pandas* that I just read is below that.

Q. And that's from Page 71 and 72 of *Pandas*?

A. Yes.

Q. And is that accurate?

A. Is it an accurate representation of science?

Q. Yes.

A. I believe it's a little more complex than that. The next slide is another quotation from Duane Gish, who we've seen before as the vice president for the Institute for Creation Research. Duane Gish is talking about the Cambrian geological strata, a sudden great outburst of fossils, and he says that what is found in rocks supposedly older than the Cambrian, that is, in the so-called pre-Cambrian rocks, he says not a single indisputable fossil, unquote. This is very reminiscent of the language we've just seen in *Pandas* where they say there aren't any ancestors.

And if I could show the next slide. This

quotation, also from *Pandas*, implies quite directly that there are no chains of fossils leading from lower organisms to higher ones. They stress that we can only accept evolution if we assume that only natural causes were at work to explain these things.

But then they say there's another possibility that science leaves open to us, and that is that an intelligent cause made fully formed and functional creatures which later left their traces in the rocks. This is as close a definition as I could come to special creation. I don't see how else you could interpret that as the possibility that natural processes could have gotten you from one form to another.

Q. And you are just quoting from Pages 25 and 26 of *Pandas*?

A. This is Pages 25-26 of *Pandas*.

Q. And what is this slide, Professor Padian?

A. This diagram comes from Page 95 of the second edition of *Pandas*. It's Figure 4.2. I can best describe it by the caption provided, their own caption, which says, This is a generalized schematic of the fossil record that's designed to show the Cambrian origins of nearly all animal phyla. Dotted lines represent the presumed existence of phyla, not

the fossil record.

Again, I'm not sure what this chart is meant to represent, because what students are not being shown here or, indeed, any readers, there's no real time scale on here, so the implication clearly is that the vast majority of these things appeared all at once at the Cambrian/pre-Cambrian boundary. Boom, there they are. And if you look at that line below the Cambrian, where it says pre-Cambrian, there is no record whatsoever. There are no fossils as far as they're concerned.

They say in the caption this is a generalized schematic of the fossil record. They don't tell you which animal groups they're talking about, and they don't give you any idea that there could be any possible relationships among these organisms.

And so the question of whether that's an accurate depiction of the fossil record may be illustrated by this diagram from Kevin Peterson and his colleagues in *Paleobiology* earlier this year.

Q. I'm sorry, what is that text?

A. *Paleobiology* is a peer-review journal in our field.

Q. And that's 2005?

A. 2005. What the authors have done here is essentially to turn the rock column on its side, so time is now going from the lower left to the lower right as we move up into the Cambrian early and late. And you can see the boundary here between the Cambrian and the Ediacaran period right before that.

Q. Professor Padian, you have a pointer, a laser pointer there. It might be helpful to show that.

A. Okay. We'll see if it works. I can see that there. Okay, I can kind of see it myself. I'm not sure if that's visible to you.

THE COURT: We can see it.

THE WITNESS: Okay. The dark bars here, the dark black bars, are the actual fossil records of organisms. The gray bars you see here, these are cases where there are fossils that are supposed to be this old, but they haven't been verified yet.

The lighter colored black bars here are inferred existences that are inferred by a different line of evidence. These red boxes with numbers in them are dates by which scientists estimate when the divergences between -- that is, the separations between lines like this took place, the annelids and the mollusks.

You may ask, how is this done? And the answer is, well, molecular biology looks at the configurations of genes on chromosomes. By lining up the genes, the sequences of the genes are homologized and matched up with each other, and the closest matches and the more derived similarities, the unusual features of evolution, tell us which groups are most related to which.

Now, in the *Pandas* diagram, all of the names on the right-hand side in these various colors, the names of the major groups of organisms were not given, and there was no indication that we had any idea that these lines could be related to each other.

But, in fact, we had morphological ideas based on fossils, on embryology, and on the shells and tissues of these animals. Molecular biology has now come through with a whole other wealth of data. And this is --

BY MR. WALCZAK:

Q. I'm sorry, in the red boxes, those are dates?

A. The red boxes are numbers that are estimated dates of when each of the lines in question would have separated from each other based on how much their molecules differ or resemble each other.

Q. So that would be the age of the fossils?

A. That would be the age of the splits of the lineages. The fossils may not extend back that far. Sometimes they get nearly that far, and sometimes they don't.

The fossils are represented by the little purple boxes below the slide here. There you see the purple boxes at the bottom. And, for example, here at about 600, we have listed the oldest metazoans. Metazoans are multicellular animals with several distinct tissue layers, so they would include actually all the animals here on this slide except the bottom two, and the bottom two, as their names suggest, are sponges.

And it turns out that the molecular date shows a divergence time at about 604 years. The oldest metazoans are dated, estimated in the fossil record at this date, as well.

Q. I'm sorry, you said 604 years. That's 604 million years?

A. Million years, yeah. The next slide I think will give an indication of not so much the relationships of these organisms, but of the fact that, indeed, before the so-called Cambrian explosion, there was a lot of evolution.

For example, the Cambrian explosion listed here in yellow -- and I'm not sure if I can make this -- yeah. The Cambrian explosion here of skeletonized animals is seen by scientists as really mostly a preservational artifact, although a lot of evolution is going on. But this is the point in history in which a lot of skeletons begin to be preserved, where before this we're not getting that much.

So the Cambrian explosion here is occurring along this yellow bar from about the Cambrian boundary well up into over 520 million years ago. It's not a single abrupt process but rather it's a process that takes quite a long time.

Even after this so-called Cambrian explosion, there are amazing preservations of fossils, soft-bodied critters that show us remains that we don't find earlier just because they're not preserved. It's very difficult to preserve fossils.

And at this Cambrian boundary where, according to works like *Pandas*, there are no fossils before that, there are no transitions, there are no possible ancestors, well, one of the things I pointed out before is that, you know, we're not always looking for direct ancestors, we're finding things that have

the same features as the organisms that we're trying to understand the relationships of.

And so this pre-Cambrian record is actually quite interesting. We have fossilized animal burrows, and the burrows of these animals go in sort of all sorts of curvy lines and wavy lines that indicate that the animals were proceeding front to back, so they were what we call bilaterian, that is, two-sided things like us, like snails, like worms, like things that are -- have a left and a right side. This is the way they walk.

So even though we didn't have their shells or other remains of them, we have their burrows that could only have been made by complex metazoans that were also bilaterians, that is, two-sided animals. We can even go back --

Q. I'm sorry, and those have been dated before the Cambrian boundary?

A. Oh, yes. Everything that you see at the Cambrian boundary is over 540 million years old, and these are things that are still older than that.

Q. And on the right-hand side of this slide, there are several photographs. Can you tell us what those are?

A. These are photographs of the actual fossils.

This is the actual fossil evidence that is preserved. These are taken from, in some cases, peer-reviewed books and journals and in some cases Web sites where the specimens are well known from other sources.

I want to point out that at about 590 million years there's a little dot there where it says "fossil metazoan embryos" at the bottom of the slide, and there's a picture of one of them.

This is a really amazing find because it shows us that some 50 million years before the Cambrian boundary and even longer before some of the Cambrian explosion took place, we have evidence of metazoan embryos. By that we mean the embryos of organisms that belong to one of the groups I showed in the previous slide.

How do we know this? We know this because the embryos themselves have characteristics of metazoans. They are not simply one-celled organisms. And if there are these embryos then, then there are metazoans present. That doesn't mean that there are full-blown trilobites and snails and brachiopods and so forth, but it does mean that there was some kind of metazoan life.

Q. And is this well established in science?

A. Oh, yes. It's the subject of countless

articles and books and papers. And a few of them just are here, along with a recent book by Jim Valentine, who is emeritus professor in my department, member of the National Academy of Science, and one of the four or five most important paleobiologists of the last century, and he treated this problem and all its ramifications in depth.

Q. And if you could just read the titles and the journals from which they came into the record.

A. The top one is, *Fossils, Molecules, and Embryos: New Perspectives on the Cambrian Explosion*. This comes from a journal called *Development*.

Now, *Development* is about developmental biology. Would you expect to see fossils in developmental biology? Well, as I said before, this is the new age of integrative biology. Fossils are really important to all kinds of evolutionary study. They're incredibly indispensable to this sort of work.

A paper below that from *Integrative and Comparative Biology*, which is, again, not a paleontological journal, by Nick Butterfield called, *Exceptional Fossil Preservation and the Cambrian Explosion*, because we see this as a problem of preservation, not just of quick evolution. Both things are going on here.

And, finally, below in a journal called *Molecular Phylogenetics and Evolution*, again, not a journal you'd think the average rock hound would be publishing in, but we have *Current Advances in the Phylogenetic Reconstruction of Metazoan Evolution, a New Paradigm for the Cambrian Explosion*?

And these are all journals and articles that show the integration of molecular techniques with the fossil record, with developmental biology, and this is why it's one of the most exciting areas you'll find.

Q. And so the statements you've read to us a few minutes ago about the way *Pandas* characterizes the Cambrian boundary and says that there are no fossil ancestors before that boundary, that's not supported by the state of science today?

A. Well, as we can see, there are some metazoans that appear well before the Cambrian boundary. If you are looking for direct ancestors, if you insist on an unbroken stream of intermediate fossils to document a case, I'm afraid that that's going to be difficult to get under any circumstances, but it's also equally impossible for the historical record of humans.

If we had to come up with evidence of every one of our direct linear or collateral ancestors and

know everything about them, it would be impossible, yet we don't question the parentage of our friends and neighbors because they can't do that.

Q. Now, we talked about the evolution of invertebrates. Can you talk to us about how *Pandas* portrays the evolution of vertebrates?

A. Yes, I would like to talk a bit about some of the major transitions that are discussed in *Pandas* that relate to backboned animals, which are closer to home, as far as we're concerned, because we belong among the backboned vertebrates. The text from *Pandas* says that fossil types are --

Q. I'm sorry, are you quoting?

A. I'm quoting from Page 22. Fossil types are fully formed and functional when they first appear in the fossil record. For example, we don't find creatures that are partly fish and partly something else leading to today's fish.

They say, Instead, fish have all the characteristics of today's fish from the earliest known fish fossils, reptiles in the record have all the characteristics of present-day reptiles, and so on. This is, again, the abrupt appearance theory, sudden appearance complex adaptive packages, irreducible complexity argument.

Q. So this says fish were formed intact?

A. Yeah, pretty much, yep. Here is their treatment of amphibians.

Q. And this is a slide from Page 104 of *Pandas*?

A. Page 104, yes. They say at the upper left column, Darwinists believe that the first amphibians evolved from early fish. "Darwinists believe," that's problematic language. It suggests to students that these are just matters of faith without any evidence. And for myself, I'd prefer to reserve matters of belief and faith for things that are not tested empirically.

The *Pandas* authors say in the next paragraph that if Crossopterygians, by which they mean the fish-like things, really did evolve into amphibians, by which they mean the first animals that came on land, tremendous changes must have taken place. Fins must have been transformed into four limbs, the skull had to change from two parts to a single solid piece. The hipbones had to enlarge and become attached to the backbone. Numerous changes must also have occurred in other soft tissues and so on.

They say in the next paragraph, How many different transitional species were required to bridge the gap? Hundreds even thousands? We don't know, but

we do know that no such transitional species have been recovered.

Q. The next slide, is this a diagram from *Pandas*?

A. This is a diagram from *Pandas* of two forms from the fossil record. Eusthenopteron, which they take to be a fish, and Icthyostega, which they take to be an amphibian. Eusthenopteron doesn't look much like any fish you know. Neither does Icthyostega look much like any living amphibian. But in naming them like this, the editors, authors of *Pandas* are really giving them assignments to different whole groups of organisms and suggesting that the transition between them would be very difficult to achieve.

Certainly there are differences between these two skeletons. There are differences in the way they're drawn, as well as many features of their specimens that we find in the fossil record. And the next slide --

Q. I'm sorry, and that was from Page 103 of *Pandas*?

A. Yes. We've prepared some slides that show a bit more accurately the way that scientists understand this fossil record. What we've done here is to take the text from *Pandas* on Pages 103 and 104, but to

illustrate our illustration of some of the major fossil animals that are known that move from aquatic, fish-like critters, up into the first animals that appear on land.

We're including in this Eusthenopteron, which is the second guy from the bottom left, and Icthyostega, which is three more guys up to the right from him, which are the two animals you saw in the last slide in *Pandas*. *Pandas* is giving you two animals and inviting you to draw contrasts between them. What we'd like to do is show the evidence that scientists have to show comparisons and to show the transitional features that the *Pandas* authors say do not exist.

So, for example, the text in the upper left taken again from *Pandas* insists in blue that no transitional species have been recovered.

Q. Could you read that please, that quote?

A. It says, How many different transitional species were required to bridge this gap? We don't know, but we do know that no such transitional species have been recovered.

Now, here, of course, we're going to focus on what are you defining as a transitional species? Does it have to be a direct ancestor, does it have to

be intermediate in all features? Do you have to know that it had the same genetic antecedent composition and therefore could only have been the great, great, great, great, great, great grandfather of the next animal along the way?

That seems like a very difficult standard of evidence to live up to. We can't do that with humans most of the time, and I'd be surprised if we could do it with animals that are 350, 400 million years old.

The next slide looks a lot like the one you just saw. The *Pandas* authors say in blue that there are two large gaps in the fossil record that we're talking about here. One is between ordinary fish and Crossopterygians, what they would regard as the organisms that are closest to the land animals, and an even larger second gap between these lobed-finned fish and amphibians, again, the transition to life on land.

This slide just points out where the ray-finned fish are on the left. Ray-finned fish include the 25,000-odd species of fish that live today that we would all think of as fish, that is, tunas, trout, salmon, monkfish, angler fish, catfish. It would not include sharks, for example, which are cartilaginous animals. And it doesn't include any of the animals you see running along the right side of

this slide. No one thinks that an animal like a trout directly gave rise to an animal like a frog.

Q. When you say "no one," no one in science?

A. No one in science, but I don't think any creationist obviously wouldn't think so, either. But scientists don't think this. Rather, we find that ray-finned fishes, this great radiation of 25,000 species today reaching back into the remote past, have a long history that's independent from the other watery creatures, so to speak. And, in fact, their histories are quite separate.

The two little crosses below the ray-finned fish and the two little crosses to the left of the lungfish are representations of two pairs of fossil species are that listed on the right-hand side. We call them stem taxa because they are ancient relatives. Their names here, just for a couple of examples, Moythomasia and Howqualepis. The names are really unimportant. And on the other side, Psarolepis and Achoania. Again, the names are unimportant.

But it just goes to show you that we have extinct relatives outside the lungfish. We have extinct relatives outside the ray-finned fishes that indicate that the ray-fins are not directly ancestral to the lungfish and all the other animals on the right

side. They are rather a separate evolutionary branch, and they have been since way back in the Devonian, 400 or so million years ago.

The next slide talks a bit about another transition here where the *Pandas* authors note that fins must have transformed into four limbs, which is certainly fair enough, but they say that no such transitional species have been recovered.

Well, again, here is this cladogram that you see here. And I want to stress, as I did before, that the cladogram in question, that is, the way that we have -- the way that we have developed the relationships of the lungfish, the Eusthenopteron, Panderichthys, and all the other animals on this slide are not just based on a couple of features, they're based on dozens and dozens and dozens of skeletal characters of which we're only going to show a few. But this is backed up by a lot more evidence in peer-reviewed publications that I'll show you at the end of this.

The *Pandas* authors say that no such transitional species have been recovered, but, in fact, we have indications here, beginning with Eusthenopteron, of a limb that is a very interesting limb with branching bones in it.

Q. I'm sorry, the photograph just below the blue text on *Pandas* there, what is that?

A. That's a photograph of a limb of Eusthenopteron. And you'll have to excuse me, I'm showing you some Paleozoic road-kill. That's the best way I can describe it. It's pretty ugly. But I wanted to show you the actual fossils so you could see that we have them and then to show you next to that a drawing of what these bones actually are.

This doesn't look much like an arm of any animal today, but scientists have been able to compare the elements, which we've put here in the same colors, by the process of homology, which I'll talk to you about later. And there really is no dispute about the fact that these are, in fact, the precursors of limbs that we see in animals today, the same kinds of structures, the humerus here in yellow, the radius, and ulna, which are, I guess, in green, and then some of the features that become parts of the hand and the other digits in a darker color there.

You can also see that in the course of evolution, animals that begin having eight digits, such as Acanthostega here, reduce to seven digits, to six digits, and to five digits. I don't know how we could find anything more in the way of transitional

forms or features unless we went to six and three-quarters or five and a half digits. But, I mean, that may be as good as we'll get in the fossil record in terms of a transition.

So we do have a very clear change, not just in the reductions of digits, but you'll also notice that they look a lot more digital-like the closer you get to the animals that we recognize as living amphibians and so forth.

In contrast, above, when *Pandas* teaches this to students, it gives them two animals and invites them to draw contrasts. It essentially does not identify any of the bones, does not indicate that you could have any identification between those two bones, places them in different positions, reconstructs an outline for them that may not be unreasonable, but it's certainly in a different orientation.

And its function, the cumulative effect is really to sort of confuse students, and certainly I'm confused looking at it about what I'm supposed to take out of a diagram like this, except the fact that, boy, these are different, and I don't see how we could get from one way to the other. It would have been so much nicer if they had used a diagram like the one at the bottom or acknowledged that we did at least have some

transitional features that we could discuss.

Q. And that's Figure 4.9 from *Pandas* at the top of the slide?

A. That is Figure 4.9. The next slide is another feature. The *Pandas* authors, as noted before, said the skull had to change from two parts to a single solid piece, but, again, no such transitional species have been recovered.

Q. And, I'm sorry, that's what *Pandas* authors say?

A. That's what *Pandas* says, yeah. But as you can see, on this slide we can go easily from two mobile parts to two immobile parts to two parts that are fused and lack a ventral gap, that is, a one-part skull, to all the remaining vertebrates which have a one-part skull. This is a perfectly reasonable transition, morphologically and physically, and it's difficult to see how you could become any more transitional than this.

Q. So these are transitional fossil forms that have --

A. These are drawings of actual specimens and reconstructions of them from the scientific literature.

The next slide I think will indicate that

although the *Pandas* authors say that the hipbones had to enlarge and become attached to the backbone, no such transitional species have been recovered, according to the *Pandas* authors.

But we can see, moving from Eusthenopteron up through Acanthostega and Icthyostega, that, in fact, you can go from small, unattached hind limbs and hipbones to become somewhat larger as you can see in Acanthostega and attached to the backbone by what we call a sacral rib. Our sacroiliac is the human equivalent of that.

And as you can see in Icthyostega and other animals, it gets even larger, expanded and attached to the backbone as these animals begin to use their limbs more in support of the skeleton. And as they come out on land, this will be even more important, as it is, of course, in the living animals which -- almost all of which have at least two sacral ribs attaching to their backbones.

So I think the next slide is just a depiction of some of the references from the scientific peer-reviewed literature from which the slides I've just shown you have given us the information.

Q. Could you just maybe read a couple of the

titles into the record, please?

A. Yes. Fins to Limbs, What the Fossils Say, that appeared in *Evolution & Development*. Again, you can see where paleontology and developmental biology are seeing a great cooperation and a great number of new insights. From Fins to Fingers, again, a paper published in *Science* by Jenny Clack, who is a paleontologist at Cambridge. Fish-Like Gills and Breathing in the Earliest Known Tetrapod. So we can actually find fossil evidence even of some soft tissues which tell us a bit about these sorts of things. And I'd like to point out that these works are published in *Nature*, in *Science*, in the *Bulletin of the British Museum of Natural History,* and in the *Philosophical Transactions of the Royal Society of London*, among other publications.

Q. Dr. Padian, I note that some of these articles appear to be pretty old, for instance, Fins to Limbs appears to have been published in 1969, *Bulletin of the British Museum* is 1984. These were published before *Pandas* was written.

A. Yes.

Q. So the fact that there were, in fact, transitional fossils is something that was known to scientists at the time *Pandas* was being written and

was published?

A. Yes. There were many fossils that had transitional features that were available in the scientific literature, as scientists understood them. And so for whatever reason, these were not included by the authors of *Pandas*. Perhaps they didn't accept it as evidence.

Q. And do you know why in *Pandas* they would misrepresent, it seems, or not accurately portray the state of scientific knowledge at the time?

A. Well, the *Pandas* book, as noted, promotes the view of intelligent design, which they state here means that various forms of life began abruptly through an intelligent agency with their distinctive features already intact, fish with fins and scales, birds with feathers, beaks, and wings, et cetera. I believe this is from maybe Page 99.

Q. That's right. And what you've just shown us is an evolutionary pathway?

A. Well, this is sort of worrisome, because scientists would interpret this as an evolutionary pathway, and intelligent design seems to be excluding the possibility that you can actually get those pathways. Now, we should note that as you pointed out, some of those publications I just showed were

available when *Pandas* was written and some of them appeared afterward.

But it worries me that students would be told that they have to make a conclusion in advance of all the evidence that you can't get from A to B, essentially, by natural means. This quotation from *Pandas* says, Should we close our minds to the possibility that the various types of plants and animals were intelligently designed? This alternative suggests that a reasonable natural cause explanation for origins may never be found and that intelligent design best fits the data.

And so the question I would have is, what is a kid supposed to think when you tell him that you can't get from Point A to Point B and then evidence is uncovered that shows that, well, in fact, it looks pretty conceivable you can get from Point A to Point B and we're not making up this stuff.

Is a student supposed to say, well, gee, I guess there's no designer? Or is the student supposed to say, well, I guess the methods of intelligent design are really not very good? Or is he supposed to conclude something else? The intelligent design proponents provide no guidance on this.

Q. So when *Pandas* asserts that fish must have

been created abruptly intact with fins and scales, really science has refuted that proposition?

A. Yes.

Q. And in the passage which I think virtually every expert witness has focused on in this trial, Page 99 to 100, when they talk about fish being formed abruptly and the other animal that's mentioned there is birds with wings, feathers, and beaks already intact, can you talk to us about whether or not there is an evolutionary pathway, natural explanation for the evolution of birds?

A. Well, I'd be delighted to, if I can look at the next slide. As it turns out, when I went to graduate school, my advisor there, John Ostrom, is the person who actually established the origin of birds from carnivorous dinosaurs. And this became very well accepted over the next several years. We are now 30 years on into that, and it is one of the great achievements of 20th Century paleontology and that kind of science.

And I did work on this myself in the course of 30 years of research, the origin of birds and the origin of flight and of feathers. And so I'd like to show a little bit about what science has understood about this.

The next slide, I believe, gives you two quotes from *Pandas*, along with a picture of Archaeopteryx, which is the first known bird. It's about 150 million years old. It comes from Germany. It's a beautiful fossil. This is the Berlin specimen. It's known from a number of specimens, seven or eight now.

And as you can see, it's got beautiful wings, feathers, look very modern in their appearance, and yet Archaeopteryx has a long bony tail, its skull still has teeth, it's got various configurations of bones that we don't find in birds today. Many of the bones of its hand and foot are not fused like the bones of living birds. And so it's been known since its discovery in the 1860s, the time of the Civil War, right after Darwin published the *Origin of Species*, that scientists have accepted this as an animal that shows a lot of intermediate characteristics between birds and other animals, particularly certain kinds of reptiles.

Q. And what does *Pandas* say about this?

A. Well, *Pandas* says that there is no gradual series of fossils that lead from fish to amphibians or from reptiles to birds, rather these animals are fully formed.

Q. And you were quoting from Page 106 of *Pandas*?

A. 106, yeah. And that's one problem that they come up with. And a second problem that they talk about on Page 22 is that -- is their bemoaning the lack of fossils that show scales developing the property of feathers. They say, then we would have more to go on, but the fossil record gives no evidence for such changes.

I've picked out these two quotes because I want to emphasize that in the first case, there was very good evidence for the evolution of birds from dinosaurs when they wrote *Pandas*. And in the second case, they were right at the time, we did not have very many fossils that showed anything about the origin of feathers.

But in the past decade, we've had a bunch of remarkable fossils that have. And so this raises the question again of, if you tell children that you can't get there from here and then evidence is found, what are you going to do?

The next slide, I believe, talks about some of the -- this is really just a montage of a few, I mean, it's just a very few of the papers about feathered dinosaurs, dinosaurs that are not birds,

they didn't fly, but they had various kinds of very rudimentary feathers.

And these have been discovered in a remarkable deposit in Northeastern China, the first one in 1996, so this was after *Pandas* was written. And so we wouldn't expect those authors to know anything about these discoveries, but it just goes to show that there are some really interesting things that crop up.

Q. And could you just read into the record the titles of some of these?

A. An Exceptionally Well-Preserved Theropod Dinosaur from the Yixian Formation of China. This is a dinosaur with feathers. The next one is Two Feathered Dinosaurs from Northeastern China. Another one here is Branched Integumental Structures in Sinornithosaurus and the Origin of Feathers.

Q. In what type of journals were these published in?

A. These happen to be taken all from the journal *Nature*, which is one of those two magazines that I noted that all scientists are going to read every week. They're the most prestigious journals to publish in.

Q. And what you're going to show us now about

the evolution of feathers is taken based on these peer-reviewed --

A. These and many others, yes. In the next series of slides, if I may, I'd like to show you three things going on at once, because I want to tell you that this is not simply a matter of speculation or of isolated observation and inference, that this comes from independent lines of evidence, not just the fossil record.

What I've done in this series of slides is to take, on the left, one of those hat rack cladograms that show you the relationships of organisms, and again I've turned it on its side. So you can see that Archaeopteryx and modern birds are on the bottom, and that successively the groups above them are various dinosaur groups that are closely related to them.

I want to stress that this scheme of relationships, again, is based on dozens and dozens of characteristics that are not controversial to any extent in the scientific community, and whereas we do have uncertainties about some of the minor relationships among these animals, this is the scheme that is generally accepted by paleontologists.

On the upper right, I want to show you a series of pictures that were taken from an article in

Scientific American that reflects the work of Rick Prum at Yale and Alan Brush and Scott Williamson and their coauthors on the development of feathers, that is, how feathers develop in living birds.

And the reason for doing this is to couple this with a series of slides I'm going to show you on the bottom, which are of fossils of feathered dinosaurs, that is, dinosaurs that are not birds but that have feathers or some structures that are rudimentary feathers.

And what I want to show you is that as we proceed on the left up the tree leading to birds, we will also see that the feathers that are found in these little carnivorous dinosaurs in the lower right are becoming more and more complex and that they are reflecting the complexification of feather structure seen in the series of diagrams in the upper right as feathers develop embryologically.

So we're actually looking at phylogeny or relationships on the left, we're looking at fossils on the right, and we're looking at developmental structures and embryology on the upper left -- upper right, I mean. Fair enough? Okay.

Then in this stage, we see a little animal in the lower right, and that black fuzz that seems to

be going along its backbone is recognized as the most basal traces of things that are going to become feathers. And these structures are hair-like. They look like the structures in the upper right. There has been observation suggesting that they are even hollow in their structure. And we find these at that point in the cladogram noted at Stage 1 on the left-hand side.

The next slide should show us Stage 2. Now we've just jumped up a notch in the cladogram. And here we're beginning to find not just these single filamentous features, but also feathers that begin to branch and begin to have different kinds of tufts involved with them. The specimen on the lower right I realize is a road-kill and it's difficult to interpret, but let me see if I can just give you a sense of -- there we go. Down here we have bones of the backbone, tail. And these black and white marks up in here are remnants of these branched, feathery structures that appear in these dinosaurs.

The next slide shows a further complexification of feathers in the next step up on the cladogram toward birds in which we have a gaggle of feathers there in the center. These are just a group of feathers that have, as you might be able to

see, a central sort of stalk where you can see all these things gather in the middle. You can see this happening in the early development of a feather in the upper right. And then you see the feather differentiating into veins along a central stalk, just like you see in the next stage of the development of a feather in a bird that lives today.

The next slide, again, at this stage we also see another kind of feather that is a feather that is organized very well into veins on each side. And these veins are very well organized along the central stalk. In this fossil I've shown you in the middle, you can see perhaps faintly the outline of these black and white structures radiating off along this white stripe, which is the central axis of the feathers.

And so these are several feathers from the tail of one of these animals that are just bunched up right next to each other in one of these fossils. And, again, this is mirrored also in the progress of development from the feather from a single follicle bud up to a complete feather that we'd see today.

The final stages I want to show you as we get closer to birds is a feather in which the veins are asymmetrical, that is, one side of the feather is bigger and the other side is smaller. And this is

seen in birds today, but it's also seen in some of the other carnivorous dinosaurs that are close to birds, but not in all of them.

So, again, what we're seeing is as we move up the cladogram towards birds, we go from the simplest filamentous feathers up to more complex structures that are then gathered and around a central stalk that produce veins. These are interlocked by barbs and barbules, and they eventually become the aerodynamic structures that birds use in their wings.

But I'd like to point out, if I can, in the next slide that the obvious question is, what are they doing with these feathers before they're flying? And the evidence that we found in the fossil record in the last ten years indicates beyond any reasonable question that feathers did not evolve for flight. Flight was an afterthought for birds. They somehow acquired that adaptation later on.

What do we know about those first little hairy feathers that we're looking at? Well, one thing we know is, if you put a fur coat on somebody, they're going to stay warmer. And this little covering of dense fibers is going to give you insulation. That tells us something about the metabolic status of these animals even then.

Another thing is, you may have noticed some dark and light color patterns on those feathers. The fossils preserve this. What good are color patterns? Well, on these animals, they could serve as camouflage, as display, or even to help them recognize species.

I'm going to show you another function in a second that indicates that these animals were also using the feathers to shelter the eggs as they brooded their young. And these are all examples of what we call exaptation and evolution. And by that I mean that a structure evolves for one purpose, but it's selected, in turn, to acquire a second purpose, without, of course, losing the first one instantly. It will retain the first one.

And as it develops the second one, because it has the ecological opportunity or the pressure to do so, that second structure, that second function, may become more and more important to the structure, it may be selected to change more to accommodate this new function. And this is how exaptation works to change one kind of function into another through evolution.

Q. You have at the top there, What good is a half wing? What do you mean by that?

A. Well, if you just -- this is the question that has always been asked of evolutionists. St. George Mivart asked this of Darwin in the 1870s, what good is half a wing?

And the answer is, well, if you don't think of it as something you have to use to fly with, you can find out other functions if you just let the evidence tell you. And these are some of the lines of evidence. I will briefly show, if I may, a couple of these other functions.

The next slide provides some additional evidence of the other problem we talked about, not so much feathers, but the question of the evolution of birds. We have tremendous evidence on this, but one line of evidence comes from the hand itself. If you look at the hand of crocodiles, they have got five fingers. If you go all the way over to the left, you see Archaeopteryx, the first bird, that has only three.

Well, again, here's a cladogram of relationship diagrams of how these organisms are related based on many, many characteristics. And as we move up from the crocodiles through the various kinds of dinosaurs, we see that the fourth and the fifth finger, first the fifth and then the fourth,

become reduced and finally lost, until, when you get up to animals like Allosaurus, Deinonicus, and Archaeopteryx, they have only three fingers, and those are the first three fingers. The second finger is the longest, and you can see that through time, these fingers and the hand bones become even longer and more gracile.

Those three fingers that you see in Archaeopteryx at the end are still separate fingers, but in birds today, they're fused up. You would know them better as the pointy part of the wing in the Kentucky fried chicken.

So if you were to dissect your Kentucky fried chicken, which I don't recommend, but I can tell you about turkeys and Thanksgiving, which is a lot of fun, you will find that you can get to the individual hand bones, we can watch the bird develop, and these are individual bones that later become fused. And this is because the bird is no longer using its hand for anything except flight. It's not using its fingers to pick up things or claw or scratch anymore.

And early in the evolution of birds, when they dedicated themselves to flying with the four limbs and very little else, there was no further need to use these fingers for anything, and it made more

sense to fuse them into position rather than use muscles to hold them there. And this is the evidence that we have of how these organs evolve.

The next slide, I believe, will give us one more thing about feathers and behavior, too. This is a dinosaur, an extraordinary ostrich dinosaur relative. It's an Oviraptor dinosaur. The name isn't important. But one thing you can see about this specimen, which is very beautiful, it comes from the Cretaceous of Mongolia, is that in the photograph at the top, I'm going to show you, here is the right arm, here is the humerus, the bones of the forearm, and three clawed fingers of the right hand. Moving over to the other side, the arm comes out here, and here are the three clawed fingers of the left hand.

These white objects you see in this specimen are eggs. And here is the hind limb and the foot on the left side. Here is the hind limb and foot of the right side. Here is part of the tail. And the animal's rib cage is in here. There are more eggs underneath this animal. This critter was brooding its eggs in exactly the same position that hens brood their eggs today.

Furthermore -- well, one thing to draw from this is that some behaviors that we associate with

birds did not evolve with birds, they actually apparently were already present in the dinosaurian relatives of birds, and they simply were passed on to birds as they evolved.

But the other thing this shows is a funny thing. The fingers, you'll notice, are spread so as to cover the eggs. And in the fossil relatives of this particular dinosaur, not this specimen because they aren't preserved, but we have feathers in other Oviraptor dinosaurs that come off the fingers that are long and gracile. And if this particular dinosaur had preserved its feathers, it would have been using them to shelter the eggs as it brooded them. This is evidence of behavior, not just of structure, that we can find very anciently in the fossil record.

The next slide, I believe, shows an equally extraordinary find. And this is of a dinosaur, not a bird. He looks a lot like a bird, but he's in a sleeping position. And what is unusual about this critter is that here's its skull here with its big eye right here, and here's its little beak and its tail, bones like this. Up here are the arm bones of the left arm. And what this animal is doing -- his tail end is back this way and his front end is really to the left, but he's tucked his head and neck underneath

his left arm. In other words, he's sleeping like a bird does. This is not a bird. This is a little carnivorous dinosaur that's close to birds.

So, again, there is remarkable evidence that not just the structures of birds, but the behaviors of birds can sometimes be found in the fossil record and they precede birds. They actually are more general. They apply to the fossil record of many dinosaurs, as well.

Q. And, again, this is all based on peer-reviewed research?

A. The paper you see there is from *Nature*.

Q. And so do scientists today understand that, in fact, birds evolved and were not created abruptly?

A. In fact, that they evolved from small carnivorous dinosaurs sometime in the middle or late Jurassic period about 150 million years ago.

MR. WALCZAK: You Honor, I know there have been a number of references to food here. I have one more very short topic that I'd like to cover with Professor Padian, and that will be a good place to break.

THE COURT: After that point?

MR. WALCZAK: Yes.

THE COURT: That's fine. I thought we'd go

to about no later than 12:15, but if it takes longer than that, that's fine. Let's break at whatever point you think is logical so that we don't break up the testimony unnecessarily.

BY MR. WALCZAK:

Q. Professor Padian, you talked about this change of function, and I think you used the term "exaptation."

A. Yes.

Q. Is that a biological concept that's well established?

A. Yes, it is.

Q. And how do intelligent design proponents deal with exaptation?

A. Well, as far as I can tell, they don't really. It's very difficult for them to deal with exaptation because it implies that you can take a structure and change its function to a new function. And the whole purpose of intelligent design is to identify structures and functions that are too complex to have changed naturally from an antecedent state to a new state.

I believe that the evidence that I'm providing here is trying to show that we have, piece by piece, assembly of major adaptations. I believe

that we've shown that with the transition of swimming animals up into the animals that came onto land, for example, a very good transition of features step by step by step, and that it isn't like an adaptational package of land animals that had to be assembled abruptly, but rather that structures are changed in their function.

So, for example, the fin of a fish moves up and down and helps it to negotiate the water, that is, to push water, pass it or to steer and do things like that in a medium that's a thousand times denser than air.

How do you get from that to an animal that puts its limbs under its body and stands on this limb? Well, as we've seen, what happens in the evolution of limbs from basic fins is that these bones become stouter and stronger. Their articulations change. They begin to be able to be much more able to support weight, and they change from having a lot of those individual sort of rays that you see in any fish fin to a fewer number of things that are covered by flesh. In fact, these are the fleshy fins that we have, our hands. They're exactly the same structures.

And we saw from the slides that these structures, the numbers of fingers, how they

articulate, change in a very step-like pattern, not in an abrupt way at all. So the answer is that intelligent design proponents, this is the last thing they want to hear, because it would indicate to them that there are ways of getting from Point A to Point B when they want to talk about abrupt appearance and irreducible complexity.

MR. WALCZAK: I'd like to end abruptly now so we could get some lunch.

THE COURT: I don't know if there will be a run on chicken. But we'll break here until -- how are you proceeding time-wise?

We could take an abbreviated lunch, take an hour rather than the longer lunch, or we can go to 1:30, which might be a little bit more reasonable. I'll give you a crack at that because you know how much more you have on direct and you want to save time -- I know you don't want to bring this witness back -- you want to save time, reserve time for appropriate cross.

MR. WALCZAK: I'm guessing an hour, maybe a little bit more. We've got mammals, we've got whales.

THE COURT: Mr. Muise, if we stopped at 2:30 or if we gave Mr. Walczak until 2:30, if we reconvened at 1:30, would that give you enough time to

cross-examine?

MR. MUISE: 2:30 and stop at 4:00, Your Honor?

THE COURT: Well, no, we'd stop at 4:30-ish. That would give you two full hours. But if you don't think that that's going to be enough, I want to try to regulate what we're doing here.

MR. MUISE: It's always hard to judge, Your Honor, you know, for cross-examination, depending on, you know, how the responses come, obviously.

THE COURT: Well, I'm saying I would hold Mr. Walczak, because I know there's an issue -- this witness has come a great distance. I would hold him to 2:30. You've got to keep it within two. Now, you may not use two, but I'm saying, is that enough? Now, if you want a little over, that's fine. I'm just trying to get a fix on --

MR. MUISE: Let's do an abbreviated lunch since we want to make sure we get done.

THE COURT: Let's take precisely an hour. We'll come back at 1:15. And then why don't you have a conversation during the lunch break about how you want to carve up the afternoon, because I think that's the appropriate thing to do.

So, Mr. Walczak, if you don't go too deeply

into the afternoon and not give Mr. Muise enough time, in the interest of not bringing this witness back -- which I think is what you're striving to do. Am I correct?

MR. WALCZAK: That's right, Your Honor.

THE COURT: So as a courtesy, make sure he's got enough time. All right?

MR. WALCZAK: Yes, Your Honor.

THE COURT: We'll be in recess until 1:15.

(A luncheon recess was taken.)

CERTIFICATION

I hereby certify that the proceedings and evidence are contained fully and accurately in the notes taken by me on the within proceedings and that this copy is a correct transcript of the same.

Dated in Harrisburg, Pennsylvania, this 17th day of October, 2005.

/s/ Lori A. Shuey

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