

CHAPTER VI.  
SIXTH DAY'S PROCEEDINGS—FRIDAY,  
JULY 17, 1925.

The Bailiff—Raps for order. Everybody stand up, please. Is Rev. Mark in the house?—Rev. Rabbi Mark. Is Rev. Dr. C. G. Eastwood in the house?

The Court—Dr. Eastwood, open court with prayer.

Dr. Eastwood—Our Father and our God, we thank Thee for the privilege that is ours of living in this glorious land that Thou hast given to us through the sacrifice and heroism of those who have lived and gone. We thank Thee, Oh God, that Thou didst inspire them to press onward and upward in the building of a civilization that should last and we pray Thee that the same spirit that impelled them may grip our hearts and seize upon us that we may give to the generations that shall yet follow as rich a heritage as they have bequeathed unto us. And, our Heavenly Father, we thank Thee for the courts of justice in our land, where men can come and receive justice and this morning we pray that Thy blessings may rest upon the Court at this hour and upon this occasion. Wilt Thou give him clearness of vision and of mind for the solution of the problems that are before him? And, our Father, we pray that Thy blessings may rest upon the jury in its deliberations and upon the counsel and upon all those engaged in or participating in this case and, Oh God, we ask Thee that Thy blessings may rest upon those who are members of the press as they send out the messages to the waiting millions of the world. Now again we pray that Thy blessings may rest upon the Court and Thou wilt give Thy divine guidance in the things that shall be done and the decisions that shall be made. These things we ask in the name of our Lord and Master Jesus Christ. Amen.

The Court—Open court, Mr. Sheriff.

The Bailiff—Oyez, oyez, this honorable circuit court is now open, pursuant to adjournment. Sit down please.

**TEXT OF JUDGE RAULSTON'S  
RULING IN EXCLUDING  
EXPERTS**

State of Tennessee vs.  
John T. Scopes.

This case is now before the court upon a motion by the attorney-general to exclude from the consideration of the jury certain expert testimony offered by the defendant, the import of such testimony being an effort to explain the origin of man and life. The state insists that such evidence is wholly irrelevant, incompetent and impertinent to the issues pending, and that it should be excluded.

Upon the other hand the defendant insists that this evidence is highly competent and relevant to the issues involved, and should be admitted.

The first section of the statute involved in this case reads as follows: "Be it enacted by the general assembly of the state of Tennessee, that it shall be unlawful for any teacher in any of the universities, normals and all other public schools of the state which are supported in whole or in part by the public school funds of the state, to teach any theory that denies the story of divine creation as taught in the Bible, and to teach instead that man has descended from a lower order of animals."

The state says that it is both proven and admitted that this defendant did teach in Rhea county, within the limits of the statute, that man descended from a lower order of animals; and that with these facts

ascertained and proven, it has met the requirements of the statute, and has absolutely established the defendant's guilt; and with his guilt thus admitted and established, his ultimate conviction is unavoidable and inevitable, and that no amount of expert testimony can aid and enlighten the court and jury upon the real issues, or affect the final results. In other words, the state insists that by a fair and reasonable construction of the statute, the real offense provided against in the act is to teach that man descended from a lower order of animals, and that when this is accomplished by a fair interpretation and by legal implication, the whole offense is proven. That is, the state says that the latter clause interprets and explains what the legislature meant and intended by the use of the clause, "any theory that denies the story of divine creation as taught in the Bible."

But the defendant is not content to agree with the state in its theory, but takes issue and says that before there can be any conviction the state must prove two things:

First, that the defendant taught evolution in the sense used in the statute;

Second, that this teaching was contrary to the Bible.

That these are questions of fact, that the proof must show what evolution is, so that the jury may determine whether evolution as taught by the defendant conflicts with the Bible; that it is not merely what the defendant said, or what the book taught; and that they cannot do this without evidence. That is, that the defendant must have taught the descent of man from a lower order of animals, and a theory contrary to that of divine creation as taught by the Bible. That the teaching of either would not be a crime.

Now upon these issues as brought up, it becomes the duty of the court to determine the question of the admissibility of this expert testimony offered by the defendant.

It is not within the province of the court under these issues to decide and determine which is true, the

story of divine creation as taught in the Bible, or the story of the creation of man as taught by evolution.

If the state is correct in its insistence, it is immaterial, so far as the results of this case are concerned, as to which theory is true; because it is within the province of the legislative branch, and not the judicial branch of the government to pass upon the policy of a statute; and the policy of this statute having been passed upon by that department of the government, this court is not further concerned as to its policy, but is interested only in its proper interpretation and, if valid, its enforcement.

Let us now inquire what is the true interpretation of this statute. Did the legislature mean that before an accused could be convicted, the state must prove two things:

First—That the accused taught a theory denying the story of divine creation as taught in the Bible;

Second—That man descended from a lower order of animals.

If the first must be specially proven, then we must have proof as to what the story of divine creation is, and that a theory was taught denying that story. But if the second clause is explanatory of the first, and speaks into the act the intention of the legislature and the meaning of the first clause, it would be otherwise.

To illustrate, when the legislature had provided that it shall be unlawful to teach a theory that denies the divine story as taught in the Bible; and, then, by the second clause, merely clarified their intention, and that the real intention as provided by the statute taken as a whole, was to make it unlawful to teach that man descended from a lower order of animals, then there would be no such ambiguity and uncertainty as to the meaning of the statute, and as to the offense provided against, as to justify the court in calling expert testimony to explain.

The court will seek the aid or opinion of expert evidence only when the issues involve facts of such complex nature that a man of

ordinary understanding is not competent and qualified to form an opinion.

In Tennessee an act should be construed so as to make it carry out the purposes for which it was enacted.

The legislative intent will prevail over the strict letter, and in order to carry into effect its intent, general terms will be limited, and those which are narrow expanded.

In construing a statute we must look to the act as a whole, to the object with which it deals, and the reason and the spirit of the enactment, and thereby, if possible, discover its real purpose. The meaning must be determined, not from the special words in a single sentence or section, but from the act taken as a whole, comparing one section with another, and viewing the legislation in the light of its general purposes.

In the act involved in the case at bar, if it is found consistent to interpret the latter clause as explanatory of the legislative intent as to the offense provided against, then why call experts? The ordinary, non-expert mind can comprehend the simple language, "descended from a lower order of animals."

These are not ambiguous words or complex terms. But while discussing these words by way of parenthesis, I desire to suggest that I believe evolutionists should at least show man the consideration to substitute the word "ascend" for the word "descend."

In the final analysis this court, after a most earnest and careful consideration, has reached the conclusions that under the provisions of the act involved in this case, it is made unlawful thereby to teach in the public schools of the state of Tennessee the theory that man descended from a lower order of animals. If the court is correct in this, then the evidence of experts would shed no light on the issues.

Therefore, the court is content to sustain the motion of the attorney-general to exclude the expert testimony.

Mr. Hays—Your honor will per-

mit me to take an exception? To state my grounds of exception. We say that it is a denial of justice not to permit the defense to make its case on its own theory.

The Court—You mean the state?

Mr. Hays—No, sir, not to permit the defense to make its case on its own theory. I say further that it is contrary to every element of Anglo-Saxon procedure and jurisprudence to refuse to permit evidence as to what evolution is and what it means and what the Bible is and what it means. Take my exception on the further ground that for the court of Rhea county to try to determine whether or not this law is unreasonable without informing itself by evidence assumes plenary knowledge on a subject which has been the subject of study of scientists for generations and for these reasons and those placed on the record yesterday the defense most respectfully excepts.

The Court—Let the exception be entered on the record.

Gen. Stewart—I desire to except to exceptions stated in that manner. Such a procedure as that is unknown to the laws of Tennessee and I except to the manner in which the counsel for the defense excepts to the Court's ruling. I think it is a reflection upon the Court.

The Court—Well, it don't hurt this Court.

Gen. Stewart—I think there is no danger of it hurting the Court for that matter.

Mr. Darrow—There is no danger of it hurting us.

Gen. Stewart—No, you are already hurt as much as you can be hurt.

Darrow Is Sarcastic.

Mr. Darrow—Don't worry about us. The state of Tennessee don't rule the world yet. With the hope of enlightening the Court as a whole I want to say that the scientists probably will not correct the words "descent of man" and I want to explain what descent means, as starting with a low form of the life and finally reaching man.

Gen. Stewart—We all have dictionaries.

Mr. Darrow—I don't think the Court has one.

Gen. Stewart—I think the Court knows what "descent" means all right.

Mr. Darrow—We will submit your honor's request to the Association of Scientists.

The Court—I think the Court understands some things as well as the scientists.

Mr. Hays—May I respectfully move if the Court regards this question as one of law for the Court and if the Court believes that the question as to whether or not this law is unreasonable is wholly one for the Court, that the Court hear evidence in order to inform itself on that question in the presence of the Court only and in the absence of the jury.

Gen. Stewart—They are entitled to have entered on record the substance of what they expect to prove. We do not question that. I make no question as to that, but then, of course, they have no right to examine witnesses and conduct a long drawn-out examination and make a farce of your honor's opinion. They are entitled to have sufficient in the record to enable the supreme court to pass upon the proposition, and, in my opinion, a sufficient amount of which is already in the record. How many branches of science have you represented here by witnesses?

Mr. Hays—About six. As I interpret your opinion it does not cover this proposition. The court still has to charge the jury and the court still has to pass on questions of law. We wish to raise, not only before your honor, but before your higher court, our proposition that this law is unreasonable. If your honor will permit me to give an example. Suppose the legislature passed a law prohibiting workmen from working more than six hours in a paint factory. The court would declare that law unconstitutional. But in doing that the court would find out the effect of working more than six hours, and if the work was deleterious to the health of the workmen, then the court would

hold such law constitutional.

Raulston Explains Stand.

The Court—Let me state what I have in mind. I think you are entitled to have in the record a sufficient amount of your proof to indicate to the appellate court, in case of conviction here, what your proof would have been. I think you have a right to introduce that proof that is under such limitations as the court may prescribe and let it be written in the record in the absence of the jury, and I meant all the time for you to do that.

Mr. Hays—I would like to state further—if I can prevail upon you to do so—I understand the rule is that we can put in the evidence in that fashion in order that we may make a record for the appellate court, but we not only want to do it for that reason, but we feel we have a right to argue before the court and the court will hear us upon the question of whether or not this law is reasonable. Gen. Stewart says that that motion has been denied. That is true, but I hope the court will hear me with an open mind, and we want to introduce the evidence and ask that the court take that evidence and inform itself, and should the court come to a different conclusion, and we hope to persuade the court that this law is unreasonable—we ask the court to permit us to put in evidence for the sole purpose of informing the court so you can determine, after evidence, whether or not this law is unreasonable. I regard that as so important, if you will permit me again to refer to my Copernican illustration, which has seemed to be so humorous to the court in general—your honor knows there are people in the United States who would like to enforce on the people of the United States laws to the effect that nothing could be taught contrary to the theory that the planets moved around the earth and that the earth was the center of the universe, and I have learned of them in the hill country back of Dayton. When people, present the fact that science present the facts in court you would say that a law of that kind was un-

reasonable, and I state to your honor, in my judgment, if you permit us to come to the evidence your honor will come to the same conclusion on evolution that you have come to on the question of the Copernican theory, and I ask that it be put in as evidence in this case in order to inform this court and give us an opportunity to show whether that law is reasonable or not. Your honor told me yesterday that your honor would hear us with an open mind.

The Court—I am going to let you introduce evidence and I will sit here and hear it, and if that evidence were to convince me that I was in error I would, of course, reverse myself.

Mr. Hays—That is true. I know you would do that.

The Court—You can introduce evidence for the other purpose and I will hear it and I never hesitate to reverse myself if I find myself in error.

Mr. Hays—That being so I think your honor ought to permit us to enter the evidence for both purposes.

The Court—It looks like we are quibbling over a matter really without a difference.

Mr. Hays—If that is so won't your honor give me that privilege?

Mr. Malone—I want to ask Gen. Stewart whether he would mind withdrawing his remarks that the purpose of the defense in producing this evidence is to make a farce out of the judge's opinion. Certainly that is not our purpose and I don't think he meant that it is. We haven't really provided any low comedy here so far, so let us not—

Stewart Stands Ground.

Gen. Stewart—I will be glad to withdraw that and supplement it with this remark, which you will not deny. It is a known fact that the defense consider this a campaign of education to get before the people their ideas of evolution and scientific principles. This case has the aspect of novelty, and therefore has been sensationalized by the newspapers, and of course these gentlemen want to take advantage of the

opportunity. I don't want to make any accusations that they are improperly taking advantage of it. They are lawyers and they have these ideas, and it is an opportunity to begin a campaign of education for their ideas and theories of evolution and of scientific principles, and I take it that that will not be disputed and all I ask, if the court please, is that we not go beyond the pale of the law in making this investigation and that we and that they not forget ourselves to the extent that we go beyond the pale of the law. Our practice, if the court please, has been in matters of this sort to let the substance of the evidence be stated by one of the attorneys and let it be placed in the record, in affidavit form, and I think that would be much better and would expedite the trial of this case, and I would much prefer that that course be taken. If witnesses are put on the stand, as your honor knows, a lawyer would ask a thousand questions that are not relevant, and if we do that we go beyond the pale of the investigation, and I respectfully ask your honor to confine this to the subject of that particular theory that is involved in the act and that no more be permitted. They say they have here six branches of science. I don't care how many branches they have, there is only one that is pertinent to this case—only one theory and that is that theory of evolution which teaches that man is descended from a lower order of animals, and if they want something for the higher courts to look at to support that theory—let that be put in substance.

Mr. Darrow—That is what I am willing to do.

Gen. Stewart—Let them put it in in substance—in affidavit form and not take up our time in the trial of the case. I don't object to your testimony or affidavits being printed.

Mr. Malone—I just want to make this statement for the purposes of the record, that the defense is not engaged in a campaign of education, although the way the defense

has handled the case has probably been of educational value. We represent no organization nor organizations for the purpose of education. Your honor knows that everything the court says not only goes out to the world through the newspapers, but through the radio and it is difficult for a court these days to exclude a jury from what is going on in the courtroom, because it would be difficult for a juror to go anywhere in the utmost privacy and not hear what's going on, so the rules would have to be changed to meet the advance of science. If the defense is representing anything it is merely representing the attempt to meet the campaign of propaganda which has been begun by a distinguished member of the prosecution.

#### Bryan wants to Cross-examine Scientists

W. J. Bryan—May I ask if these witnesses are allowed to testify as experts, for the information of the judge, I presume they will be subject to cross-examination?

The Court—Well, Mr. Bryan, I will say, I think the court would make itself absurd after the court has passed upon the question to say he will hear testimony whether or not he was right in his former decision.

What I said was this: I want this proof put into record. I think they are entitled to some of it, under the limitations the court may prescribe. Now the court will be here to hear it and this court is always ready to correct any error it makes. If, after hearing this proof, I shall conclude my former decision was erroneous and unlawful, I would not hesitate to set it aside; but I am not inclined to set it aside in the beginning and say I will hear proof to determine whether or not I will set my opinion aside.

Mr. Bryan—I ask your honor: Will we be entitled to cross-examine their witnesses?

The Court—You will, if they go on the stand.

#### Darrow's Shot at Bryan.

Mr. Darrow—They have no more right to cross-examine than to bring

in the jury to hear this issue. We want to submit what we want to prove. That is all we want to do. If that will not enlighten the court cross-examination of Mr. Bryan would not enlighten the court.

(Laughter in the courtroom.)

Mr. Bryan—If I were to dispose—

#### Colloquy Which Caused Darrow to be Cited for Contempt

Mr. Darrow—What we are interested in, counsel well knows what the judgment and verdict in this case will be. We have a right to present our case to another court and that is all we are after. And they have no right whatever to cross-examine any witness when we are offering simply to show what we expect to prove.

The Court—Colonel, what is the purpose of cross-examination?

Mr. Darrow—The purpose of cross-examination is to be used on the trial.

The Court—Well, isn't it an effort to ascertain the truth?

Mr. Darrow—No, it is an effort to show prejudice.

(Laughter.)  
Nothing else.

Has there been any effort to ascertain the truth in this case? Why not bring the jury and let us prove it?

The Court—Courts are a mockery—

Mr. Darrow—They are often that, your honor.

The Court—When they permit cross-examination for the purpose of creating prejudice.

Mr. Darrow—I submit, your honor, there is no sort of question that they are not entitled to cross-examine, but all this evidence is to show what we expect to prove and nothing else, and can be nothing else.

The Court—I will say this: If the defense wants to put their proof in the record, in the form of affidavits, of course they can do that. If they put the witness on the stand and the state desires to cross-examine them, I shall expect them to do so.

Mr. Darrow—We except to it and take an exception.

The Court—Yes, sir; always ex-

pect this court to rule correctly.

Mr. Darrow—No, sir, we do not. (Laughter.)

The Court—I suppose you anticipated it?

Mr. Darrow—Otherwise we should not be taking our exceptions here, your honor. We expect to protect our rights in some other court. Now, that is plain enough, isn't it?

Then, we will make statements of what we expect to prove. Can we have the rest of the day to draft them?

The Court—I would not say—

Mr. Darrow—If your honor takes a half day to write an opinion—

The Court—I have not taken—

Mr. Darrow—We want to make statements here of what we expect to prove. I do not understand why every request of the state and every suggestion of the prosecution should meet with an endless waste of time, and a bare suggestion of anything that is perfectly competent on our part should be immediately over-ruled.

The Court—I hope you do not mean to reflect upon the court?

Darrow Evidently Peeved.

Mr. Darrow—Well, your honor has the right to hope.

The Court—I have the right to do something else, perhaps.

Mr. Darrow—All right; all right.

Mr. Bryan—May it please the court. Do I understand that the defense has decided to put on no witnesses, but simply to present affidavits?

Mr. Darrow—That is it; to present statements.

Mr. Bryan—And no cross-examination. I understand they were to present witnesses and we were to have a right to cross-examine.

Mr. Darrow—You wouldn't have a right to cross-examine if we put on witnesses for the purpose of showing what we expect to prove.

Gen. Stewart—The court has held he has—we are conducting this case as the court directs.

Mr. Darrow—So far.

Gen. Stewart—So long as it continues, I hope.

Mr. Bryan—Your honor, then to be

entitled to go in in the form of affidavits, would we have a right to produce any rebuttal?

Not for this court, but an upper court, is it to be a one-sided trial in the upper court, and will the upper court have nothing before it except the expert statements of the defendant? Or, will the plaintiff be entitled to put in, in the form of affidavits, its proof in rebuttal of what is promised or expected by the defendant?

Mr. Darrow—Mr. Bryan is naturally a little rusty in practice. Of course, the plaintiff has no such right. The question is, is it admissible now. After it has been heard, the state can introduce its rebuttal, but the question is, is this evidence which we offer admissible now? And, as long as the court has held it is not, we are expected to state what we will show.

The Court—I rather think, Col. Darrow is correct. The state's theory is that none of this proof is relevant to the issues, and I have excluded their evidence, holding that under the issues made up under the statute that it is not relevant. Now, the only purpose the court would have in allowing them to put their testimony in the record would be that the higher courts might properly determine whether this court was in error or not in excluding their testimony. If the court there decides that evidence was admissible, then it would not be a question there to determine which theory was correct. But the appellate court, independent of any number of affidavits, you would put in, would not attempt to pass upon the facts. But, if they found that this court had erred in excluding this expert testimony, the case would be sent back. So, I think you would not be entitled to put in any rebuttal proof, would be my conception.

Mr. Hays—Doesn't that mean that they are not entitled to cross-examine?

The Court—That is another question.

Mr. Darrow—We will present it as I said.

The Court—Well, when it comes to taking the whole day, to prepare affidavits, I hate to lose the time. Col. Darrow is certainly laboring under a mistake when he says this court has ever taken a day to prepare an opinion. I read an opinion the other day. The court waited from 1:30 to 3—no,—the forenoon, about five hours, perhaps. It did take time, yes. I believe that is correct.

Gen. Stewart—Your honor needed that time.

Mr. Darrow—I want to ask if it is unreasonable for me to ask for the rest of the day to prepare the statements?

The Court—I don't know.

Mr. Darrow—I ought to know.

The Court—Do you think you need the time?

Mr. Darrow—I do need it, your honor.

The Court—You would know better than I.

Mr. Darrow—I will read them tomorrow.

Gen. Stewart—They wouldn't be read; just filed in the record.

The Court—Yes, they will be filed in the record; no occasion to read them.

Mr. Darrow—All right.

Mr. McKenzie—It has been held that they can go in any time in the world; why take the time of the jury? Put them in the record any time after the lawsuit is done.

The Court—You would dictate to the court stenographers what you expect to prove, and then let it be copied and filed later.

Mr. Darrow—No, I think it ought to be in the record.

Mr. Malone—We have these witnesses here who cannot stay here; we want to make use of them while they are here.

The Court—I mean right now, dictate it.

Mr. Darrow—No, we want to dictate it from our witnesses' statements.

Says He Wants to Be Fair.

The Court—Regardless of the opinion of counsel, I have no purpose except to be fair, but if it takes

the day to do it, why of course, but I hate to lose the time, but justice is more important than time.

Mr. Darrow—Certainly, your honor. Your honor, we will come in tomorrow morning.

The Court—Have any of you gentlemen on the state's side any suggestions to make; do you want to be heard any further?

Gen. Stewart—I would like very much to have the afternoon, your honor. There is nothing left now except the argument of the case before the jury.

The Policeman—Order in the courtroom.

Gen. Stewart—We hate so much to lose this time. I do not want to be unreasonable. But, they have six men here.

The Court—Col. Malone, you think you could be ready by 1 or 1:30?

Mr. Malone—Your honor, we have these witnesses here, and they have summer assignments; we don't expect it is possible to make a statement in public here; we cannot do it in public, we have to concentrate upon it. (Consultation between counsel not heard by reporter).

Mr. McKenzie—Both counsels have agreed that a large number of counsel are worn out. These gentlemen want to try and prepare their affidavits; we know we cannot finish the case tomorrow, and there are many reasons why the jury should have a chance to go home and rest. This is the situation, and it is the unanimous agreement we made here, a minute or so ago, subject to your honor's agreement, to finish this case on Monday at 8 o'clock.

Mr. Malone—We think we can finish it up on Monday.

The Court—Today is Friday.

Mr. Malone—Yes, your honor.

The Court—That is agreeable to the court if it suits both sides.

Mr. McKenzie—Suits the attorneys on both sides.

Mr. Hays—Before we adjourn, we do not understand that we have agreed merely to file the affidavits,

because if we make our offer of proof, we reserve the right to make it in open court.

The Court—You have made that, and the court has overruled it.

Mr. Hays—No. The suggestion of the general was that we file affidavits. Instead of filing affidavits we may wish to have the opportunity of stating our offer of proof in open court. We have not made up our minds on that.

Gen. Stewart—You have no right. Mr. Hays—Are not trials public in Tennessee? Isn't it a part of the trial when we state what we expect to prove?

Mr. Neal—As I understand—

The Court—I have passed upon that when you presented it to me.

Mr. McKenzie—It is not part of the trial.

Gen. Stewart—We cannot meet here Monday morning and spend the whole day in statements—the statements are in affidavit form, and placed in the record.

The Court—I will tell you what has been a practice in my court, for the man whose evidence is excluded, is to step to the court reporter and give the proof, so that the jury does not hear it, and proceed with the trial. That is the way we have been doing. But, they say they cannot do that in this case intelligently.

Mr. Darrow—It is too elaborate.

The Court—But, if the statements are put in, in open court, why not make them today?

Mr. Hays—We are not prepared to do that. As you say, when that question comes up, we want to discuss it, but the General wants to discuss it before it comes up.

Gen. Stewart—I don't want to spend all next week—

Mr. Hays—Pardon me.

Gen. Stewart—I understand, if your honor please, they do not have a right under our procedure and practice to state in open court what their witnesses will testify to. What would be the purpose of a statement in open court, for the enlightenment of the crowd present? If they want it for the record—

The Court—If the court excluded a statement Monday morning, I could not give them time then to to prepare it.

Mr. Hays—I ask that your honor hear that question Monday morning.

The Court—I will hear it Monday morning. Let the court take a recess until Monday morning.

Mr. Malone—Until 8 o'clock.

The Court—Nine o'clock. Nine o'clock Monday morning.

Thereupon at the hour of 10:30 o'clock a.m., of Friday, July 17, A. D., 1925, a recess was taken to the hour of 9 o'clock a.m., of Monday, July 20, 1925.

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Mr. Darrow—It is too elaborate.

CHAPTER VII.

SEVENTH DAY OF DAYTON EVOLUTION TRIAL—MONDAY, JULY 20, 1925.

Court met pursuant to adjournment. Present as before.

Prayer by Rev. Standefer:

Almighty God, our Father in Heaven, we thank Thee for all the kindly influences Thou hast surrounded our lives with. Thou hast been constantly seeking to invite us to contemplate higher and better and richer creations of Thine, and sometimes we have been stupid enough to match our human minds with revelations of the infinite and eternal. May we, as a nation, have Thy guiding and directing presence with us in all ultimate things, and wilt Thou this morning be the directing presence that supplements human limitations and enables each individual in his respective position to meet the full requirements of this position. Do Thou grant to all of us Thy presence and Thy direction in all things, we ask for Christ sake. Amen.

The Court—Mr. Sheriff, open court.

(Court was then opened.)

Judge Cites Darrow for Contempt of Court.

The Court—If there is any member of the jury in the courtroom, let him at once retire. Any member of the jury anywhere about the courtroom, let him at once retire. You gentlemen have seats in the bar. No member of the jury in the courtroom?

The Court—In the trial of a case there are two things that the court should always endeavor to avoid:

First—The doing of anything that will excite the passions of the jury, and thereby prejudice the rights of either party.

Second—The court should always avoid writing passion into his own decrees.

On last Friday, July 17, contempt and insult were expressed in this court, for the court and its orders

and decrees, when the following colloquy occurred between the court and one of the attorneys interested in the trial of the case:

Mr. Darrow—What we are interested in, counsel well knows what the judgment and verdict in this case will be. We have a right to present our case to another court and that is all we are after. And they have no right whatever to cross-examine any witness when we are offering simply what we expect to prove.

Court—Colonel, what is the purpose of a cross-examination?

Mr. Darrow—The purpose of cross-examination is to be used on the trial.

Court—Well, isn't it an effort to ascertain the truth?

What Darrow Said.

Mr. Darrow—No, it is an effort to show prejudice. Nothing else. Has there been any effort to ascertain the truth in this case? Why not bring in the jury and let us prove it?

Court—Courts are a mockery—

Mr. Darrow—They are often that, your honor.

The Court—When they permit cross-examination for the purpose of creating prejudice.

Mr. Darrow—I submit, your honor, there is no sort of question that they are not entitled to cross-examine, that all this evidence is to show what we expect to prove and nothing else, and can be nothing else.

The Court—I will say this: If the defense wants to put their proof in the record in the form of affidavits, of course they can do that. If they put witnesses on the stand, and the state desires to cross-examine them, I shall expect them to do so.

Mr. Darrow—We except to it, and take an exception.

The Court—Yes, sir, and always expect the court to rule correctly.

Mr. Darrow—No, sir we do not. The Court—I suppose you anticipated it?

Mr. Darrow—Otherwise we would not be taking our exceptions here, your honor. We expect to protect our rights in some other court. Now, that is plain enough, isn't it? Then we will make statements of what we expect to prove. Can we have the rest of the day to draft them?

The Court—I would not say—

Mr. Darrow—If your honor takes half a day to write an opinion.

The Court—I have not taken— Yes, I did take five hours.

Mr. Darrow—We want to make a statement here of what we expect to prove. I do not understand why every request of the state and every suggestion of the prosecution would meet with an endless loss of time; and a bare suggestion of anything that is perfectly competent, on our part, should be immediately overruled.

The Court—I hope you do not mean to reflect upon the court?

Mr. Darrow—Well, your honor has the right to hope.

The Court—I have a right to do something else, perhaps.

Mr. Darrow—All right, all right.

#### The Citation.

The court has withheld any action until passion had time to subside, and it could be arranged that the jury would be kept separate and apart from proceedings so as not to know of the matters concerning which the court is now about to speak. And these matters having been arranged, the court feels that it is now time for him to speak:

Both the state and federal governments maintain courts, that those who cannot agree may have their differences properly adjudicated. If the courts are not kept above reproach their usefulness will be destroyed. He who would unlawfully and wrongfully show contempt for a court of justice, sows the seeds of discord and breeds contempt for both the law and the courts, and

thereby does an injustice both to the courts and good society.

Men may become prominent, but they should never feel themselves superior to the law or to justice.

The criticism of individual conduct of a man who happens to be judge may be of small consequence, but to criticise him while on the bench is unwarranted and shows disrespect for the official, and also shows disrespect for the state or the commonwealth in which the court is maintained.

It is my policy to show the same courtesy to the lawyers of sister states that I show the lawyers of my own state, but I think this courtesy should be reciprocated; those to whom it is extended should at least be respectful to the court over which I preside.

He who would hurl contempt into the records of my court insults and outrages the good people of one of the greatest states of the Union—a state which, on account of its loyalty, has justly won for itself the title of the Volunteer State.

It has been my policy on the bench to be cautious and to endeavor to avoid hastily and rashly rushing to conclusions. But in the face of what I consider an unjustified expression of contempt for this court and its decrees, made by Clarence Darrow, on July 17, 1925, I feel that further forbearance would cease to be a virtue, and in an effort to protect the good name of my state, and to protect the dignity of the court over which I preside, I am constrained and impelled to call upon the said Darrow, to know what he has to say why he should not be dealt with for contempt.

Therefore, I hereby order that instant citation from this court be served upon the said Clarence Darrow, requiring him to appear in this court, at 9 o'clock a. m., Tuesday, July 21, 1925, and make answer to this citation.

I also direct that upon the serving of the said citation that he be required to make and execute a good and lawful bond for \$5,000

for his appearance from day to day upon said citation and not depart the court without leave.

JOHN T. RAULSTON.

Mr. Darrow—What is the bond, your honor?

The Court—\$5,000.

Mr. Darrow—That is, I do not have to put it up this morning.

The Court—Not until the papers are served upon you.

Mr. Darrow—Now, I do not know whether I could get anybody, your honor.

Mr. Neal—There will be no trouble.

(Frank Spurlock, of Chattanooga, thereupon volunteered his services in the matter.)

The Court Officer—Let us have order in this courtroom. If you people come up here to hear the trial, this is not a circus. Let us have order.

Mr. Spurlock—Do you want a signed bond, judge?

The Court—I reckon not, Mr. Spurlock. Oh, Mr. Spurlock.

(The court and Mr. Spurlock thereupon held a whispered consultation.)

The Court—Are you ready to proceed with the case on trial, gentlemen?

Mr. Hays—Yes, sir, if your honor please; shall we proceed?

The Court—Yes.

#### The Governor's Message.

Mr. Hays—Before coming to the evidence that we wish to read into the record, the defense wishes to introduce in evidence a certified copy of the message from the governor approving this bill, on the ground that the message of the governor approving the bill has a bearing on the public policy of this state. Is there any objection?

Gen. Stewart—Yes, we except to that.

The Court—All right, I will hear you.

Gen. Stewart—That is the message that the governor sent to the legislature at the time this bill was

being considered by that body. It is not competent in this case.

Mr. Hays—Oh, no, this is the governor's message approving the bill.

Gen. Stewart—That message has no bearing on this case and I object to it.

Mr. Hays—He said, "having these views, I do not hesitate to approve this bill." This is the message approving the bill.

Gen. Stewart—Well, sent to the legislature? Who is the message to?

Mr. Hays—A message from the governor.

Gen. Stewart—To whom?

Mr. Hays—To the senate and house of representatives, approving the bill.

Gen. Stewart—We except to that. Mr. Hays—I presume the signature is important also. He signs the bill.

Gen. Stewart—We except to that being put in the record.

Mr. Hays—May I read a part of it?

Gen. Stewart—I except to your reading any of it.

The Court—I will hear it.

Gen. Stewart—Why not get what some of the representatives said and introduce it in evidence?

Mr. Hays—I have not yet come to it. You don't give me time.

Gen. Stewart—I will not be surprised if you undertake to do it.

The Court—That would be a matter addressing itself to the powers of the legislature on the question of public policy. I think I will hear you.

Mr. Hays—The governor said, among other things: "It will be seen that this bill does not require any particular theory or interpretation of the Bible regarding man's creation to be taught in the public schools. We know that creeds and religions are commonly founded in the different refinements and interpretations of the Bible. \* \* \* It seems to me that the two laws are entirely consistent. The widest latitude of interpretation will remain as to the time and manner of God's processes in His creation of man."

"Another part says: 'After careful examination I can find nothing of consequence in the books now being taught in our schools with which this bill will interfere in the slightest manner. Therefore, it will not put our teachers in any jeopardy. Probably the law will never be applied. It may not be sufficiently definite to permit of any specific application or enactment.'"

Now, your honor, I believe that that statement is important on the question of the public policy of the state, and has a bearing upon the question of whether this statute is reasonable or within the police powers of the state.

The Court—That is the governor's opinion about it.

Mr. Hays—But when it is a statement made in approval of a bill, your honor will agree with me that his signature is important in the approval of bills.

The Court—Yes.

Mr. Hays—Why not his statement?

Gen. Stewart—His signature on the act is all that could be important, to put the law in force.

Mr. Hays—These are our reasons—

Gen. Stewart—If your honor please, it is absurd to put that into the record.

The Court—He has the floor.

Gen. Stewart—I want to except to his reading any more. If he wants to put that into the record it might be proper to put it in without reading. I say it is not competent for any purpose.

The Court—I will tell you, gentlemen, without further argument, as I have said before, the state government is divided into three branches, one, executive, the other legislative, the other judicial. Of course, the legislative branch has nothing to do with interpreting the law, the courts do that. Gov. Peay—with all deference to Gov. Peay—does not belong to the interpreting branch of the government. His opinion of what the law means, whether or not it would be enforced, is of no consequence at all in the court, and

could not have any bearing, and I exclude the statement.

Mr. Hays—I take an exception.

The Court—Yes.

Mr. Hays—May I ask that it be marked for identification?

The Court—Let the record show it was offered and excluded.

Mr. Hays—Will you mark this for identification?

(Passing to court reporter.)

The Court—Yes, mark it for identification. Are you ready to proceed with the case?

Gen. Stewart—Yes, we are ready.

The Court—Do you want the jury?

Gen. Stewart—The state is ready to proceed with the argument.

Mr. Hays—I do not think your honor wants the jury yet.

The Court—No.

Offers New Text Book.

Mr. Hays—We offer in evidence the message of the governor of the state approving the bill; first, for showing the public policy of the state; second, for the purpose of showing that the law providing for the school work that was taught in the schools is not necessarily inconsistent with the teaching of which Scopes is accused, in other words, that the two laws are not necessarily inconsistent; and third, I ask the court to take judicial notice, without the presence of the jury, of the message of the governor as an indication of the public policy of the state. Motion denied. Excepted to. Statement is ruled out. Exception taken by defendant. Now, your honor, at the same time I wish to introduce in evidence the text-book that has now been adopted by your state commission, these parts—

Gen. Stewart—Your honor—

Mr. Hays—Why should I not be permitted to state what I wish to offer in evidence without interruption? May I make my statement without interruption?

Gen. Stewart—No, sir, you cannot do that.

The Court—The court can exclude that if it is improper. It cannot hurt you.

Gen. Stewart—Your honor, the exception I am making is, he is not entitled to read it, that is from a textbook that has just been adopted, since this trial began.

Mr. Hays—Again on the question of public policy, at any rate I wish to state what I wish to offer in evidence.

The Court—Well, state the substance.

Gen. Stewart—If he wants to get it into the record let it be treated as read. I do not see the benefit of reading it.

Mr. Malone—The jury is not here.

Gen. Stewart—What is the reason of reading it to the court?

Mr. Malone—No, he is reading to the stenographer.

The Court—I think the court should hear what he wants to read, if it is not proper.

Mr. Hays—Referring to page 6 (reading): "Charles Darwin, to whom the world owes a great part of its modern progress in biology, spent twenty years in getting answers to puzzling questions as to how plants and animals came to resemble and to differ from each other. He then published one of the epoch-making books of all time, on 'The Origin of the Species.' Even if we cannot hope to be Pasteurs or Darwins, we can at least keep our eyes and ears open; we can be constantly learning new and interesting facts, and we may be able to contribute something of real value to the sum total of human knowledge."

Referring to page 463 (reading): "The highest order of mammals, the primates." You will remember we referred to that the other day—

"There remains one other group of mammals of which we shall speak, namely, the highest, that to which man belongs. This group also includes the monkey, the baboon and the ape. To the latter group belong the orangoutang, the chimpanzee and the gorilla. Because these animals excel the rest of the animal kingdom in brain development and in intelligence, this order of mammals is known as the primates (from the Latin, meaning first).

Some of these animals, while resembling the human species in many characteristics, must, of course, be recognized as having evolved (developed) along special lines of their own, and none of them are to be thought of as the source or origin of the human species. It is futile, therefore, to look for the primitive stock of the human species in any existing animals."

Then, there are questions following for the student to take up. The tenth is, "What animals belong to the order of mammals known as primates? Why are they so called?"

Also, this book, of course, contains a picture of Darwin, and on the order of primates contains a picture of the gorilla, and this is the book we are prepared to prove was recently adopted by your textbook commission. I want to offer these parts in evidence.

The Court—I will hear you, gentlemen.

Gen. Stewart—What is the purpose of offering that?

Mr. Hays—To show the public policy of the state, trying to prove to the court that this law is unreasonable.

Gen. Stewart—The public policy now, or at the time the law was passed?

Mr. Hays—Both.

Gen. Stewart—When do you claim that book was adopted?

The Court—Both?

Gen. Stewart—What?

Mr. Hays—I am going to ask you to tell me or to call witnesses. I thought you would concede our statement.

Gen. Stewart—I mean since the passage of the law.

Mr. Hays—Oh, yes.

Gen. Stewart—We do not think that is competent. The book involved in this case, along with the other evidence, is Hunter's Civic Biology. The book he reads from now is not the same book that was taught last year in the public schools. What is the name of that book?

Mr. Hays—That is true. I do not claim that it is. The testimony as to the other is here. I claim this book

was adopted in substitution for that. I claim it indicates you cannot teach biology without teaching something about Darwin and evolution. If this law is unreasonable, it is, of course, unconstitutional. That shows how unreasonable that law is, that is one of the questions we have to make on the constitutionality of the statute. I take it that the court takes judicial notice of every fact that bears upon that question.

The Court—I have already passed upon it, but you have the right to have my action reviewed, of course.

Mr. Hays—No, I think we have a right to have your honor to pass upon it. We want to be heard in order to have it before the court should we desire to make a motion in arrest of judgment or the direction of a verdict.

The Court—Mr. Stewart, for the present I will let this book be filed. If I see proper I will exclude it later. It might be competent, I am not sure.

Gen. Stewart—We except.

Mr. Hays—I am referring to page 6 of "Biology and Human Welfare," by Peabody & Hunt, and page 463. I am quite ready to suggest, if the prosecution wants to use any other part of the book on appeal, or if we want to use any other part, that this same ruling be adopted as to the other parts. (Said book was thereupon received and marked defendant's exhibit, No. 2.)

Mr. Hays—If your honor please, we next desire to make another offer. I have, since the last hearing, looked up the law and inquired from prominent members and jurists of your bar as to the practice in your courts. I understand, of course, that the offer of proof must be made in the absence of the jury. I understand, further, that it is done in any one of three ways. Either you call your witness and first bring out the testimony by question and answer, so as to make your record; or, secondly, you state to the court what you intend to prove; or, thirdly, you make an affidavit, first handing it to opposing counsel. I believe all three ways are properly

recognized and used. I am told that an attorney, so long as the jury is not present, is seldom, if ever, denied the right to make this offer of proof in his own way. We are anxious, your honor, to state what our offer of proof is, and we are particularly anxious to state it in reference to a statement that your honor made in the discussion on last Friday. You will remember that I suggested to your honor that it might be, after hearing some of the statements, you would change your ruling, at least as to some of it. For instance, we are prepared to prove what evolution is by a witness, and by the same witness what the Bible is, qualifying him as an expert on both subjects, and show according to a proper interpretation or translation of the Bible, or translation, these two parts of the act are not conflicting and Scope's act has not conflicted with the first part. I don't say that will be convincing to your honor, but I suggest we want to prove it on that ground and also on the ground that after hearing the evidence your honor might change your opinion as to the reasonableness of this law. In the discussion I said: "I asked to be given an opportunity to show whether or not that law is reasonable or not." Your honor then told me this: That your honor would hear us. Here is what happened. I asked that it be put in evidence in this case in order to inform the court and give us an opportunity to show whether that law is reasonable or not. Your honor told me yesterday that your honor would hear us with an open mind.

Your honor said: "I am going to let you introduce evidence and I will sit here and hear it, and if that evidence were to convince me that I was in error, I would, of course, reverse myself."

Mr. Hays—That is true. I know you would do that.

The Court—You can introduce evidence for the other purpose and I will hear it, and I never hesitate to reverse myself if I find myself in error.

Mr. Hays—That being so, I think your honor ought to permit us to enter the evidence for both purposes.

So I suppose we may assume in this offer to proof that we can make it in our own way.

The Court—I said, further, that I did not know about it. Of course all this discussion we have now we did not have before the court, the question as to how that would be introduced.

Mr. Hays—Yes, but your honor said you will hear us.

Gen. Stewart—Permit me to interrupt for just a minute.

Mr. Hays—Yes.

Gen. Stewart—On Friday we adjourned until Monday to give them an opportunity to prepare statements or affidavits of witnesses to be filed. I stated I would not agree to a continuance if we were to meet on Monday morning to spend a whole day in a harangue. I stated it expressly, and the record shows that. We adjourned with the express understanding that they would be permitted to prepare the affidavits for the record, and the only thing left for the court to determine, according to the court's own statement in response to an inquiry by Mr. Hays, as to whether or not the affidavits would be read.

Mr. Hays—That is what I wanted to do. I want to present my offer of evidence, stating that we would prove such and such a thing by such and such a witness.

The Court—You mean you will make the statement yourself, Mr. Hays?

Mr. Hays—Oh, yes; yes, sir.

The Court—Gen. Stewart, do you object to that?

Gen. Stewart—How is that?

The Court—Do you object to his statement that he hopes to prove so and so by certain witnesses?

Gen. Stewart—Your honor, the statement could be made for the record and we would except to it being stated in open court.

The Court—Of course. I want to hear it or want to read it, one.

Gen. Stewart—Your honor could read it. About how long would it

take to make these statements?

Mr. Hays—I do not know. If I presume on the patience of the court, the court will stop me. But this is in the absence of the jury.

The Court—I know, of course, you would not expect to read all of the statements, but would merely summarize it.

Mr. Hays—I will merely state what I expect to prove. Some I would summarize, others I would read.

Gen. Stewart—That is not the correct way to put it into the record. If it is to go in in affidavit form, it must have the effect of testimony.

Mr. Hays—I do not understand. I understand statements are allowed to go in.

Gen. Stewart—They must be sworn to.

Mr. Hays—I do not understand the practice. That is not the practice in your state, *Cruso vs. State*, 95 Tennessee, appears the statement that where you do file a statement, "one way is for counsel to write it out at that time, what is expected to be proved, hand it to opposing counsel, so there is no dispute." I cannot find anything in that case that requires any affidavits being sworn to whatever.

The Court—What about the agreement when we adjourned Friday?

Gen. Stewart—It was to be prepared. We made no such statement. You said you would present the statements to be read in court. That you would have to prepare these, because your scientists were going away.

Mr. Hays—Exactly. We could not prepare these in their absence.

Gen. Stewart—I suggest, your honor, the record will show the word "affidavit" was used, that is the understanding.

Mr. Hays—It was used in one place and not another. "Statement" was used, statements, of course.

Gen. Stewart—We adjourned on Friday to give them the opportunity to prepare them.

Mr. Hays—After our discussion on Friday the court said: "If the

statements are to be put in open court, why not put them in today?" That was at the very end. Do you now insist we not put in affidavits?

Gen. Stewart—Read what was said when you asked them for a continuance to Monday?

Mr. Hays (Reading)—"I don't want to spend all next week." That was the reason, probably.

Gen. Stewart—That is the reason; a pretty good reason.

Mr. Hays (Reading) from Friday's minutes of the record.)

Gen. Stewart—The record further shows his honor stated you better have your affidavits prepared.

Mr. Hays—Statements, your honor said, I would like to make my reasons a little clearer, but Gen. Stewart perhaps will agree—

The Court—Yes.

Mr. Hays—First, I offer the proof in open court, while we are all here, so that, if the state's attorney desired to they have a right to deny that the witness would so testify. Secondly, the court should hear read the statements in order to properly certify them as part of the bill of exceptions on appeal. Thirdly, to consider whether the court erred in excluding the testimony from the jury; next, holding the statute unconstitutional, and to consider whether the testimony is not properly before the jury in that it tends to show that the theory of the divine creation of man, as set forth in the Bible, and that the science Scopes taught merely portrayed the manner of man's creation— There are manifold reasons why the court should read these, and if we are wrong the court could point out to us, and if we are right we should have the benefit of reading them.

The Court—Why not read a synopsis?

Gen. Stewart—Why do you object to preparing them in written form and handing them to state's counsel?

Mr. Hays—It may be a habit or custom of mine, but I like to try my case in open court.

Gen. Stewart—I stated on Friday—

Mr. Hays—I believe under your practice I have a right to make my offer of proof in the form I want to?

Gen. Stewart—No.

Mr. Hays—I believe the prosecution should not insist we make our proof or prepare our record, but in a proper way as long as we are right.

Gen. Stewart—In the discretion of the court.

Mr. Hays—Of course it is, if we ask for anything unreasonable.

Gen. Stewart—It is anyway.

Mr. Hays—Is it unreasonable to state what we mean to prove by certain witnesses, when they can do no harm?

Gen. Stewart—I stated that the primary purpose of the defense is to go ahead with this lawsuit for the purpose of conducting an educational campaign and say to the public through the press their idea of their theory. And I think that this thoroughly demonstrates that that statement was more than correct.

Mr. Hays—You see the prosecution not only attempts to state our theory of the case, but also to tell our purpose to the court. Why not do it?

The Court—Let us hear from the attorney-general.

Gen. Stewart—There could be no purpose in reading the statement, or making the statement in open court to this crowd, the people here, except for the purpose of furthering its educational campaign as they call it, or spreading propaganda as I call it. That is the only purpose. Put them in the record for the supreme court that it may review the statement when the statement reaches the supreme court. The record is being made up by the stenographers here and they can take the statements prepared and write them into the record, and we can proceed to the disposition of this case without the necessity and the time of arguing this matter out here before the court. Of course, these statements will have to be submitted to the court and counsel here.

The Court—Of course it would relieve the court of a great amount of work, instead of sitting here and reading them.

Gen. Stewart—I think we are fixing to lose two or three days on these statements, right now if that is permitted.

Mr. Hays—Justice is more important than time.

Gen. Stewart—The crowd is not going to try the lawsuit.

Mr. Malone—We are not talking to the crowd. We are talking to his honor.

Gen. Stewart—Put them in—

Mr. Malone—Let his honor dismiss the crowd, and have your honor and the attorneys—

Gen. Stewart—Why not put them in written form?

Mr. Hays—We feel the prosecution has been allowed to state what the theory of our case is, and we insist at any rate to state our purpose. I am afraid perhaps my methods of explanation may be somewhat confused because after ten minutes of explaining why I prefer to present my offer of proof, and the general explanation, and I have a reason, and I am entitled to do it, as long as my procedure is right according to your state practice. The attorney-general may not like our methods, and suspect our purposes, but we have a right to state them to your honor for ourselves.

Mr. Stewart—It is my desire that these proceedings retain what legal aspect they may. It may be contended that it is going to be a Sunday school class or a chautauqua, if so it is time to adjourn.

Mr. Hays—I take exception. No one on this side of the table talks on the chautauqua.

The Court—It is not my purpose to withhold anything from the crowd, or give anything to the people who happen to be here. It is purely a legal question for me.

I would like to see the holdings in Tennessee on this point, if there are any. In my practice we have not had a big case like this. This is my first case of this kind, perhaps, the first the court has had. Ordina-

narly, when we offer proof that has been ruled out, counsel for the party against whom the court rules just steps over to the shorthand reporter and gives it to him quietly, with the jury in their seats. Now that is the way we ordinarily do it.

As to whether it shall be put in affidavit or in statement form, I am not prepared to rule.

Mr. Hays—Your honor, affidavits have never been required. I can state from the cases I examined yesterday.

Gen. Stewart—You might be right on that.

Mr. Hays—We already insisted it should be done out of the presence of the jury?

Gen. Stewart—I would object as vigorously as I know how as to the statements being made in open court. It is unnecessary. They are being made for the appellate court and whether verbal or written makes no difference to the appellate court.

Mr. Hays—It may make some difference to this court. He still stated he had an open mind. What is the fear?

Gen. Stewart—My objection is to making a Sunday school out of this at the expense of Rhea county, of the courthouse.

Mr. Hays—It may lead to intelligent thought and that can do no harm.

Gen. Stewart—The fact that it may lead to unintelligent thought may do harm.

Mr. Hays—I don't think intelligent thought ever does any harm. I have a right to make my offer of proof in my own way.

Mr. Bryan—If the court pleases—

The Court—Gentlemen—

Mr. Stewart—Mr. Bryan, if your honor pleases—

The Court—If there is no theory why this should not be—to prevent the court from sitting down and reading this, the court and counsel going to a private room and having this put into the record—I do not mean to intimate that it should be done this way.

The Court—Col. Bryan, I will hear you.

**Must Not Be a One-Sided Case.**

Mr. Bryan—If your honor please, if the object of the defense is to make a record for the higher court, that can be done by affidavits and we will not be allowed any affidavits, on the other side.

If the purpose of the defense is to present an argument with the purpose of persuading your honor that he was wrong, and in order to induce him to reverse himself, if that is the purpose of this, it cannot be a purely ex parte matter.

If they are allowed to present argument to the court that it should be wrong, and should reverse itself, we certainly should be allowed to present an argument on the other side. As long as it goes into the record for the other side, we are excluded, but so long as the defense is attempting to persuade this court and to secure action in this matter, it cannot be on side ex parte, it seems to me. We must be allowed to present our side to the court so that the court, when it comes to consider whether it should reverse itself, should have both sides of the case and not only the other side.

Mr. Malone—Mr. Bryan is guilty of the same fallacy in his statement now that he was guilty of the other day when he asked the right to cross-examine our witnesses who might be called merely for the purpose for which these statements are offered. The prosecution and the court sustained that objection to the admissibility of the testimony of our witnesses who were here. If the prosecution had not objected and your honor had admitted our witnesses, then Mr. Bryan would have the right he now wishes to claim to cross-examine witnesses. But after limiting us to witnesses to testifying to mere points in synopsis, he wanted to maintain all the broad rights which he would have had if our testimony had been admitted even without the prosecution having objected to our testimony being limited. Now, this morning he claims the right when limited not to witnesses, but statements, and I have the same right to answer that he cannot have the issue limited as to our offer of proof,

the court having ruled upon it, and then claim all the broad rights which he would have if the proof had been admitted that we wish to offer.

Mr. Bryan—The point which the gentleman makes is not the point in this case. He says I object to the introduction of witnesses without the right to cross-examine. Now, even if the court had held that we had no right to cross-examine these witnesses on the ground that the testimony was not for the court to consider, but for the higher court, even if the court had so held and we had been permitted to cross-examine witnesses, I submit that this morning is in for an entirely different purpose. The argument to be made by the gentleman from New York is not for the higher court, but for this court, to persuade this court that it was wrong, to secure from this court a decision in this trial, and surely we are not to be banned from presenting our side, whenever they try to persuade this court to take an action that vitally affects this case. This is an entirely different point this morning, Mr. Malone, and had the other side been right when they objected to cross-examination, they cannot be right now, because if they had been right then, it would be simply because the evidence was for the upper court, which could not render a decision, but only remand the case for a new trial. Had they been right then, they cannot be right now, when their purpose is not to make a record for the higher court, but to persuade this court and secure a decision from this court for the acquittal of the defendant at this time.

Mr. Darrow—May I say a word in reference to Mr. Bryan's statement, if your honor please?

The Court—Judge MacKenzie, couldn't you furnish me some authorities on this question?

Mr. Hays—I have the authorities.

The Court—Just a minute, Col. MacKenzie.

Mr. MacKenzie—Your honor—

Mr. Darrow—I don't suppose there is any dispute between us lawyers on it, but you may differ, Mr. Bryan. If there is I suggest, your honor, that is a good way to send out for them,

but I do not believe there is any dispute between the lawyers on this method.

The Court—I will hear you.

Mr. Darrow—I only want a moment. I agree exactly what the practice is, not only here, but elsewhere. We offer certain evidence; the court refused it. We offer to call witnesses and the court said it was not competent. Now, we cannot predicate error on that unless we put in the record what we expected to prove by witnesses.

Your honor is quite right, and that is ordinarily right, too, stepping up to the shorthand reporter and stating what we expect to prove, telling the court and the shorthand reporter taking it down. That is exactly what we want to do here. We want to state it to the court and have it taken down by the shorthand reporter, or else pass them the statements we have already prepared to be used in the record in lieu of that.

We want to state to the court exactly what we expect these witnesses to swear to. How can there be any question?

The Court—Have you the affidavits?

Mr. Darrow—They are not affidavits, but statements.

Gen. Stewart—Have you the statements prepared?

Mr. Darrow—Yes.

Gen. Stewart—Then simply place them—let them turn them into the record, and proceed with the case.

Mr. Darrow—We think we have the right—

Gen. Stewart—To make a speech? That is what you are talking about!

Mr. Darrow—To choose our own way of protecting the record.

Gen. Stewart—I think not.

Mr. Darrow—We have a right, if we choose, to state in open court we expect to prove, for instance, Dr. Osborn—

The Court—How long will it take?

Mr. Darrow—I think, your honor, we will not need to read all of them; I think we could read all we wanted to in an hour, and then adopt their method on the rest.

The Court—What do you say?

Mr. MacKenzie—What do you say?

The Court—Let me ask you a question; they ask to file statements; they want an hour to briefly review what is in the statements.

Mr. MacKenzie—Can we see the statements?

Mr. Darrow—Certainly.

Mr. MacKenzie—After he speaks an hour and tells us what he expects to prove, this is excluded testimony for the supreme court to review, how much closer to the facts than you are right now? Is your honor going to say under your statement, as judge of the Eighteenth Judicial Circuit of the state of Tennessee, if these gentlemen could prove that—have either of the witnesses fainted? Have they run off and has it gotten down to the point where these distinguished gentlemen have to take the statements, too? Not even concerned to? What does the statement of an hour mean in this record? Of course, they are entitled to preserve their exceptions.

Mr. Darrow—That is all?

Mr. MacKenzie—Not what Mr. Hays of New York thought he hoped to prove? This is not an application for a continuance?

Mr. Hays—Why of New York?

Mr. MacKenzie—I noticed you don't want to be of Tennessee, and hence I thought I would place you. We want you to have the respect of your own wishes, Brother Hays, and we have no objections to your living in New York.

Mr. Hays—(Not heard in the noise and continued talking of counsel.)

Mr. MacKenzie—Please do not interrupt me. I am talking to the court, if you please. I will answer anything you want to ask, and write you a letter to boot.

Mr. Hays—You cannot—

Mr. MacKenzie—Your honor, I was proud to see as a friend of these distinguished gentlemen among the many able Chattanooga lawyers up here, my distinguished friend, Frank Spurlock, one of the best lawyers in Tennessee, standing by Col. Darrow. If you want to get the Tennessee laws as to how to get this in the record, let him make a statement in the record.

Mr. Hays—He told me.

Mr. McKenzie—We are perfectly willing for you to have it, but we don't want to give you three hours over it; your honor is not going to let you prove that unless you could show some symptoms you could prove that.

Mr. Hays—I want to see the symptoms.

Mr. McKenzie—We have had several of them. I think we have heard the speeches of my good friends, Hays and Malone. We kind of enjoy Brother Darrow speaking, but we heard their speeches and sitting around for two hours, on every exception. Now it is a mere matter of law and procedure what shall go into the record in this case.

Mr. Hays—That is right.

Mr. McKenzie—It has been excluded. Now, will your honor put it in the record in this case? In the first place, this honorable court must be satisfied that they could have proved by these witnesses this excluded testimony.)

The Court—How can I be satisfied?

Mr. McKenzie—The onus is on them.

Mr. Darrow—Let me ask you a simple question.

Mr. McKenzie—All right, Col. Darrow.

Mr. Darrow—If you were asking for the admission of some evidence or John Smith here to testify, and you told the court what it was and the court said it was not competent and ruled you could not give it, isn't that simple statement of what you expect to prove by John Smith enough to preserve the record?

Mr. McKenzie—No, sir; not unless it is agreed to by the other side.

Mr. Darrow—What?

Mr. McKenzie—Never has been in Tennessee. If that is the way of it we ought to just practice law on the statements of the lawyers on each side as to what they want to prove and dispense with the witnesses, and argue the case.

Mr. Darrow—I don't like to dispute on Tennessee law, but I am sure I am right.

Mr. McKenzie—Let Col. Stewart

look at your statements there, and if he will agree your witnesses will swear to them—that trouble is all over.

Mr. Hays—Why not read them in open court?

Mr. McKenzie—I don't want to read them and nobody else wants to read them.

Mr. Darrow—It won't take over an hour, and take the statements of the rest of them.

Gen. Stewart—I don't think we will have any trouble about what goes into the record; the only thing is the reading of these in open court.

The Court—They do not purpose to read them.

Gen. Stewart—Read them and make speeches on them.

Mr. Hays—No.

Mr. Darrow—We expect to show that a certain professor will say so and so and read the statement; read two or three of them, and let it go at that.

Mr. Hicks—As I understand and remember, they made the statement the other day to this effect: What they intended to prove, that evolution does not conflict with the Bible, or they want to interpret the Bible or show evolution does not contradict the Bible. Now, your honor has ruled that line of evidence is not admissible in this case. Now, will your honor rule time and again on it? Is there an end to that?

The Court—Didn't they say what they intended to prove; didn't Mr. Hays say that he wanted to offer proof they wanted to show what was meant by it?

Mr. Hicks—That is true, your honor has already ruled on that; what is their purpose?

The Court—I thought that the defendant admitted that he taught that man descended from a lower order of animals.

Mr. Hicks—If they exclude everything else but the only evidence on this merely to save time.

The Court—The higher courts may differ with me.

Mr. Hicks—What is the use of reading them in open court?

Mr. Darrow—We are just trying to make the record, nothing else.

Mr. Hays—We are entitled to make this record in our own way as long as it is in accord with the practice of Tennessee and the constitution. Aren't we entitled to make it as long as it is in accord with your practice or the way you gentlemen say?

Gen. Stewart—Like the court says.

Mr. Hays—If it is in accord with your practice.

Gen. Stewart—Why state them in open court?

Mr. Hays—I understand that three times.

Gen. Stewart—I would not be able to understand you.

Mr. Hays—That is not my fault; beg pardon.

Mr. McKenzie—As I understand these gentlemen, the other day, they offered this scientific testimony, and your honor held that was not competent; am I right?

The Court—I held it was immaterial and incompetent because it would not reflect upon the issues involved in the case.

Mr. McKenzie—Now, as I understand, if your honor please, the only purpose in their offering these statements now is to make up the record, and in the event the case goes to the appellate court to convince the court your honor is in error in refusing to admit this particular testimony. Now, if this is true, may it please this honorable court, what right would they have to come into this court by reading these statements and then after that as indicated by Mr. Hays, make an argument on the very statements of these scientists that you have held their testimony was not competent?

The Court—Just an hour to make up the record.

Mr. Hicks—To make up the record, not to make an argument.

(Thereupon after a further colloquy between counsel, the court said):

The Court—I give you an hour, gentlemen, to go over that, I will then hear you on both sides. I will let you have a chance to see the statements offered as proof.

(Thereupon Mr. Hays proceeded to read):

Mr. Malone—We can finish it in an hour, your honor.

The Court—I am very much inclined to give them an hour, general. I believe I will give the defense an hour to make up their record for the appellate court. I want to be fair to both sides and it occurs to me that that is fair.

Mr. Hays—We expect to prove by the Rev. Walter C. Whitaker—

The Court—I wish you would stand over here near the stenographer, Mr. Hays.

Mr. Hays—We expect to prove by the Rev. Walter C. Whitaker, rector of—

Gen. McKenzie—I just want to ask for information. Is he first going to state what he expects to prove here by each of these witnesses and then read the affidavit covering the some thing?

The Court—No, I don't think he wants to do that. Mr. Hays, what do you want to read, your statement of summaries? I don't understand he wants to argue the statements.

**Bible Not to Be Taken Literally.**

Mr. Hays—I will offer a portion of them. I have two here which have not been prepared and I will state what they are and then I will offer just one where the witness is in court and I want to read from that what we offer to prove. The others will state in general and we will save time if we can. We expect to prove by the Rev. Walter C. Whitaker, rector of St. John's Episcopal church, Knoxville, Tenn., and chairman of the committee which passes on the competency of new ministers for the United States that a man can be a Christian and an evolutionist at the same time. He says "As one who for thirty years has preached Jesus Christ as the Son of God and as 'the express image of the Father' I am unable to see any contradiction between evolution and Christianity.

"And also a man can be a Christian without taking every word of the Bible literally. Not only so, but

the man has never lived who took every word of the Bible literally. When St. Paul said: 'I am crucified with Christ,' and when David said, 'The little hills skipped like rams,' neither expected that what he wrote would be taken literally. The sense of Scripture is Scripture. That sense is conveyed to us sometimes in a story and sometimes in a poem. The higher and truer meaning would often be lost if we held ourselves exclusively to the letter and rejected that which it suggests or figures. The story of Abraham's two sons, as contained in Genesis, is interesting and valuable; but in his epistle to the Galatians, St. Paul does not hesitate to say that it is an allegory, and that its true value is its teaching as to the two covenants or testaments.

"I am thoroughly convinced that God created the heavens and the earth, but I do not know how he proceeded. I am sure that He made man in His own image, but I find nothing in the Scriptures that tells me His method. Since God is not subject to the categories of time and space a thousand years being in His sight as a single day, I am unable to see that there is any incompatibility between evolution and religion. Some evolutionists are irreligious, but so are some who are not evolutionists. I myself hold with the writer of the Epistle to the Hebrews that 'God, who at sundry times and in divers manners, spoke in time past unto the fathers by the prophets hath in these last days spoken unto us by His Son, by whom He made the world.'" That would be the testimony of Dr. Whitaker.

#### Would Use Shailer Matthews.

We expect to prove by Dr. Shailer Mathews, dean of the Divinity school of the University of Chicago, and one of the leading American authorities on the Bible, author of the book on "Contribution of Science to Religion," that "a correct understanding of Genesis shows that its account of creation is no more denied by evolution than it is by the laws of light, electricity and gravitation. The Bible deals with religion.

#### Two Accounts of Creation.

There are two accounts in Genesis of the creation of man. They are not identical and at points differ widely. It would be difficult to say which is the teaching of the Bible. The aim of both, however, is clear and wonderfully inspired. Each shows how God created man and how man differs from beasts.

In the first account in Genesis, Chapter 1 to Chapter 2, Verse 3, it is said that God made beasts, cattle and all creeping things by having the earth bring them forth as living creatures. The Hebrew expression here used to quote Nephesh Shayah is the same as that used in Genesis, Chapter 2, Verse 7, to describe man when created. The first story then continues with the creation by God of man in the divine image, male and female being created on the sixth day. In the second account Genesis, Chapter 2, Verses 2 to 24, God is said to have formed man from the dust of the ground and to have breathed into him the breath of life. Man thus became a living soul. In the Hebrew the same word is used as that previously used to describe the animals which the earth brought forth.

This living creature, Adam, is placed by God in a garden, which he is to till. He is forbidden to eat of the tree of the knowledge of good and evil. He, however, disobeys and eats the fruit. God then declares that man has become "one of us knowing good and evil." Genesis thus says that an animal life, produced by God from the earth by his spirit, came to be like God through a development born of experience. Thus so far from opposing the Genesis account of the creation of man, the theory of evolution in some degree resembles it. But the book of Genesis is not intended to teach science, but to teach the activity of God in nature and the spiritual value of man. It is a religious interpretation, its writers use the best of the then current knowledge of the universe to show how God was in the creative process, and how that process

culminated in man possessed of both animal and divine elements.

The theory of evolution is an attempt to explain the process in detail. It does not take place in a vacuum, but in an environment in which is God. Genesis and evolution are complementary to each other, Genesis emphasizing the divine first cause and science the details of the process through which God works. This view that evolution is not contrary to Genesis is held by many conservative evangelical theologians, such as Strong, Hall, Micou, Harris and Johnson, Mullins also holds to a theistic evolution."

Mr. Hays then read the statement of Dr. Fay Cooper Cole, anthropologist, University of Chicago; the statement of Kirtley F. Mather, chairman of department of geology, of Harvard university, and the statement of Dr. Winterton C. Curtis, zoologist, University of Missouri.

At 11:40 a. m., during the reading of Dr. Curtis' statement, the further hearing of this case was adjourned to 1:30 p. m., when the following proceedings were had:

#### Darrow Apologizes to the Judge.

Gen. Stewart—This morning the court read a citation to one of the counsel for the defense, referring to a certain matter which occurred here on Friday and during the noon hour I conferred with some of the gentlemen for the defense, particularly the gentleman involved, Mr. Darrow, and Mr. Darrow has a statement that he wants to make at this time and I think it is proper that your honor hear him and I want to ask the court to hear the statement.

The Court—All right, I will hear you, Col. Darrow.

Mr. Darrow—Your honor, quite apart from any question of what is right or wrong in this matter which your honor mentioned and which I will discuss in a moment—quite apart from that, and on my own account if nothing else was involved, I would feel that I ought to say what I am going to say. Of course, your honor will remember that whatever took place was hurried,

one thing followed another and the truth is I did not know just how it looked until I read over the minutes as your honor did and when I read them over I was sorry that I had said it. This is not all I am going to say—I am just going to preface it. So on Friday I determined immediately on reading it over I would tell the court just what I thought about it this morning. In the meantime, I had seen the paper which stated that the court thought that I was trying to get in position where I would be held in contempt and they thought so and the like and I was at loss what to do, but I knew your honor wanted to be heard first. Now I want to say that what I say is in good faith, regardless of what your honor may think, it is right for you to do. But I say it because I think I ought to say it for myself. I have been practicing law for forty-seven years and I have been pretty busy and most of the time in court I have had many a case where I have had to do what I have been doing here—fighting the public opinion of the people, in the community where I was trying the case—even in my own town and I never yet have in all my time had any criticism by the court for anything I have done in court. That is, I have tried to treat the court fairly and a little more than fairly because when I recognize the odds against me, I try to lean the other way the best I can and I don't think any such occasion ever arose before in my practice. I am not saying this, your honor, to influence you, but to put myself right. I do think, however, your honor, that I went further than I should have gone. So far as its having been premeditated or made for the purpose of insult to the court I had not the slightest thought of that. I had not the slightest thought of that. One thing snapped out after another, as other lawyers have done in this case, not, however, where the judge was involved, and apologized for it afterwards, and so far as the people of Tennessee are concerned, your honor suggested that in your opinion—I don't know as I

was ever in a community in my life where my religious ideas differed as widely from the great mass as I have found them since I have been in Tennessee. Yet I came here a perfect stranger and I can say what I have said before that I have not found upon anybody's part—any citizen here in this town or outside, the slightest discourtesy. I have been treated better, kindlier and more hospitably than I fancied would have been the case in the north, and that is due largely to the ideas that southern people have and they are, perhaps, more hospitable than we are up north. Now I certainly meant nothing as against the state of Tennessee, whom I don't think is any way involved, as your honor knows that these things came up in court time and time again and that it is not unusual perhaps in a case where there is a feeling that grows out of proceedings like this that some lawyers will overstep the bounds. I am quite certain that I did that. I do not see how your honor could have helped taking notice of it and I have regretted it ever since on my own account and on account of the profession that I am in, where I have tried to conform to all rules and think I have done it remarkably well and I don't want this court, or any of my brethren down here in Tennessee, to think that I am not mindful of the rules of court, which I am, and mean to be, and I haven't the slightest fault to find with the court. Personally, I don't think it constitutes a contempt, but I am quite certain that the remark should not have been made and the court could not help taking notice of it and I am sorry that I made it ever since I got time to read it and I want to apologize to the court for it. (Applause.)

#### The Judge Forgives Darrow.

The Court—Anyone else have anything to say? In behalf of Col. Darrow in anyway? (No response.) If this little incident had been personal between Col. Darrow and myself, it would have been passed by as unnoticed, but when a

judge speaks from the bench, or acts from the bench, his acts are not personal but are part of the machine that is part of the great state where he lives. I could not afford to pass those words by without notice, because to do so would not do justice to the great state for which I speak when I speak from the bench. I am proud of Tennessee, I think Tennessee is a great state. It has produced such men as the Jacksons, such men as James K. Polk and such men as Andy Johnson and such men as the great judge that recently went from our neighborhood to the supreme bench of the United States—Judge Sanford—so I feel that we must preserve the good name of this great state that has produced such great men—such great characters as these that I have mentioned. We have had another man who lived in Tennessee—I believe he is dead now—he was a poet and he wrote these words:

"Dost thou behold thy lost youth,  
all aghast,  
Or dost thou feel from retributions'  
righteous blow  
Then turn from the blotted archives  
of the past  
And find the future pages white  
as snow.  
Art thou a mourner? Rouse thee  
from thy spell;  
Art thou a sinner? Sin may be  
forgiven.  
Each day gives thee light to lead  
thy feet from hell.  
Each night a star to lead thy feet  
to heaven."

#### Raulston Acts on Christian Principles.

My friends, and Col. Darrow, the Man that I believe came into the world to save man from sin, the Man that died on the cross that man might be redeemed, taught that it was godly to forgive and were it not for the forgiving nature of Himself I would fear for man. The Savior died on the cross pleading with God for the men who crucified Him. I believe in that Christ. I believe in these principles. I accept Col. Darrow's apology. I am sure his remarks were not premeditated.

I am sure that if he had had time to have thought and deliberated he would not have spoken those words. He spoke those words, perhaps, just at a moment when he felt that he had suffered perhaps one of the greatest disappointments of his life when the court had held against him. Taking that view of it, I feel that I am justified in speaking for the people of the great state that I represent when I speak as I do to say to him that we forgive him and we forget it and we commend him to go back home and learn in his heart the words of the Man who said: "If you thirst come unto Me and I will give thee life." (Applause.)

I think the court should adjourn downstairs. I am afraid of the building. The court will convene down in the yard.

(Court thereupon adjourned to the stand in the courthouse lawn and upon reconvening the following proceedings occurred:)

Mr. Hays—If your honor please, I will not take very much time. I have condensed these statements considerably.

The Court—Where is my officer? Announce to the jury if any are present they must retire.

Officer Kelso Rice—Now, if any of the jurors are present please retire, by orders of the court.

Mr. Hays—Your honor, as to the next order of proof which the defense would offer I should like to say that the defense, as lawyers, take no position of this. It has to do wholly with the question of what the Bible means, and what we would be able to prove from witnesses—we wish to state that we should be able to prove from learned Biblical scholars:

(The statement of defense counsel was thereupon read, which has heretofore been multigraphed and delivered to the press.)

#### Rabbi Rosenwasser's Statement.

Mr. Hays—Next, your honor, we come to the question of what we would like to prove on the questions of translation that occur in the

King James version from the original.

(The statement of Dr. Herman Rosenwasser was thereupon read, which follows.)

Dr. Herman Rosenwasser is a rabbi whose qualifications are vouched for by Dr. Kaufman Kohler, president emeritus of the Hebrew Union college of Cincinnati, and the leading Hebrew Scholar of America, who says:

"I consider Rabbi Rosenwasser well qualified to interpret Genesis scientifically and fully agree with him in his endeavor to reconcile evolution with the Bible, as I did in all my teachings."

(Biography—Dr. Herman Rosenwasser resides at 180 Commonwealth avenue, San Francisco, Cal. He is 46 years of age, was born in Hungary and came to the United States in 1893. He studied in the West High school of Cleveland, O. Upon graduation he went to the Hebrew Union college, where he was a pupil of Dr. Isaac M. Wise. After two years, and before graduation, he was called to the rabbinate of the congregation at Springfield, Mo., and while there, in addition to his religious duties, he taught in the public high school. He left Springfield for Cleveland in 1903 to continue his academic studies at the Western Reserve university of Cleveland. He specialized there in semitics and philosophy. In the year 1905, he received a degree of master of arts from the Western Reserve university. In 1906 he continued his rabbinical studies at the Hebrew Union college in Cincinnati, and in 1908 was there ordained a rabbi. His first charge was Lake Charles, La., two years; then Baton Rouge, three years. While there he was a member of the Protestant Ministerial alliance. Then he went to San Francisco, where he occupied for ten years the rabbinate of Temple Sholem, leaving there two years ago to devote himself to research.

During all this time he was a student and teacher of the Bible and has contributed largely to theological papers.

He speaks fluently, English, German, Yiddish, Hungarian and Hebrew. He reads and translates the above languages and in addition, Latin, Greek, Chaldaic, French and Italian. On the Bible he has done original research work for years.)

The defense counsel, of course, disclaims any knowledge on the subject and knows there are any number of translations, but this witness would testify that the King James version is not an accurate translation; not true to texts vitally teaching creation, man, life and soul.

In 1611, when the King James revision was made, little was known of the Hebrew language. The scholarly study did not begin until 1753. 142 years after the King James version. From that time on, great strides have been made. To understand the Bible one must know Hebrew.

The original Bible was without vocalization (that is, the vowels were missing), and without punctuation, and the five books of Moses are read in Hebrew synagogues from unvocalized or unvowelized and unpunctuated texts.

#### Mistakes in Bible Translation.

In the translation of the Hebrew Bible, from which the King James Protestant version is derived, there are many errors, none of them basic. The word "create" purports to be a translation of "bara." This word, "bara" is used with reference to both inorganic and organic creation, man as well as animals and plants. The word "bara" is used to represent the whole cosmic scheme. The correct translation is "to set in motion." From the incorrect translation into English in the King James version great confusion has resulted.

In Verse 2 of the King James version of the Protestant Bible appears the following: "The spirit of God moved upon the face of the waters." That is not a correct translation of the Hebrew. A correct translation of the Hebrew word "marachefeth" is, "And God animated, imparted life, vivified." The words, "The face of the waters" are "alpenai humayin,"

which means "to animate the face of the fluid mass."

In Psalms cxlviii:6, the King James version says: "He hath made a decree which shall not pass." That is not a correct translation. The word "chak" in Hebrew means "natural law" or "law of nature." Here it is translated "decree." The words "which shall not pass" do not represent a correct translation, either. The words should be "which He doth not transgress." The proper English translation of the whole would be as follows: "He hath made a law of nature, which He doth not transgress." In other words, the laws of nature are unchanging.

In the Bible there are four distinct terms for man: Adam, Enoch, Gever and Ish. Some of these are used as meaning animals.

In the Book of Ecclesiastes 3:19: "Adam (the physical man) and animals are declared to be subject to the same laws. The original, properly translated, is "There is no pre-eminence of the 'Adam' (of the natural man) over the animal, for all is unstable." The word "eucsh" also refers to the physical man, because that man turns to dust. (Psalms xc:3). These two words, "Adam" and "Eaosh" refer to the physical man only and identify him with the physical creation.

In the first chapter of Genesis, the word "Adam" is used. The word Adam means a living organism containing blood. If we are descended from Adam we are descended from a lower order—a living, purely organism containing blood. If that is a lower order of animal, then Genesis itself teaches that man is descended from a lower order of animals.

The terms "Gever" and "Ish" refer to the intellectual and spiritual man.

Wherever the higher attributes of man are referred to, such as love, mercy, justice, righteousness, purity, etc., or any ethical attribute, the words used are "Gever" and "Ish." Every translation of a term here is a literal translation. The Hebrew dictionary will bear out every translation referred to.

If the Hebrew Bible were properly translated and understood, one would not find any conflict with the theory of evolution which would prevent him from accepting both.

Mr. Hays—The defense counsel, of course, disclaims any knowledge on the subject, but knows there is a number of translations, and this witness would testify to them.

#### What Dr. H. E. Murkett Would Say.

We would also be able to prove that the Bible, properly interpreted, does not conflict with the theory of evolution by Dr. Herbert E. Murkett, pastor of First Methodist Church, Chattanooga.

There is nothing whatever in the belief in evolution that denies the divine story of creation. The non-Calvanistic churches have never believed, through their leaders, in divine fiat or determined and fixed processes as acts of God.

The divine story does not tell how man was made. It says that he was made out of the dust—that is, the material—it tells what God did with him when made—breathed into him his spirit. The process is not mentioned anywhere.

If the second chapter of Genesis is taken literally then the creation of man was progressive. First man is formed and he is put to sleep and through another process that no man can interpret, woman was made, and then through another process children were made and this process has been going on for centuries.

Take the statement that God said, "Let us make man in our image." This is open to interpretation. Was man already made? The story does not say, "Let us make another creature and call him man and let us make him after image." No, let us make man—already known, already a part of the animal life—let us make him after our image. He was then endowed with the spirit of God, possessing his moral, spiritual and intelligent nature.

Again note the story in the second chapter of Genesis. Man is introduced as perfectly naked, and does

not know it; he is ignorant of right and wrong. This is a story of a man awakening to the consciousness of right and wrong, of the consequences of such a knowledge, and he begins the only process known to allay the pangs of conscience and lack of harmony with his Creator.

To science and not to the Bible must man look for the answer to the question as to the process of man's creation. To the Bible and not science must men look for the answer to the cause of man's intelligence, his moral and spiritual being.

Man is here and must be accounted for from two standpoints. He is a physical being and lives the life of all other physical beings and is a study for material science. He is spiritual and lives in the realm of spirit and for understanding of that spiritual side one must study the science of theology. When these two shall be harmonized then will we have an understanding of this dual personality that follows after God rather than the animal existence, who plays with God's laws and learns how. He operates them, who sees in spirit and then transforms the vision into locomotives, airplanes, telegraph instruments, radio, and by many inventions overcomes time and space.

Students have a right to be taught the truth about the whole man rather than a half truth. The future of human progress demands it.

Mr. Hays—Our next witness would be Donald F. Metcalf and I think I stated his qualification the other day.

The Court—His testimony is in the record?

Mr. Hays—I have a few statements I will read.

The Court—All right.

(Excerpts of the statement of Mr. Metcalf were thereupon read.)

Mr. Darrow—I take it you want all of the testimony incorporated in the record?

Mr. Hays—Yes, of course, the whole statement will go into the record.

The Court—Yes, let the whole statement go into the record.

Mr. Hays—The next is Herbert A. Nelson, who, as your attorney knows, is state geologist of Tennessee. (Reading statement by Nelson.)

Mr. Hays—I will next read Dr. Jacob Lipman, as your honor no doubt knows, Mr. Lipman is a very eminent scientist.

(The statement of Mr. Lipman was thereupon read.)

#### Letter From Luther Burbank.

Mr. Hays—While we are on that subject I will say Mr. Luther Burbank makes a full statement.

The Court—Is he here?

Mr. Hays—He is not here, your honor. This is his letter. We will take his deposition if you will let it in as evidence.

Mr. Hicks—Will you let us cross-examine him?

Mr. Hays—Do you want to cross-examine Mr. Burbank, Mr. Hicks?

Mr. Hicks—We would cross-examine him if you put him on.

Mr. Hays—I would like to hear you cross-examine Mr. Burbank.

Mr. Hicks—I would like to hear you too. (Applause and rapping for order by Policeman Kelso Rice.)

(Letter by Mr. Burbank was then read.)

Gen. Stewart—That is just a letter from Mr. Burbank?

Mr. Hays—That is what we would be able to prove and if the scientific witnesses went on the stand, I assume we could take his deposition and prove it if we could get it here in time. Dr. Charles Hubbard Judd would testify:

(The statement of Mr. Judd was thereupon read.)

Mr. Hays—And the last statement which I would read to your honor, showing what I could prove, is from Dr. Horatio Hackett Newman, zoologist of the University of Chicago.

(Reading.)

The Court—Have you had the statements marked filed, Mr. Hays?

Mr. Hays—Yes, sir, I will.

#### STATEMENTS ARE FILED.

By Defense Counsel.

Of course, the defense, as lawyers, take no position on the truth of the stories of the Bible, but we wish to state that we should be able to prove from learned Biblical scholars that the Bible is both a literal and figurative document, that God speaks by parables, allegories, sometimes literally and sometimes spiritually.

We should be able to prove:

First—That the entire Bible teaches the fact of the fundamental difference between the soul and the body. This is clearly shown by the following passages: Ecclesiastes vii:8; Luke viii:55, xxiii:46, xxiv:39; John vi:63; I Corinthians vi:17,20; Hebrews iv:12, xii 22,23; James ii:26—all of which show the Bible attitude on the question of the nature of the soul.

Typical examples of the teaching of the Bible in reference to the body or flesh are given below:

"My substance was not hid from thee, when I was made in secret, and curiously wrought in the lowest parts of the earth. Thine eyes did see my substance yet being imperfect: and in thy book all my members were written, which in continuance were fashioned, when as yet there was none of them." (Psalm cxxxix:15-16.)

Here there is a distinct statement that the human body was created by the process of evolution.

Also Roman viii:22 says "For we know that the whole creation groaneth and travaileth in pain together until now."

Second—That the entire Bible teaches that God is a spirit and "the father of spirits," and not the father of flesh. (See Numbers xxvii:16; John iv:23-24; Hebrews xii:9.)

Third—Therefore, it is man's soul or spirit, and not his body, that is the Son of God, and which consequently is in the image of God.

Fourth—That the Bible is concerned with the ethical and spiritual side of life, and not with the body, or chest of tools, which is the means of self-development or self-expression of that soul.

Fifth—That natural science is concerned with the developmental history, the structure and the functions of all living bodies, and not with any religious or any ethical questions.

Sixth—That the Bible simply states that God created the human body and the material he used in doing it, and not how he did so. There are at least four separate accounts of the creation of the human body in Genesis, and they can only be harmonized in accordance with this viewpoint.

#### Science Discovers Method.

Science has discovered the developmental history (evolution) of that body—i. e., the method by which God has brought it into being.

Another theory of some Biblical scholars is that the Bible interprets itself. In Roman iv:17 appears the statement that God "callet things that be not as though they were."

For instance, some scholars would say, where the Bible states that man was made in the image of God, it refers only to Christ and His body, and in the Bible are found passages to uphold this. As an instance, in Philippians iii:21 is the statement concerning Christ, "Who shall change our vile body that it may be fashioned like unto His glorious body?"

We can merely give illustrations. Genesis said, "Let there be 'light' and there was 'light'." According to some scholars, the word should be law. According to others, as appears in Psalms cxix:105, "Thy word is a lamp unto my feet and a light unto my path,"—the word light should be construed in a different sense. In Psalms cxix:130, the statement is "The entrance of thy words giveth light, it giveth understanding unto the simple." In Psalms xliii:3 appears, "Send out thy light and thy truth." "Let there be light" should be interpreted, these men say, as "let there be understanding," according to those other statements in the Bible. So, within the Bible itself, can be found many interpretations. Even those who do not choose to go outside the Book, inter-

pret from within the Book. Innumerable illustrations might be given bearing upon almost every word in the Bible.

In other words, we should prove that the Bible is subject to various interpretations depending upon the learning and understanding of the individual, and that, if this is true, there is nothing necessarily inconsistent between one's understanding of the Bible and evolution. Many accept these statements in the Bible as legends or parables. They may accept them as legends or parables, and thus not find them inconsistent with any scientific theory.

In II Timothy iv:4 appears the following, according to the translation from the Greek of Prof. Goodspeed, of the University of Chicago:

"For the time will come when they will not listen to wholesome instruction, but will overwhelm their whims and tickle their fancies, themselves with teachers to suit and they will turn from listening to the truth and wander off after fiction."

#### Statements of Noted Scientists as Filed Into Record by Defense Counsel.

By Charles Hubbard Judd

Director of the School of Education, University of Chicago.

(Biography.—Director of the School of Education and head of the Department of Education at the University of Chicago; has been in this position sixteen years. Prior to that was professor of psychology at Yale University. He was educated in Connecticut Wesleyan, a Methodist college, where the doctrine of evolution is taught by all of the instructors in the Science Department. He received the degree Ph. D. at Leipsig University, where he took comparative anatomy as a minor subject, with psychology as a major. In 1909 he was president of the American Psychological Association; was twice president of the Society of College Teachers of Education, president of the National Society for the Study

of Education, president of the North Central Association of Colleges and Secondary Schools, vice-president of the section of psychology of the American Association for the Advancement of Science. He is author of seven books and of numerous articles of psychology and education.)

In the normal schools of the state of Tennessee it will, I think, be impossible to obey the law without seriously depriving teachers in training of a proper view of the facts of human mental development. Every psychologist recognizes the fact that the human organs of sense, such as the eye and the ear, are similar in structure and action to the organs of sense of the animals. The fundamental pattern of the human brain is the same as that of the higher animals. The laws of learning, which have been studied in psychological and educational laboratories, are shown to be in many respects identical and always similar for animals and man. It is quite impossible to make any adequate study of the mental development of children without taking into account the facts that have been learned from the study of comparative or animal psychology.

#### Would Handicap Teaching.

It will be impossible, in my judgment, in the state university, as well as in the normal schools, to teach adequately psychology or the science of education without making constant reference to all the facts of mental development which are included in the general doctrine of evolution. The only dispute in the field of psychology that has ever arisen among psychologists so far as I know has to do with the methods of evolution. There is general agreement that evolution in some form or other must be accepted as the explanation of human mental life.

Elaborate studies have been made in the field of human psychology dealing with such matters as the evolution of tools, the evolution of language and the evolution of customs and laws. All of these studies are

based on definitely ascertainable facts and show without exception that a long process of evolution has been going on in the life of man as it is definitely known through historical record and prehistoric remains. In my judgment it will be quite impossible to carry on the work in most of the departments in the higher institutions of the state of Tennessee without teaching the doctrine of evolution as the fundamental basis for the understanding of all human institutions.

Whatever may be the constitutional rights of legislatures to prescribe the general course of study of public schools it will, in my judgment, be a serious national disaster if the attempt is successful to determine the details to be taught in the schools through the vote of legislatures rather than as a result of scientific investigation.

By Jacob G. Lipman,

Dean of the College of Agriculture and Director of the New Jersey Agricultural Experiment Station, State University of New Jersey, New Brunswick, New Jersey.

Dr. Jacob G. Lipman, of Rutgers and the state university of New Jersey, is a specialist in the field of soil science. He received his bachelor's degree at Rutgers in 1894, his master's degree at Cornell in 1900, and the degree of doctor of philosophy also at Cornell in 1903. His alma mater gave him the honorary degree of doctor of science in 1923. He has been soil chemist and bacteriologist of the New Jersey Experiment stations since 1901; director of the stations in 1911, dean of the college of agriculture, State university of New Jersey since 1915. Since 1902 he has been a member of the faculty of Rutgers.

He is editor-in-chief of *Soil Science*, associate editor of the *Journal of Agricultural Research*, *International Mitteilungan fur Bodenkunde* and of *Annales Sciences Agronomiques*. He is also editor of the *Wiley Agricultural Series*, and associate editor of the *Pennsylvania Farmer*.

He is a member of the National Research Council, the American Association for the Advancement of Science, the American Chemical Society, the American Society of Bacteriologists, the American Society of Agronomy, the American Academy of Science, the Washington Academy of Sciences and a number of other American scientific societies. He is president of the International Society of Soil Science and corresponding member of the Swedish Royal Society of Agriculture and Veterinary Medicine.

#### Organic Evolution from the Point of View of the Soil Investigation.

The student of soils is obliged to consider the materials from which they are made. These materials are represented by rocks and minerals, and by the remains of plants, animals, insects, bacteria and other micro-organisms. The change of rocks into soils is a slow and gradual process. In the older geological ages the mantle of soil covering the rocks was not as thick as it is today. Going back far enough, we come to the time when the depth of soil was not great enough to support plants of any but very primitive forms. Like plants and animals, our soils had to pass through a long period of change to support the varied forms of life on the earth. A direct relation may be traced between soil, plants and animals in the evolution of organic life.

Among the early forms of life there were bacteria capable of developing in a purely mineral medium. Such forms are still found in the sea, in mineral springs and in soils. Some of them can obtain the energy for their life processes by oxidizing hydrogen gas, methane (marsh gas), carbon monoxide, sulphur, sulphurated hydrogen, iron and even carbon. In the primitive seas, and on the rock surfaces, these simple forms of life prepared the way for the more highly organized beings. Some bacteria are able to manufacture nitrogen compounds out of the simple nitrogen gas of the air. They thus supply material out of which the protoplasm of plant and

animals cells is made. Other bacteria convert the nitrogen of the plant and animal substances into ammonia and nitrates. Mineral acids, like nitrous, nitric, sulphuric and phosphoric, are partly, if not entirely, the products of bacterial activity. Carbon dioxide is generated in enormous quantities through the activities of nitro-organisms. In the course of ages the by-products of microbial activity served to dissolve enormous quantities of rock material, and this dissolved material started on its way to the sea. Silicates, phosphates, nitrates, sulphates and carbonates, went to supply the building stones for the bodies of marine organisms. Some of the salts dissolved from the rocks ultimately became the source of salt deposits, such as rock salt, gypsum, potash, salts, limestone, etc. Bacteria are thus recognized as the primary or secondary cause of extensive mineral deposits, in other words, as geological agents of importance. By way of example, mention may be made of the potash deposits of certain European countries, estimated to be 20,000,000 years old. The green sand formation of New Jersey and states further south originated in the sea about 10,000,000 years ago. The phosphate deposits of Central Tennessee are derived from limestone rock 50,000,000 years old at the very lowest estimate. The extensive deposits of coal represent the remains of the ancient vegetation. We are now burning coal derived from plants that grew at least 20,000,000 years ago. The coal deposits contain nitrogen which today is the source of fertilizer. In making coke, illuminating gas and other products from coal, a large part of the nitrogen is saved and converted into ammonia for refrigeration and fertilizer purposes. We know of extensive deposits of sulphur which originated millions of years ago and which today are used for industrial and agricultural purposes. In a smaller way, mention may be made of deposits of iron ore, gypsum, or limestone, in the formation of which bacteria played an important part.

Today, like many millions of years ago, bacteria are busy creating conditions necessary for the growth of plants and animals. Bacteria are responsible for the circulation of carbon and nitrogen in nature. The material of plant and animal bodies is used over and over again, and processes of decay must go on in order that the carbon, nitrogen, sulphur phosphorus, lime and other elements locked up in the bodies of plants and animals may be released for the development of countless generations of living things. It has been truly said that we may have in our bodies today the carbon or the nitrogen which were once in the bodies of the kings of Egypt or of living organisms of whose origin and history we know nothing.

After the lowly bacteria and other microscopic forms of life had lived and produced extensive changes on land and in the sea, conditions became more favorable for the growth of plants. The primitive forms of plant life gradually developed into more perfect organisms, until the mosses, ferns, cycads gave way to flowering plants, perhaps 10,000,000 years ago at a very conservative estimate. In some way bacteria learned to establish a partnership with some kinds of plants, such as clover, alfalfa, soy beans, etc. These plants, together with the bacteria, are the important factors in our agriculture as regards the maintenance of a supply of nitrogen in our soils.

Thus plants had to develop both as to quantity and quality in order that there might be sufficient food for the advancing forms of animal life. One may properly speak of the genesis and evolution of soil as one would speak of the genesis and evolution of plants and animals. Man has learned to use this knowledge to improve his condition, and in following the laws laid down by the divine Creator, he has been able to fashion more perfect forms of plant and animal life. The story of Genetics, which deals with the principles of plant and animal breeding, is full of interest. It has to its credit more

perfect flowers, fruit of higher yielding qualities and better flavor, fibre crops of superior fibre, sugar crops with a higher content of sugar, crops resistant to plant diseases, crops suitable for dry climates and wet climates, for sour soils and sweet soils, and, in general, for a wide range of soil and climatic conditions. In the same way, genetics has made it possible for us to improve on the types of animals of economic importance in our farming industry.

We are indebted to science for a clearer vision of the great laws of nature, and of the methods of the divine Creator. The men of science, carrying on their labors in a spirit of reverence and humility, try to interpret the great book of knowledge in order that the paths of man may fall in more pleasant places, and the ways of human society may be in better keeping with the divine purpose.

With these facts an interpretations of organic evolution left out, the agricultural colleges and experimental service to our great agricultural institutions could not render effective industry.

By Dr. Fay-Cooper Cole,  
Anthropologist, University of  
Chicago.

(Biography)—Dr. Fay-Cooper Cole received the degree bachelor of science at Northwestern university. After work as a graduate student at Rush Medical college and the University of Berlin, he took the degree doctor of philosophy at Columbia university. He is now anthropologist at the university of Chicago. Before that he was connected with the Field Museum of natural History at Chicago, one of the three chief museums in America, for nineteen years, for the greater part of that period he was in charge of the museum's work in physical anthropology and Malayan ethnology. He conducted three expeditions covering a period of five and one-half years in the Philippine Islands, Borneo, Java, Madura, Nias, Sumatra and the Malay peninsula, making a particular study of the origin and the migration of the pygmies

and Malays, and of their social organizations. He was a member of various expeditions to the American southwest, excavating the ruined cities of cliff dwellers in the southwest and carried on investigations among the Pueblo and Navajo Indians. From 1907 to 1912 he was special investigator for the Philippine Bureau of Science, codifying the laws and making a study of the social, economic and mental life of the uncivilized tribesmen. During the last three years of connection with the field museum he was also lecturer in anthropology at Northwestern university. He is a fellow of the American Association for the Advancement of Science, fellow of the American Geographical society, member of the council of this association and now one of the vice-presidents of the American Anthropological association, and member of the Social Research council of this association. He is author of four monographs and various scientific papers dealing with the folk lore, physical types, social, religious and economic life of the primitive tribes of the Philippine islands.)

Anthropologists accept evolution as the most satisfactory explanation of the observed facts relating to the universe, to our world and all life on it. They hold that evidence abundantly justifies us in believing that development has been from the simple to the complex and that present forms of life, including man, have been produced from earlier existing forms, but through immense periods of time.

The field of the anthropologist is man, man's body, and man's society, and in this study he finds himself working side by side with the biologist and the geologist. For the study of man's body he has worked out a set of instruments and has selected a series of points for observation, by means of which he can accurately describe each individual of a group, the length, breadth and height of head, the facial proportions, the length of limbs and so on.

In this way the anthropologist determines the average of a group or

tribe or race, and to determine its normal variation. Anything strikingly beyond the normal at once becomes the subject of inquiry to determine its cause. In addition to the mathematical description there are added observations—color of skin, shape of teeth, the form of the hair, and many others.

On man's skeleton these observations are even more exact and are so definite that given a single skull or skeleton it is possible to tell with considerable certainty the age, sex and race of the individual, while for a series of skeletons the results are definite. The skeletons tell much of man's history, for the articulation of the bones and the lines of attachment of the muscles reveal how he walked, how he held his head and many other details of his life. It also reveals the fact that man presents many variations difficult to explain without referring to similar conditions found in the animal world. To gain further light on these variations the anthropologist works with the anatomist and comparative anatomist and he quickly finds that every human being of today possesses many muscles for which there is no apparent use, such muscles are those behind the ears, those going to the tail, the platysma—a muscle going from the chin to the Clavicle. These are but a few among many which today are functionless in man, but are still in use by certain animals. Going to the human embryo we find these vestiges of an earlier condition much more developed while others appear for a time and then vanish before birth. Such a case is the free tail possessed by every human embryo, a few weeks before its birth.

#### Man's Useless Organs.

It is difficult to explain the presence of these useless organs in man unless we believe that sometime in his development they were in use.

This study also reveals the fact that man closely resembles certain members of the animal world in every bone and organ of his body. There are differences, but they are

differences of degree rather than of kind. The animals most closely resembling man are the anthropoid apes. A careful study shows that they have specialized in their way quite as much as man has in his, so that while they are very similar, yet it is evident that man's line of descent is not through any of these anthropoids. It does appear, however, that both man and the other primates have a common precursor, but that the anthropoids must have branched off from the common stock in very remote times. If this is true, then we might hope to find in ancient strata of the rocks some evidences of earlier forms of men, who might perhaps more closely approach the common ancestor. This is exactly the case. The geologists have established the relative age of the strata of the rocks, while the palaeontologists have made plain the forms of life which lived in the epochs when these strata were deposited.

In the strata laid down at the end of the Pliocene period, at least 500,000 years ago, there has been found the bones of a being which appears to be an attempt of nature toward man. In the year 1891 on the island of Java, there was found the bones of an animal which in many ways seems to be intermediate between man and the anthropoids. These bones were found in undisturbed strata, forty feet below the surface, at a point where a river had cut through the mountainside. There can be no doubt that these bones were laid down at the time that stratum was deposited and by studying the associated fauna, consisting of many extinct animals, the age of these rocks was established. These bones were not lying together, but had been scattered over a distance of about forty-five feet by the action of the ancient river which deposited them.

These semihuman bones consisted of a skull cap, a femur, and two molar teeth. The skull was very low with narrow receding forehead and heavy ridges of bone above the eye-sockets, while a bony ridge extended from between the eye-brows to the

top of the head approaching a condition found in the cranium of the anthropoids. The brain capacity of this individual was between 850 and 900 cubic centimeters, or a little more than half of that of modern man. On the other hand it is half as much again as that of the adult gorilla, and the special development has taken place in these regions whose high development is typical of the brain of man. Hence in this respect this being seems to stand midway between man and the highest anthropoids. The teeth approach the human type and indicate the peculiar rotary mode of mastication of the human, which is impossible in animals having their interlocking canine teeth. The thigh bone is straight, indicating an upright posture and ability to run and walk, as in man. And the muscle attachments show he was a terrestrial and not an arboreal form. If, as seems probable, these four bones belonged to the same individual, he must have been more man-like than any living ape and at the same time, more ape-like than any human known to us. He is known as *Pithecanthropus erectus* or the erect ape-man.

Another find of somewhat similar nature was made only a few months ago in Bechuanaland of South Africa by Prof. Dart, of the University at Johannesburg. This find consisted of the skull of an animal well developed beyond modern anthropoids in just those characters, facial and cerebral which are to be expected in a form intermediate between man and the anthropoids. Neither of these two beings are of certainty, directly ancestral to man, but they do seem to indicate that nature at a very early period was making experiments toward man.

Two other fossil beings, found in the early strata of the rocks, also seem to indicate a development toward man. In the strata of the second interglacial period, probably at least 250,000 years ago, there lived a being with a massive jaw, a jaw human in every respect, except that it had no chin and the ramus or upright portion toward the socket was

very broad, as in the anthropoids. This jaw is so narrow behind that it is thought the tongue could not have sufficient play to allow of articulate speech. The teeth, although very large, are essentially human with even tops, as in man, while the canines lacked the tusk-like character which they still retain in the apes. This jaw was found in the year 1907 in a sand pit working near Heidelberg, Germany. It was discovered in place at a depth of nearly eighty feet and lay in association with fossil remains of extinct animals which make possible its dating in geologic time. It is difficult to picture a man from the jaw alone, but this much we can say the mouth must have projected more than in modern man, but less than in the chimpanzee or gorilla. He had a heavy protruding face, high muscles of mastication, essentially human teeth, and he was already far removed from his primate ancestors with large canines. He was nearer to man than to the apes; he was further along the line of evolutionary development than *Pithecanthropus erectus*, the Java ape-man, and he lived at a much later period. This being is known as the Heidelberg man.

The second of these two finds which we have mentioned occurred near Piltdown in Sussex, England. This consisted of the crushed skull of a woman and a jaw which can scarcely be distinguished from that of a chimpanzee. For a time there was much question if the two could possibly belong together, but a more recent find, which occurred about three miles distant from the first, again showed portions of the same type of skull and jaw. The skull is exceedingly thick and its capacity much less than that of modern man, but it is distinctly human, while, as indicated, the jaw approaches that of an anthropoid. Here again we seem to have an approach toward man in very ancient strata.

Toward the end of the second interglacial period in Europe at least 225,000 years ago we begin to find stone implements which give indication of having been intentionally

formed and used by intelligent beings. By the third interglacial period, more than 150,000 years ago these utensils have taken on definite form and we find thousands of stone axes of crude type scattered over a large portion of central and southern Europe. We have no fossil remains of man during this third interglacial period, for he then lived in the open and it would only be by the merest chance that his skeletons might be preserved to us. But when the fourth glacial epoch spread over Europe these men were compelled to make their homes in the shelters and caves of the rocks, and here in the debris around their ancient hearths we can read the record of their home life, and from this period on for a period of at least 50,000 years, we can read the record of man's occupancy of Europe as clearly as though we were reading from the pages of a book. Fortunately for the scientists, these people buried their dead and we have preserved for us a considerable number, ranging from children to adult men and women, so there is no guessing as to the sort of man who occupied Europe at this time.

They were massively built, with long arms and short legs, in height they averaged about five feet three for the men, and four feet two, for the women, or about the same as the modern Japanese. The head was long and narrow, above the eyes was a heavy bony ridge, back of which the forehead retreated abruptly, indicating rather little development of the fore brain. The nose was low and broad, the upper lip projecting, but the jaw was weak and retreating. The head hung forward on a massive chest, this we know because the foramen magnum, the opening by which the spinal cord enters the cranium, was situated further back than is the case in modern man, and the points of articulation with the bones of the neck also show conclusively that the head hung habitually forward. In all cases we find the thigh bone to be curved and this, together with the points of articulation, show that the knee was habitu-

ally bent and that this man walked in a semierect position. Those people known as the Neanderthal race spread out over the western half of Europe and we now know and have excavated very large numbers of the stations in which they lived. They were men—they were human—but they were much more like the anthropoids in many respects than is modern man. They lived in Europe for a period of at least 25,000 years, probably much longer, when they were displaced by newcomers who pushed in from around the eastern end of the Mediterranean and from Asia. The newcomers known as Cromagnon, are a much finer physical type, but so closely related to modern man that it is not necessary to describe their physical type; but it is of interest that we can study his home life, his art and his life among certain animals now extinct, for a period beginning about 20,000 years ago and extending down to the coming of modern races.

Only a few points relating to man and his history have been reviewed, but enough has been said to indicate that the testimony of man's body, of his embryological life, of his fossil remains strongly points to the fact that he is closely related to the other members of the animal world, and that his development to his present form has taken place through immense periods of time.

From the above it seems conclusive that it is impossible to teach anthropology or the prehistory of man without teaching evolution.

By Wilbur A. Nelson,  
State Geologist of Tennessee.

(Biography—Wilbur A. Nelson is state geologist of Tennessee, president of the American Association of State Geologists, past president of the Tennessee Academy of Science, chairman executive committee, Southern Appalachian Power conference, 1923, member of the executive committee of the division of states relations of the Natural Research council; member of the council of the

American Engineering council, and president of the Monteagle Sunday School assembly, of Monteagle, Tenn., the leading interdenominational chautauga and summer resort in the south, founded forty-three years ago, and after Sept. 1st, Corcoran professor of geology and head of the department of geology, University of Virginia, and state geologist of Virginia. He received the degree bachelor of science at Vanderbilt university and the degree master of arts at Leland Stanford university. He has held responsible positions with commercial firms as well as in the service of the state. He is a fellow of the American Association for the Advancement of Science, a fellow of the Geological Society of America, member American Institute of Mining and Metallurgical Engineers, American Association Petroleum Geologists, Seismological Society of America and other organizations. He has published a number of papers on geological and related subjects, both scientific and of a popular nature.)

The different layers of rock which form the surface of the earth unfold a remarkable story of evolution. These rock layers may be read as clearly as the leaves of a book, and they are the book which tells the true history of the earth; and the buried remains of animal and plant life which they contain likewise show the rise of life and its development on this earth. All forms of life have changed and developed to meet the conditions which have existed on the earth, as it has developed to meet the conditions which have been developing from the beginning of geological time.

Tennessee is an ideal place in which to study and learn the story of the rock layers which have been laid down, from the earliest times in which any life existed up to the present. Life forms suitable for one period of the earth's history, proved unsuitable for another period, and so new forms, therefore, evolved through natural causes.

This is not a new study in Tennessee, as geology and its study of

buried animal and plant remains has been taught in this state since 1828, at which time Gerard Troost, one of the founders of the Philadelphia Academy of Science, was elected professor of geology at the University of Nashville, and three years later was elected state geologist of Tennessee. From that date to the present time, this science, dealing with the age and study of the earth, and its rocks and the buried life which they contain, has been continuously taught in Tennessee.

Such teaching could not have been carried on through ninety-seven years of time, unless the teaching of evolution had been permitted as it was permitted by our religious ancestors who formed this state.

We know that streams and rivers carry sediment; that muddy waters are full of the soil of some field, washed into a nearby stream by a hard rain, and some such soil, when it once gets into a stream, starts on a long journey to the ocean. Most of the streams in this section are muddy for many months in each year, and this mud, which is the soil washed from our gullied hillsides, in this particular case goes down the Tennessee river, into the Mississippi river and to the Gulf of Mexico.

We know that at the mouth of the Mississippi river the sediments brought down by this river are deposited so rapidly that land is formed which is extending into the Gulf of Mexico at the rate of many feet a year. As a rule, these processes of weathering of rocks to produce soil, of erosion of this soil, and of deposition of this transported soil through rivers into some nearby sea or ocean, takes place so slowly, as time is generally measured, that we can only see through detailed and scientific observation the results within our own lifetime. But at the delta of the Mississippi river this very process is taking place so rapidly that anyone can easily measure it year by year and can understand that these same processes have been taking place all through all geologic

time, and in each and every part of the world.

We also know that practically all of the earth has at some time or other been covered by water, and in these ancient seas life has existed, which has left its record to us in fossil form. It must, however, also be understood that large parts of our present water areas were at some period in past geologic time also land areas. These seas have come and gone over limited areas of the earth's surface many times during the geologic history of the earth.

We know that originally the mouth of the Mississippi river was near Cairo, Ill., and that all of the Mississippi valley, as we now know, it was at that time (which was the close of the Cretaceous period) a part of a much larger Gulf of Mexico than the one that now exists. All of West Tennessee, during this time, was in a northern extension of the Gulf of Mexico, and the fine China clay deposits of that section were laid down in shallow water at the time tropical plants flourished in that section.

#### East Tennessee.

East Tennessee is made up of many layers of rocks, limestone, shale and sandstone, all of which were likewise laid down under water, and many of these layers contain the remains of animal and plant life. Some of the oldest rocks which contain animal life are found in East Tennessee. They are known as Cambrian rocks, and in these rocks occur the first abundant remains of sea form of life. This was the age of the early invertebrates. These rocks are well exposed to the east of Dayton in the East Tennessee valley region.

Then came the time interval which the geologist calls the Ordovician, the time when primitive fishes, corals, and land plants came into existence. Some of these first corals in fossil form have been found in the western edge of Dayton. This time interval was followed by another series of rocks which, in East Tennessee, contain the red iron ore deposits which

are used by the iron furnaces of this section. The rocks of this age are known as the Silurian, and during this time life further developed and scorpions and lung fishes came into existence.

The series goes on. Layer after layer of rocks were laid down, each series of which has been given a name by geologists so that they can be easily referred to. Next came the great age of fishes, and their remains are found in the rocks which the geologists call the Devonian and Mississippian series. The black slate, which crops out at the foot of Walden's ridge, as well as the limestone lying above it, which form the side of the mountain to the west of Dayton, are layers belonging to these series. These rocks are full of the remains of animal life.

Then came the period in which the ancient plants flourished and produced great coal deposits, the age which has been called the carboniferous. The extensive coal deposits of the Tennessee coal field, the edge of which caps the mountain a few miles west of Dayton, are of this age, and wonderfully preserved plant remains are found in the slates which lie on top of the different coal seams. This is a fact well known by the coal miners of this section. And what has been stated above as to Tennessee is but one illustration of how the different geologic periods passed and life developed over the earth.

And even when this carboniferous period in the development of the earth has been reached, we are still many millions of years back from the age of man; we must still pass through many geological time periods, through that age known as the Permian, when land vertebrates first arose; through the Triassic, when reptilian mammals arose; through the Jurassic, when flying reptiles were in existence. This was the age of reptiles. Then into the Cretaceous when flowering plants came into existence, and a great group of the reptiles known as dinosaurs, became extinct.

And then we came to that period in the earth's history, at the begin-

ning of which the ancient mammals and birds were first known to exist. Fossil remains show clearly that birds evolved from flying reptiles. This is the great age of mammals. Thru this period, the modern life forms developed. A period of glacial activity took place, during which five distinct glacial stages existed, one after the other, with four interglacial intervals, and man-like beings came into being at least the beginning of this time. Such, very briefly, is an account of the evolution of the earth from Cambrian time to the present, with a brief outline of the life forms which existed during these different periods. We know that this took many millions of years, and yet we also know that the earth existed untold millions of years before Cambrian time.

For the formation of the earth and its early stages we must turn to the science of astronomy. The relations of the earth to the stars and the planets are shown in the depths of the heavens, and there must exist in the heavens those cosmic conditions which gave rise to our world and the other planets of our system. Through the telescope and spectroscopy, the astronomers have solved many of these secrets.

But what of the age of the earth measured in years as we measure other happenings. From the brief outline just given one can see that it has been in existence unknown millions of years, but just how many it is impossible to say.

We can, however, measure back to the more recent events in geological time to the last ice age, before which we know man existed, and get a fairly accurate result, in terms of years.

One of the most accurate ways in which to measure such time intervals, is by measuring and counting the light colored and dark colored bands of clay, deposited by the melting of the ice sheet in the fresh water lakes which existed on the edges of those continental glaciers, as it retreated to its present position in the north polar regions. Each dark layer of clay was laid down

during one winter and each light layer during one summer. By such detailed studies, it has been determined that it has taken, approximately, 5,000 years for the glaciers of Sweden to melt back 270 miles, and it is further known that this melting took place 8,500 years ago. We know that the glaciers in North America extended into the northern part of the United States and reached as far south as the Ohio river. We know that now their southern edge lies far to the north in northern Canada over a thousand miles away. We know that it took approximately 4,000 years for the continental glacier which last covered the New England states to melt back from Hartford, Conn., to St. Johnsbury, Vt. This is only one way of measuring in years some of the more recent happenings. There are many more methods that could be given if it were necessary.

In connection with evolution, it is especially of interest to note that the relative ages of the rocks correspond closely to the degrees of complexity of organization shown by the fossils in those rocks. The simpler organizations being found in the more ancient rocks, each type of organism becoming more and more complex as we come nearer to the present day, man and his fossil and cultural remains being no exception.

It, therefore, appears that it would be impossible to study or teach geology in Tennessee or elsewhere, without using the theory of evolution.

By Kirtley F. Mather,

Chairman of the Department of Geology of Harvard University.

(Biography—Kirtley F. Mather graduated in 1909 from Denison university, a Baptist college at Granville, O., in which evolution has for years been taught by every science teacher. In 1915 he received the degree Ph. D. from the University of Chicago. He taught geology at the University of Arkansas for three years, at Queens university, a Presbyterian

institution at Kingston, Ontario, for three years, and from 1918 to 1924 he was head of the department of geology at Denison university. In 1923 he was appointed professor of geology at Harvard and has recently been made chairman of the department of geology at Harvard. He has been a geologist of the United States geological survey for many years, and has made geological examinations for various oil companies in Bolivia, Peru, Mexico, Canada, etc. He was for several years a trustee of the Baptist church at Granville, O., and chairman of the Baptist church at Newton Centre, Mass., and teacher of the "Mather class" in Bible school of that church. He is a fellow or member of such scientific organizations as the Geological Society of America, the American Academy of Arts and Sciences, and the American Institute of Mining and Metallurgical Engineers. In 1923-24 he was president of the Ohio Academy of Science. He is the author of numerous scientific publications and bulletins of the United States Geological Survey, dealing with the petroleum resources of Kentucky, Oklahoma, Alaska and Colorado; technical papers on geology, paleontology and evolution in scientific journals; "Christian Fundamentals in the Light of Modern Science," etc. In 1919 he prepared a bulletin of the Tennessee Geological survey, dealing with the geology and oil resources of Summer county, Tennessee.)

The facts of life development are so numerous displayed and so evident in the rocks of the earth's crust that every geologist with whom I am acquainted has accepted the evolutionary principle as demonstrated. Much of the exposed part of the earth's crust is composed of rocks deposited in layers as sand, mud, gravel or limestone in the seas, lakes, or ponds of past time, or upon the surface of the dry land. These are in many places broken through by masses of rock which has formed by solidification of molten lava. The successive ages of the various kinds and formations of rock are determined by their physical relations.

Where not greatly disturbed by crumpling or upheaval of the earth's crust, the rocks formed in layers are obviously still in their original order, the oldest underneath and the younger layers in order one upon the other, just as they may now be observed in the hills overlooking Dayton, Tenn. Where cut through by rocks which were once in a fluid state, it is apparent that each body of rock is younger than the youngest rock through which it broke and older than the oldest rocks deposited upon its surface after it was solid. Thus the succession of physical events in the history of the earth may be determined by patient and careful scrutiny of the earth's surface as it now is visible, either in natural or artificial exposure such as canyon walls, valley slopes, mines and wells.

In many of these rocks there are found entombed the fossil remains of the animals and plants which were alive at the time the rocks were formed. Some of these are the shells or bones of animals that lived in the seas or lakes, some are the harder parts of animals that lived on the land and were buried beneath the mud of river flats or the ashes blown out of volcanic vents. Discovering these fossil remains and knowing by their physical relations the successive ages of the rocks in which they are found, the geologist is able to sketch the history of animal and plant life upon the earth.

#### At Least 100 Million Years.

In the very oldest rocks which have yet been discovered, which are at least 100,000,000 years old there are absolutely no traces whatsoever of any animal or plant life. In somewhat younger rocks, but rocks, also referred to the oldest era of geological history, the archeozoic era, there are remains of one-celled plants of the type known as albae. The next era of earth history has been named the proterozoic. In rocks formed during it, there are a very few fossils of lowly types of shell-bearing animals and some rather obscure markings which are probably in part due to the presence

of worms and in part represent the remains of sea-weeds. The rocks of these two oldest eras are nearly everywhere much distorted and broken by volcanic activity and crustal upheavals.

Upon these ancient formations there rest in orderly succession the layers deposited during the several periods of time which geologists group into what is called the paleozoic era, which began at least 50,000,000 years ago. Most of the rocks of Tennessee were laid down during that long space of time. In this state, as elsewhere, these strata are known at many places to contain a great abundance of fossils. In the oldest rocks of that era, the fossils are of many and various invertebrate animals, many of which are of kinds not now known to exist anywhere on the face of the earth today. There are no fossils of animals which had a backbone of any sort in any of these rocks. In somewhat younger beds, referred to the second period of the paleozoic era, there are, however, very scanty and fragmentary remains of primitive fishes, the first known animals which possessed a backbone. The oldest known forest, composed of trees of fern-like rather than of seed-bearing types, was found a few years ago in New York in rocks formed about at the middle of this paleozoic era. That was the time when fishes ruled the waters, for remains of sharks and lungfishes are present in great numbers in the rocks formed in the seas, but in the rocks laid down on the land or in swamps there is not a trace of animals with a backbone, although insects and land snails have left their fossil remains in them. Toward the end of the paleozoic era, however, the rocks formed of desert sands and swamps contain the footprints and petrified bones of amphibians and reptiles, the first animals with a backbone which could breathe air by means of lungs. This part of the paleozoic system of rocks includes the coal seams of the eastern states, and associated with the coal are many beautiful specimens of ferns and primitive evergreen trees,

but none of the modern types of flowering plants. About at the close of the paleozoic era the Appalachian mountains were formed by the crumpling of the earth's crust in this region.

That episode of crustal crumpling is taken as the milestone to mark the end of the paleozoic and the beginning of the mesozoic era, which began at least 25,000,000 years ago, most of which have long since vanished from the face of the earth, a very few fragments of quite primitive mammals have been found.

These are small and insignificant creatures, most of whom laid eggs as do a couple species of small mammals today, but who suckled their young, were warm-blooded and presumably had no scales as surface covering. For the most part the reptiles were small-brained and large-bodied; they placed their trust in strength of talon and claw, rather than in mentality and agility. Observing the earth at that time, one could not help but feel that no good could possibly come from that welter of blood-thirstiness and cruelty. Yet the small minority of puny mammals, present then, was so endowed with instinct, such as parental love for Since that time, Tennessee and neighboring states have, with minor exceptions, remained continually above sea level, so that we have to transfer our search to other localities to find the continuation of the fossil record. The mesozoic era, the fourth great era of earth's history, is frequently referred to as the age of reptiles. In practically all the stratified rocks of this era there are petrified bones and footprints which tell that cold-blooded, scaly animals with backbones and four limbs lived in great numbers on land, in the sea, and in the air. The largest and most ferocious animals that ever inhabited the lands left their bones among the fossils of that era. Animals with enough feathers to enable them to fly, yet with claws on their forelimbs and teeth in their jaws, lived then and indicate the transition forms between reptiles and birds. In the same rocks with those reptiles,

offspring, that at the end of Mesozoic time it became the dominant form of life on land, while the few reptiles which did not become extinct were for the most part banished to the swamps and deserts or other out-of-the-way places. The close of Mesozoic time, the age of reptiles, was marked by the upheaval of the Rocky mountains. In a small fraction of the time that has elapsed since then, the entire Grand Canyon of the Colorado river has been carved by the ceaseless wear of running water. For this, and many other reasons, geologists believe that each of these eras of time should be measured in terms of tens of millions of years.

The Cenozoic era, which began 5,000,000 or 10,000,000 years ago, began as the Rocky mountains were formed. Most of the rocks of that era are still unconsolidated layers of silt or sand or volcanic ash, although some are firmly cemented into sandstone, limestone, etc. In the earliest beds deposited around the flanks of the new-born mountains of the western states, the bones of a great variety of mammals have been found. They are evidently the improved offspring of the puny mammals which had lived in constant fear of the ponderous reptiles during the preceding era. Not until about this time had there been any large quantity of the kinds or vegetation upon which modern mammals feed, and this presumably explains in part the slowness of the mammalian minority in throwing off the yoke of the reptilian majority during the age of reptiles. The first flowering plants had left their leaves and seed pods in the rocks formed during the middle of the Mesozoic era, but grasses and herbs, fruit-and-nut-bearing trees were not numerous until the beginning of the Cenozoic era.

With an abundance of the right kind of plant food and freed from reptile dominion, the mammals increased rapidly in numbers, and their bones in great variety may today be seen in the rocks of the Rocky mountains and other regions. Among those of the earliest Cenozoic strata

may be mentioned the five-toed and four-toed ancestral horses, the trunkless and small-tusked ancestral elephant, the cat-like forerunner of the modern seal. At that time, too, we find the first record of a primate, that order of mammals to which the zoologists refer man. This was evidently a small quadruped with toes terminated neither in hoofs nor claws, but with rather horny nails, and with teeth adapted neither for grinding grain like those of a horse nor for tearing flesh like those of a tiger nor for gnawing nuts like those of a squirrel, but like those of a man for eating herbs, fruits and eggs. But in general appearance this creature resembled a rat much more closely than a monkey, ape or man. Bones of that lowly type of primate have been found in North America, Asia and North Africa.

Somewhat higher in the series of Cenozoic strata of India, there were recently found a fragment of jaw which had teeth totally different from those of any nonprimate, somewhat different from those of a monkey, and closely resembling those of the great apes and of man. That animal lived somewhere between 2,000,000 and 10,000,000 years ago. He is believed to have been ancestral to the apes, chimpanzees, gorillas and mankind, all of which had by that time become completely differentiated from the monkey strain. If that be true, man has become distinct from the other anthropoids since that creature left his bones on the banks of an Indian stream. Narrowing our attention now to the strain that leads to man, the next fossil of significant interest is that known as the ape-man of Java. Some thirty years or so ago there was found on the island of Java a partially cemented layer of gravel and sand containing fossil bones and fossil plant remains. The plants were of the same sort as found elsewhere in rocks known to have been formed rather late in the Cenozoic era just before the first glaciers of the great ice age were accumulating, therefore, it must be that the associated animal bones are also of that age. The skull of this animal had

brain capacity somewhat greater than that of the most brainy apes now living and somewhat less than that of the smallest-brained human tribe. He had a receding forehead and a heavy ridge of bone above his eyes like an adult chimpanzee; yet his leg-bones show unmistakably that he stood and walked erect upon his hind limbs. The name ape-man describes him exactly; he was truly intermediate in body structure between the apes and man. He lived 1,000,000 or 2,000,000 years ago. In rocks of just about that same age in England there have been found crudely fashioned flint implements, unmistakably shaped by some intelligent creature with hands so developed as to be capable of holding a stone and striking it with another stone. Modern apes have been observed to hold clubs in their clumsy hands, but none of them can at will touch his thumb against the tip of each finger on the same hand. Presumably the creature who chipped the flints found in those rocks near Foxhall, England, could do so.

Then came the first of the great glacial advances of the ice age about 1,000,000 years ago. Five times the northern lands were buried beneath a mantle of moving ice. Five times the ice melted until the glaciers were at least as small as those now remaining on Greenland and in the valleys of Alaska. In the gravels deposited in Germany by the rivers flowing from the melting ice of either the first or the second of these interglacial intervals, there has been found the jaw of the so-called Heidelberg man. The jaw resembles that of a modern man; its sides are nearly parallel, the canine teeth are only a little higher than the incisors and molars. But it has no chin at all, and the portion of the jawbone which articulates with the skull just in front of the ears looks considerably like the equivalent portion of an ape's jaw. Scientists classify that creature as a member of the same genus to which modern man belongs, but as a different species.

Gravels of later interglacial stages have revealed the bones of still

another extinct species even closer to modern man. More than a score of practically complete skeletons and hundreds of fragmentary bones of this the Neanderthal man have been found in France, Spain and Germany. It is chiefly in the characters of the skull rather than in the other bones of the skeleton that he differs from modern man. His forehead was very receding, his brain capacity was just a little less than that of the most primitive of existing savage tribes; his brow ridges were more prominent than those of the negro, his chin was approximately half way between the chinless profile of the Heidelberg man and the clearly defined chin of the white race of today. With his petrified bones there are frequently found the stone spearheads and the bone knives which he fashioned. To this array of facts concerning him, I want to add just one inference. Many skulls of Neanderthal type were broken when found, as though struck with a hammer on top of the head either at the moment of death or very shortly thereafter. Several tribes of aborigines in recent years break the skulls of their dead in order, as they say, to permit the spirit to start on its journey to the happy hunting ground. The inference is that the Neanderthal man, a couple of hundred thousand years ago, had the same thought that man was immortal.

During the last of the glacial stages, about the same time that the ice pushed southward across Ohio and Indiana to the Ohio river, 40,000 or 50,000 years ago, there lived in southern Europe a race of men known as the Cro-Magnons. They were stalwart highbrows with prominent chins and large brain capacity, and eyebrow ridges no more protruding than those of the existing white race, but with massive cheekbones like the North American Indian. Clearly they belonged to the same species as that which today includes the white, yellow, brown and red races, but they cannot be included in any of these races. Their implements were much better manu-

factured than those of their predecessors, the Neanderthals, and they had a remarkable artistic ability as shown by the pictures they engraved or painted on the walls of caves in southern France. For thousands of years they maintained their life in Europe, but about 10,000 years ago they were displaced by the first members of the races of mankind which are today in existence.

During all this time no known record of the presence of man or man-like creatures was left in either North or South America. Not until the ice sheets of the latest glacial episode had dwindled nearly to disappearance was any clear indication of man's presence left in the New World. The oldest human inhabitants of North America were members of the existing races of mankind. They reached this continent not more than 10,000 or 12,000 years ago.

The facts stated in the foregoing paragraphs have been discovered by many different individuals. Probably no one man could be found who could testify to all of them as having been personally observed by himself. Knowledge of them is the common property of countless scientists. I can, however, affirm the truth of many of these facts from personal observations; the others I believe to be true because of my confidence in the technical ability and integrity of those who have seen the actual evidence. I have also studied many of the specimens collected by those fellow-workers and now on exhibition in various museums. In 1916 and 1917 I examined the oldest known rocks of the Archeozoic era in eastern Ontario and was unable to discover any fossil remains in them. The presence of these rocks had already been made known by a Canadian geologic survey party. I was accompanied by four or five of my students. In this bleak and windswept waste of rounded rock hills and impassable swamps, these ancient rocks are cleanly displayed. On the same trip I saw in slightly younger rocks of the same era in that locality the evidence of the

presence of primitive organisms, but no record of any of the higher forms of life. In 1906 I collected fossil shells of lowly invertebrates from the early Paleozoic rocks of Wisconsin. During the spring of 1916 I found the remains of somewhat higher types of invertebrates in slightly younger rocks of the same era in eastern Ontario and later described these fossils in publications of the Ontario bureau of mines and in the *Ottawa Naturalist*. Other invertebrate fossils of about the same age and about the same kinds were observed when I was in Bolivia in 1919 and 1920. Accompanied by half-bred guides and camp hands I, together with K. C. Heald, formerly chief of the oil and gas section of the United States geological survey, pushed far beyond the outposts of civilization into the rocky fastnesses of the eastern Andies and there we found these fossil remains.

#### Saw Evidences in Rocks.

I have seen the fossil remains of primitive fishes of middle Paleozoic age on a number of occasions near Columbus, Ohio; in 1917, in Allen County, Kentucky, and in 1919, in Sumner County, Tennessee. I observed the foot prints of large reptiles in rocks formed shortly after the upheaval of the Appalachian Mountains at several places in the Connecticut valley during 1921. While exploring in Alaska during the summer of 1923, I searched for fossils in rocks of middle Mesozoic age, but found in them only the remains of shellfish and corals. There was a party of six dispatched by the United States geological survey to search for mineral resources in a previously unknown and altogether uninhabited portion of the Alaska peninsula, not far from the famed valley of Ten Thousand Smokes, so named because of the countless vents from which steam roared heavenward. We had to cut steps with our geologic hammers across glaciers and snow fields in traversing the almost inaccessible mountains of that bleak, barren and rugged land. In Colorado, during

the summer of 1924, I had occasion to study the petrified bones of mammals imbedded in flat-lying rocks of Cenozoic age directly overlying tilted strata of late Mesozoic age, in which were the fossil bones of reptiles. The tilting of those beds was a part of the crustal movement which formed the Rocky Mountains; the flat layers on top of them were deposited while those mountains were being eroded.

To this summary of known facts concerning the life of the past, there might be added a multitude of other facts concerning the body structures of the various animals, the life history of the individual animal from its start as a single fertilized cell until its attainment of adult stature, etc. I have, however, personal knowledge of only a few of the facts in these fields in which I am not a specialist. While exploring the headwaters of the Amazon in Bolivia and Peru in 1919 and 1920, I lived for some time among quite uncivilized peoples, many of whom had never before seen a white man. At the same time I watched the habits and examined the bodies of several different kinds of South American monkeys. I have studied with care the skeletons of many of the Asiatic apes and Old World monkeys, as they were available in various university laboratories and museums. From these studies and from the studies of others, I can affirm the following generalized statements: Comparing the body structure of monkeys, apes and man, it is apparent that they are all constructed upon the same plan; with only trivial exceptions every bone in the body of one has its counterpart in the body of the others. Only in details of shape, in relative size and in method and angle of articulation with their neighbors do these bones differ in the different creatures just mentioned. Monkeys have long tails; some apes have long and some have short tails; man has a vestigial tail composed generally of about four vertebrae so small and so short as to be entirely concealed in the flesh and muscles at the base of the

spine. In relation to the total dimensions of the body, the brain of monkeys is quite small, that of the apes is much larger, while that of man is largest of all. This determines in large degree the contour of the head; thus the face of the monkey occupies more space than the top and back of its head, that of the apes is comparatively smaller, while the face of man is smallest of all in relation to the total area of head surface. No one would be surprised or shocked to learn that apes and monkeys had a common ancestor, nor would he regard it as a startling scientific theory, yet in general there are more differences between the modern monkeys and the modern apes, such as the chimpanzee, the gorilla, the gibbon and the orangoutang than there are between the apes and man. Yet in general there are more differences between the apes and man than there are between the existing races of men. The gaps between these various groups are, however, largely filled by the fossils, some of which I have already described. There are in truth no missing links in the record which connects man with the other members of the order of primates.

Such facts as I have stated above can be explained only by the conclusion that man has been formed through long processes of progressive development, which when traced backward through successively simpler types of life, each living in more remote antiquity, lead unerringly to a single primordial cell. The facts ascertained by natural science are obviously incomplete; the record of the rocks by no means tells the whole story. Man not only has an efficient and readily adaptable body, he also possesses a knowledge of moral law, a sense of rightness, a confidence that his reasoning mind finds response in a rational universe, and a hope that his spiritual aspirations will find increasing answer in a spiritual universe. Such things as these cannot be preserved in the fossil record, yet their presence must be accounted for. Nor have we a direct record of whence came the

first living cells. The inference is unmistakable that material substances from which living cells were first constructed were previously present among the rocks and minerals of the earth. All the necessary ingredients were certainly present in the outer shell of the youthful earth of even pre-Archeozoic time. But life is something more than matter. Living creatures are characterized by vital energy, something about which we really know very little, but something which is absolutely indispensable to every living creature. T. C. Chamberlin, the dean of American geologists, closes his volume on the origin of the earth with the following sentence: "It is our personal view that what we conveniently regard as merely material is at the same time spiritual, that what we try to reduce to the mechanistic is at the same time volitional, but whether this be so or not, the emergence of what we call the living from the inorganic, and the emergence of what we call the psychic from the physiologic, were at once the transcendent and the transcendental features of the earth's evolution." With this conclusion I am in hearty accord. I believe that life as we know it is but one manifestation of the mysterious spiritual powers which permeate the universe. The geologic factors assembled in the primitive earth provided an environment within which the spiritual could manifest itself in the material. The form which it should assume may have been largely determined by that environment; the primitive cell was the result. Thus, in truth, was man made from the dust of the ground.

Again, the record of the rocks tells nothing except by inference of the previous state of the mineral matter of which the earth is made. Several theories, varying from one another in greater or less detail, are now under consideration by geologists and astronomers in their attempt to understand the actual beginnings and the antecedents of the earth and its fellow planets in the solar system. So far as we now know all the planets, suns and stars

within range of our telescopes are composed of the same sort of matter, reducible upon analysis to about eight different elements, nearly all of which are present in the earth. In other words, it is a fair sample of the material substances of the entire universe. Science has not even a guess as to the original source or sources of matter. It deals with immediate causes and effects, not at all with ultimate causes and effects. For science there is no beginning and no ending; all acceptable theories of earth origin are theories of rejuvenation rather than of creation—from nothing. Indeed, there is some evidence for the prevalent view that our sun had had at least one earlier generation of planets in its train before the disturbing effect of the close approach of another star caused the reorganization of part of its matter into our present solar system. Conversely, it is probable that at some remotely distant date in the future this group of planets, on one of which we live, will be similarly destroyed by another rejuvenating disturbance and still another cycle of planetary organization may take place.

But none of these facts is really in any way disturbing to the adherent to Christianity. Not one contradicts any teaching of Jesus Christ known to me. None of them could for his teachings deal with moral law and spiritual realities. Natural science deals with physical laws and material realities. When men are offered their choice between science, with its confident and unanimous acceptance of the evolutionary principle, on the one hand, and religion, with its necessary appeal to things unseen and unprovable, on the other, they are much more likely to abandon religion than to abandon science. If such a choice is forced upon us, the churches will lose many of their best educated young people, the very ones upon whom they must depend for leadership in coming years. Fortunately, such a choice is absolutely unnecessary. To say that one must choose between evolution and Christianity is exactly like telling the

child as he starts for school that he must choose between spelling and arithmetic. Thorough knowledge of each is essential to success—both individual and racial—in life.

Although it is possible to construct a mechanistic, evolutionary hypothesis which rules God out of the world, the theories of theistic evolution held by millions of scientifically trained Christian men and women lead inevitably to a better knowledge of God and a firmer faith in his effective presence in the world. For religion is founded on facts, even as is the evolutionary principle. A true religion faces the facts fearlessly, regardless of where or how the facts may be found. The theories of evolution commonly accepted in the scientific world do not deny any reasonable interpretation of the stories of divine creation as recorded in the Bible, rather they affirm that story and give it larger and more profound meaning. This, of course, depends upon what the Bible is and what the meaning and interpretation of the stories are to each individual. I have been a Bible student all of my life and ever since my college days I have been intensely concerned with the relations between science and the Bible. I have made many addresses and have written several articles upon this subject. I have many times lectured to Biblical students, such as those in the Boston University School of Religious Education.

It is obvious to any careful and intelligent reader of the book of Genesis that some interpretation of its account must be made by each individual. Very evidently it is not intended to be a scientific statement of the order and method of creation. In the first chapter of Genesis we are told that man was made after the plants and the other animals had been formed, and that man and woman were both created on the same day; in the second chapter of Genesis we read that man was formed from the dust of the ground before plants and other animals were made, that trees grew until fruit

was upon them that all the animals passed in review before man to be named, and then after these events woman was made. There is obvious lack of harmony between these two Biblical accounts of creation so far as details of process and order of events are concerned; they are, however, in perfect accord in presenting the spiritual truth that God is the author and the administrator of the universe. And that is the sort of truth which we find in the Bible. It is a textbook of religion, not a textbook of biology or astronomy or geology. Moreover, it is just exactly the Biblical spiritual truth concerning God which rings clearly and unmistakably through every theory of theistic evolution. With it modern science is in perfect accord.

#### Reasons for Distrust.

There are a number of reasons why sincere and honest Christians have recently come to distrust evolution. These reasons must be understood and discussed frankly, before the world will believe that science and religion are not in conflict. Some of the opposition to evolutionary science results from failure to read the Bible. Too many people who loudly proclaim their allegiance to the book know very little about what it really contains. The Bible does not state that the world was made about 6,000 years ago. The date 4004 B. C. set opposite Genesis i:1 in many versions of the Bible was placed there by Archbishop Ussher only a few centuries ago. It is a man's interpretation of the Bible; it is in the footnotes added recently: it is not a part of the book itself. Concerning the length of earth history and of human story, the Bible is absolutely silent. Science may conclude that the earth is 100,000,000 or 100,000,000,000 years old; the conclusion does not affect the Bible in the slightest degree. Or if one is worried over the progressive appearance of land, plants, animals and man on the successive six days of a "creation week," there is well known Biblical support for the scientists' contention that eons

rather than hours elapsed while these things were taking place. "A day in the sight of the Lord is as a thousand years, and a thousand years as a day." Taking the Bible itself as an authority dissipates many of the difficulties which threaten to make a gulf between religion and science. The fact that the seventh day was stated to be a day of rest has no bearing upon the length of the other days. I have no doubt that the man who made that chapter of Genesis had in his mind days of twenty-four hours each, but I reserve for myself the right to make my own interpretation of the meaning of words, as does every Christian, be he literalist, trivialist or modernist.

Another of the reasons for the modern distrust of science in the religious world is the idea that evolution displaces God. Many seem to think that when the scientist enthrones evolution as the guiding principle in nature he dethrones God, that the two words are somehow synonymous, that there is not room for both and one must go. But the facts are as follows: Evolution is not a power, nor a force; it is a process, a method. God is a power, a force; he necessarily uses processes and methods in displaying His power and exerting force. Many of us believe that science is truly discovering in evolution the processes and the methods which God, the spiritual power and eternal force, has used and is using now to effect His will in nature. We believe we have a more accurate and a more deeply significant knowledge of our Maker today than had the Hebrew patriarchs who thought a man could hide from God in a garden, or who believed that God could tell man an untruth. (Genesis ii:17 states that God told man he would surely die if he ate the fruit of the tree of knowledge; man ate, he did not die, God knew he would not die therefor.)

Again there is the widespread misconception that if one accepts the evolutionary process as the method which God uses he will find himself in a moral dilemma. Regardless of sect or creed, all followers of Christ

must accept his teaching that the law of life is love, that service to others is the true guiding principle, that self-sacrifice even to death is the best trait a man can display. To many, evolution means the survival of the fittest in the struggle for existence; and that is taken to imply that the selfish triumph, the most cruel and blood-thirsty are exalted, those who disregard others win. Obviously, this is the very antithesis of Christianity; both principles cannot be true; one must be false. The Christian needs not to be told which of the two it is. Here is a real reason for opposition to evolution; men are not driven from it by the fear of discovering that their bodies are structurally like those of apes and monkeys; it doesn't bother us to discover that we are mammals, even odorous mammals—"by the sweat of your brow must man earn food" states the Bible. It does bother us to find the implication that the law of progress has thus apparently been opposed to the love of Christ. But here are the facts. It has been my privilege as a geologist to read the record in the rocks; knowing the ages of the rocks has led to better knowledge of the Rock of Ages; I have watched the procession of life on the long road from the one-celled bit of primitive protoplasm to the present assemblage of varied creatures, including man. At times of crisis in the past it was rarely selfishness or cruelty or strength of talon and of claw that determined success or failure. Survival values at different times have been measured in different terms. Ability to breathe air by means of lungs rather than to purify the blood by means of gills meant success in escaping from the water to the land. Love of offspring and tender care for the young gave the weak and puny mammals of long ago the ability to triumph over much stronger and more powerful reptiles like the dinosaur. Especially in the strain that leads to man can we note the increasing spread of habits of co-operation, of unselfishness of love. The survival of the "fit" does not necessarily mean either the survival of the "fit-

test" or of the "fightingest." It has meant in the past, and I believe it means today and tomorrow, the survival of those who serve others most unselfishly. Even in evolution is it true that he who would save his life must lose it. Here, if nowhere else, do the facts of evolution lead the man of science to stand shoulder to shoulder with the man of religion.

Another difficulty arises from our present limitations of knowledge. If man has evolved from other forms of animal life by the continuous process of evolution it is asked how can there be any difference between him and them, how can we believe that he has an immortal soul. Again, the appeal to facts makes it clear that somehow out of the continuity of process real differences have emerged. When the cow pauses on the hillside to admire the view, when the dog ceases to bay at the moon in order to construct a system of astronomy then and not till then will we believe that there are no differences between man and other animals. Even though we may not understand how these differences arose, the facts are there; knowledge and mystery exist side by side; mystery does not invalidate the fact. Men of science are working on those very problems. They have not learned—and may never learn how God breathed a living soul into man's body. If they discover that process, and the method used, God will still be just as great a power. In the image of God cannot refer to hands or feet, heart, stomach, lungs. That may have been the conception of Moses; it certainly was not the conception of Christ who said that God is spirit, and proclaimed that man must worship Him in truth. It is man's soul, his spirit, which is patterned after God the Spirit.

#### Soul Theologian's Business.

It is the business of the theologian not the scientist to state just when and how man gained a soul. The man of science is keenly interested in the matter, but he should not be blamed if he cannot answer questions here. The theologian must tell when the individual gets his soul,

whether at the moment of conception, or when the unborn babe first stirs within the womb, or at the moment of birth, or at the first gleam of intelligent appraisal of his environment and how he knows this.

Men of science have as their aim the discovery of facts. They seek with open eyes, willing to recognize it, as Huxley said, even if "it sears the eyeballs." After they have discovered truth, and not till then, do they consider what its moral implications may be. Thus far, and presumably always, truth when found is also found to be right, in the moral sense of the word. Men of religion seek righteousness; finding it they also find truth. The farther along the two avenues of investigation the scientists and the theologian go, the closer together they discover themselves to be. Already many of them are marching shoulder to shoulder in their endeavor to combine a trained and reasoning mind with a faithful and loving heart in every human individual and thus to develop more perfectly in mankind the image of God. Neither the right kind of mind nor the right kind of heart will suffice without the other. Both are needed if civilization is to be saved.

As Henry Ward Beecher said, forty years ago, "If to reject God's revelation of the book is infidelity, what is it to reject God's revelation of himself in the structure of the whole globe?" With that learned preacher, men of science agree when he stated that "the theory of evolution is the working theory of every department of physical science all over the world. Withdraw this theory, and every department of physical research would fall back into heaps of hopelessly dislocated facts, with no more order or reason or philosophical coherence than exists in a basket of marbles, or in the juxtaposition of the multitudinous sands of the seashore. We should go back into chaos if we took out of the laboratories, out of the dissecting rooms, out of the field of investigation, this great doctrine of evolution." Chaos would inevitably destroy the whole moral fabric of so-

ciety as well as impeded the physical progress of humankind.

By Dr. Maynard M. Metcalf.

Biography—Dr. Maynard M. Metcalf is engaged in private research work at the Johns Hopkins university, specializing in zoology. From 1893 to 1914 he taught college zoology, first at Goucher, then at Oberlin college, at Oberlin, O. He received his bachelor's degree at Oberlin, the degree or doctor of philosophy at the Johns Hopkins university, and the degree of science at Oberlin. He has memberships and has held offices in the American Association for the Advancement of Science, the American Society of Zoologists and numerous other scientific and economic societies. During the past year he has been chairman of the committee on biology and agriculture of the National Research Council. He is author of numerous books and articles on zoology and evolution.)

Intelligent teaching of biology or intelligent approach to any biological science is impossible if the established fact of evolution is omitted. Discussion of the methods by which evolution has been brought about is less essential but the fact of evolution must be appreciated and the evolutionary point of view must be emphasized for any understanding of the growth of the universe, of the earth of plants or animals; for any proper grasp of the facts of structure or function of living bodies as involved in medicine and in animal and plant husbandry; psychology, whether of normal or diseased minds, must constantly remember the processes of evolution; human societies, with their diverse customs, are unintelligible without the facts of their origins and changes their evolution. God's growing revelation of Himself to the human soul cannot be realized without recognition of the evolutionary method he has chosen. Teaching in any field that deals with living things is disgracefully, yes, criminally, inadequate if it omits emphasis upon evolution. An intelligent teacher could

omit such emphasis only at the expense of his self-respect and of his moral integrity. Such teaching would be criminal malpractice just as truly as would be a physician's failure to follow established sound methods of treatment because of fear of persecution by ignorant neighbors. For a teacher to fail to bear testimony is as essentially sinful as for a man to fail to stand by his religion. Truth is one, whether scientific truth or religious truth, and it calls for loyalty from every worthy man. The fact of evolution—of man, of all living things, of the earth, of the sun, of the stars—is as fully established as the fact that the earth revolves around the sun. Change, growth evolution, is a fundamental, a pivotal truth in all nature. Those familiar with the phenomena of nature testify with unanimity to this. The great mass of evidence of different sorts from different sources, when once seen, is overwhelmingly convincing to any normal, human mind. It can be only the uninformed who fail to accept evolution as a fact established beyond doubt. On the other hand, there is great uncertainty as to the method by which evolution has been brought about. Many different factors have been in operation, among them probably the chief has been the mysterious intimate activities of the living substance itself about which as yet we know so little. As to the numerous "causes" of evolution and their relative importance, there are about as many varieties of opinion as there are students of evolution. I am somewhat acquainted personally with nearly all the zoologists in America who have contributed extensively to the growth of knowledge in this field and I know many of the botanists and a goodly number of the geologists and I doubt if any two of these put exactly the same relative emphasis upon all the numerous interacting "causes" of evolution. But of all these hundreds of men not one fails to believe, as a matter of course, in view of the evidence, that evolution has occurred.

None of this, of course, has any bearing upon the question of God as

the creator of the universe. It is only a matter of the method He has chosen in creation—whether immediate fiat or gradual growth accompanied by divergence. The evidence is overwhelming that the latter was and is His method. God is just as truly and just as intimately acting in the gradual growth of a plant from a seed or of a man from a fertilized egg as He would be in creating the full grown plant or man all at once in a thousandth part of a second of time.

#### No Contest Between Bible and Fact of Evolution.

There is no conflict, no least degree of conflict, between the Bible and the fact of evolution, but the literalist interpretation of the words of the Bible is not only puerile; it is insulting, both to God and to human intelligence.

But the fundamentalist would do much worse than insult God. He is in reality, although he doesn't realize this, trying to shut man's mind to God's ever-growing revelation of Himself to the human soul. He teaches, in effect, that God's revelation of Himself was completed long ago, that He long ago ceased to unfold His mind to men in new revelation. This is evil influence, criminal, damnable. Truth is sacred and to hinder men's approach to truth is as evil a thing, as unChristian a thing, as one can do. The thought that God is at odds with Himself, that his revelation of Himself to men of old is at variance with His works in nature is as blasphemous as it was for the Jewish leaders to say of Jesus that "He casts out devils through Beelzebub, the prince of the devils." Jesus made short work of this attack upon him.

No, the thing is not to attempt to guide God's self-revelation into channels of our own ignorant choosing, but is, rather, humbly and in a wholly teachable spirit to seek His thought and Himself in nature, in history, in the vision of Himself He has given to men of old and is still giving to the humble minded today. One of the greatest of God's revelations of Himself to men has come

through His showing us His habit of producing results, by gradual growth, by evolution, rather than by immediate fiat.

Not only has evolution occurred; it is occurring today and occurring even under man's control. If one wishes a new vegetable or a new flower it is, within limits, true that he can order it from the plant breeder and in a few years he will produce it. Hundreds of new plants and animals have been and are being produced in this way. This is evolution of just the sort that has always occurred, only it is influenced by man's purpose. We can see evolution occurring in our experiment stations and our laboratories and we can control and modify the conditions of the experiments and can thus modify the resultant product to suit ourselves. Evolution is a present observable phenomenon as well as an established fact of past occurring. The organisms produced by this present day controlled evolution in our experiments are as divergent from one another and from the original stock as are animals and plants in nature. The different kinds of domestic horses, produced by human experiment, differ far more than do the different kind of horses found in nature. Domestic fowl under man's control have evolved into a large number of kinds far more widely divergent than are the wild kinds in the genus Gallus, from which our domestic chickens came. The genus Brassica, plants belonging to the mustard family, include a number of different sorts of plants. One of these, Brassica Cleracoo, is the ancestor, the form from which man has evolved the cabbage, the cauliflower, kale, Brussels sprouts, kohlrabi and the Swedish turnip, which differ among themselves far more than do the wild members of the genus Brassica. The same sort of thing is seen in hundreds of domestic animals and plants, dogs, cattle, sheep, pigeons, cucumbers, radishes, lettuce, dahlias, roses, wheats, corns, strawberries, peaches, apples, pears, etc., etc. This is all true evolution and is going forward today with ever-increasing strides. To de-

scribe adequately the tremendous mass of phenomena which establish the fact of past and continuing evolution would require not a book or a series of books, but a library. In the main, these evidences may be arranged in four chief groups: (1) The phenomena of comparative anatomy; (2) the phenomena of comparative embryology; (3) the phenomena of paleontology and geology, and (4) the phenomena of geographical distribution. Much in the fields of physiology, psychology and human cultures has very important bearing upon evolution.

First—We can arrange plants and animals in a double, parallel series, showing increasing complexity of organization.

Second—In the development of an individual from egg to adult this individual passes through a series of stages of increasing complexity and this individual series in one of the higher organisms strangely parallels and agrees with the racial series first mentioned.

Third—In the fossiliferous rocks we find actual bodily remains of organisms of the past and these form a series showing increasing complexity within each taxonomic group, the animals and plants in the older rocks being more and more simple, while the successively younger rocks show more and more complex organisms in each group under observation.

Fourth—The distribution of animals and plants over the earth is such as to suggest strongly the origin of each group of animals or plants at some one place, and their gradual spread from that center, divergent evolution occurring while they are spreading. No other suggestion even plausible, let alone convincing, has been made to explain these phenomena. Evolution is the only key we can find.

In each of the four groups of phenomena mentioned there are many very striking things. One set of these things, in the first, morphological group, is that of the vestigial organs in animals and plants. There are in man, for example, very many structures of no conceivable

present use, but showing resemblance to organs in other animals which are useful. The appendix vermiformis is one such structure, a mere vestige of an organ of great importance in some lower mammals. The human tail—bony coccyx with its rudimentary muscles—is another. The wisdom teeth of man are approaching a vestigial condition.

It is interesting to observe that an organ in one kind of animal may have a different use from the similar organ in a related animal. There are very few, if any, structures in man, for example, which do not show clear indications of relationship to, descent from, an organ of different use in some related animal. The lungs of man correspond to the swim bladder of fishes; hair has apparently been derived from tactile sense organs in the skin of aquatic vertebrates; certain bones connected with the human larynx were derived from the supporting arches in the bars between the gill slits of our aquatic ancestors; our teeth were once scales in the skin and so on and so on. Probably there is no structure in the human body which was not at some time used for a different purpose. As the use of an organ changes, in evolution, its structure correspondingly changes and we see most complete series of intergrades between the earlier and the later conditions.

In all this discussion I have not used the word "species." There are no such things as species in nature. In nature we find different kinds of animals and plants. The words "species," "genus" "family," etc., are terms used to describe the fact that animals and plants differ among themselves and differ to different degrees. Those that are closely similar, that is, closely related, we class in one species; those less closely related, but still not too different, we place in different species, putting the related species together in one genus and so on. Species, genera and so forth, are man-made pigeon holes in which to classify the real animals and plants seen in nature. I have recently made about

150 species of protozoa, but I have never made an animal. The word species is indefinable, and is used by biologists merely as a convenience, and it has wholly different meanings when applied to different groups of animals and plants. There are many genera of animals and plants in which most of all the species completely intergrade so that specific distinctions are purely artificial. This is true to large degree among the protozoan forms I have been studying recently. I have made species among them on the basis of distinctions far too minute to be considered for a moment as of "specific" value among, say insects or mammals.

By Dr. Winterton C. Curtis

Zoologist, University of Missouri.

Biography—Dr. Winterton C. Curtis received the degree of doctor of philosophy at Johns Hopkins in 1901. He has served the University of Missouri since the latter date, and is now chairman of the department of zoology in this institution. He has also been associated with the Marine Biological laboratory at Woods Hole, Mass., for many years, being at the present time one of its trustees. At various times he has acted as an investigator for the United States Fisheries bureau, notably in studies upon the pearl-button mussels. His numerous technical papers have been along the general lines of invertebrate zoology, regeneration and parasitology. His recent work entitled, "Science and Human Affairs" undertakes a discussion, from the standpoint of biological science, of the relationships between the advancement of scientific knowledge and our civilization. Dr. Curtis is particularly qualified to speak in the matters under consideration, because in this volume he has emphasized the spiritual rather than the material influences of science. He is a member and past secretary of the American Society of Zoologists, of the American Society of Ecologists, the American Naturalists, and a fellow of the American Association for the Advancement of Science.

#### Nature and Current Aspects of the Doctrine of Evolution.

Definitions are wearisome. But we may ask ourselves, by way of limitation, what is evolution in general and organic evolution in particular. The answer can best be given by means of illustrations. The term evolution, as today used in science, means the historical process of change. When we speak of the evolution of man-made products, like automobiles and steam engines, of social institutions like democratic government, of the crust of the earth, or solar system, of animals and plants, we mean a gradual coming into existence of what is now before us, in contrast to its sudden and miraculous creation. (Such an idea is of recent origin.) Our intellectual forbears of a few centuries ago thought in terms of a world created in its present form. The evolutionary point of view marked an advance from the concept of a static universe to one that is dynamic. In the phraseology of the street, the world is a going concern, historically as well as in its present aspects.

Evolution is, therefore, the doctrine of how things have changed in the past and how they are changing in the present. It may be naturally divided into its cosmic, geologic, and organic aspects, as represented by the sciences of astronomy, geology and biology.

#### Cosmic Evolution.

Cosmic evolution includes all other forms, for by the cosmic we mean the entire visible universe, our very bodies, as well as the farthest star. But in practice, one thinks of the cosmos as remote. And what we have in mind under cosmic evolution is the changes that are postulated by the science of astronomy. It is believed by astronomers that our solar system with its central sun, its planets and lesser bodies, has not always possessed its present form, although it has been in existence from a remote period of time. Our earth seems to have been more molten, and before that perhaps gaseous. Although the famous nebular hypoth-

esis of La Place has been in part replaced by other theories, the belief of modern astronomers is that our solar system and perhaps countless others have arisen by an evolutionary process whose extent is infinite in both time and space. I take it that few will combat the concepts of astronomy regarding the nature of our sun and planets. Even when some of us were children the ideas of cosmic evolution, as set forth by the nebular hypothesis, the planetesimal hypothesis, or the like is correct, but that the astronomer regards the heavenly bodies as having reached their present state by an evolutionary stage continuous through an unfathomable past and presumably to be continued into a limitless future. There is no longer talk among intelligent or educated men—or there should not be—of "heaven, earth, center and circumference, created all together, in the same instant, and clouds full of water, on October 23, in the year 4004 B. C., at 9 o'clock in the morning," as was determined by the chronology of Dr. John Lightfoot in the seventeenth century. The astronomical evidence for the development of such a dynamic universe in space and time is of course limited. But it all points in the direction of evolution.

#### Geologic Evolution.

Geologic evolution overlaps with cosmic, since the geologist takes the evolutionary problem where the astronomer leaves it. Geology deals with the history of our earth, how it originated and how it has assumed its present form. Astronomy deals with the origin of the earth as a planet of our solar system. Geology finds evidence that the earth was once a molten mass which has since been cooler. What may be called the "countenance" of the earth is the subject matter of geology, how the land lies at the present day, how rocks and soil are being produced, and what these facts imply regarding historical origins. The evolutionary evidence of astronomy is vague and remote, although generally accepted by the layman. The

evidence from geology is written in the ground beneath our feet. The geologist's belief in a vast lapse of time and stupendous changes rests upon evidence that is everywhere at hand. Leonardo da Vinci, in the fifteenth century, grasped the significance of important geological facts, when he wrote concerning the saltiness of the sea and the marine shells found as fossils in the high mountains. Since the publication of James Hutton's "Theory of the Earth," in 1795, it has been the cardinal principle of geological science that past changes of the earth's surface are explicable in terms of changes now in operation. For example, such a vast chasm as the Grand Canyon is explained not as produced by miraculous creation or by sudden catastrophe, but by running water acting upon the rocks throughout innumerable centuries. The process may be observed in miniature in the wash of the soil in Tennessee fields. The weathering of rock into soil, erosion with its transportation of the products of weathering, deposition of the material in the oceans or in large bodies of fresh water, uplift of the ocean's floors and its hardening into rock may all be seen in slow but certain progress in various parts of the world at the present day, and their occurrence in the past is recorded in the rocks. The subtitle of Charles Lyell's famous book, the "Principles of Geology," published in 1830, runs as follows: "An attempt to explain the former changes of the earth's surface by reference to causes now in operation." Lyell established the idea of evolution as the only reasonable interpretation of geological facts and his elaboration of Hutton's doctrines still constitute the very foundation of geologic science. Today, geology without an evolution of the earth's surface, from a molten mass to its present form, and extending over millions of years, would be on a par with a science of geography postulating a flat earth. The conclusions of modern astronomy and geology, therefore, point to an evolutionary process—involving

many millions of years and still in progress—to an earth hoary with age and still growing old.

Astronomy and geology, despite their practical importance, are remote from human concern, insofar as their evolutionary doctrines are concerned. To borrow from the phraseology of a distinguished anti-evolutionist, the age of the rocks is of no particular consequence insofar as the Rock of Ages is concerned. Cosmic evolution and geologic evolution are readily accepted by the laity on the authority of science, because they do not seriously interfere with doctrines that are deemed vital. But the evolution of plant and animal life, and hence human evolution, is inseparable from that of inorganic matter as described by astronomy and geology, because of the fossils in the rocks.

#### Organic Evolution.

Organic evolution resembles the cosmic and geologic evolution above described, since it concludes that the living bodies, which are the objects of its investigation, have not always existed as they are today, but have undergone a process of change. As with the evidence of geologic change, the evidence for an evolution of animals and plants rests upon facts that are immediately before us, for example, the structure and development of animals, their distribution over the earth, the fossils in the rocks. Our time will permit of only enumeration and brief characterization of the recognized lines of evidence for organic evolution, which are as follows:

First—Evidence from structure is derived from:

Comparative anatomy.

Comparative embryology?

Classification.

Second—Evidence from distribution, past and present, is derived from:

Palaeontology.

Zoogeography.

Third—Evidence from physiology is derived from:

Fundamental resemblances in vital processes.

Specific chemical resemblances of closely related forms; e. g., blood tests.

Fourth—Evidence from experimentation rests upon:

Unconscious experimentation upon animals and plants since their domestication.

Conscious experimentation of breeders and of scientific investigators.

The nature of these lines of evidence may now be indicated.

Evidence From Comparative Anatomy—In the animal kingdom as a whole and in every group of animals, whether large or small, we find facts that may be interpreted most reasonably in terms of evolution. The vertebrates or backboneed animals will serve as an illustration. We find here a certain plan of structure, for example, backbone, two pairs of limbs, body, head and various internal organs, all laid down according to a similar general plan, but with endless modifications to suit the mode of life. The flipper of a whale, the wing of a bird or a bat, the forefoot of a horse, the arm of a man, and the like, all show the same plan of structure. One of the pre-Darwin ideas was that each animal, while created separately, was nevertheless formed in accordance with a certain type that the Creator had in mind, hence the resemblance. Such an idea is a theoretical possibility, provided there is any evidence to show that animals were created all at once and separately. But there is not a shred of such evidence that will appeal to one who approaches the matter with an open mind and uninfluenced by preconceived notions.

On the other hand, the biological explanation of this anatomical resemblance is that the present vertebrates (fishes, amphibia, reptiles, birds and mammals) have all descended from a primitive race, somewhat like the present fishes. All vertebrates are now alike, because they have never lost the underlying plan of structure inherited from their common ancestry. They have

come honestly and naturally by present organization.

The Evidence From Fossils—(Palaeontology) Interlocks with the above, since the first vertebrates known to appear were primitive fish-like forms. These were succeeded by amphibians, reptiles, mammals and birds in the order named, the last two having connecting links with the reptiles. The invertebrate groups tell a similar story.

Turning to the Facts of Comparative Embryology—The kind of evidence everywhere discoverable may be illustrated by the gill-slits in the embryos of higher vertebrates like reptiles, birds and mammals. All these forms exhibit in their early stages of development a fish-like plan of structure, particularly in the neck region where the gill-slits are located. The reasonable interpretation of the existence of such structures in the embryo of a human being, or any land-living vertebrate, is that we have never lost these tell-tale evidences of our ancestry. The later stages of our development are modified so that they lead to the adult human body. The earlier stages still show the primitive conditions of a fish-like organization. Modern fishes have survived to the present day without a fundamental departure from the ancestral condition. Modern amphibia (frogs, toads and salamanders) have survived in the halfway state between an aquatic and a terrestrial existence, through which higher vertebrates have passed as indicated by the fossil record and by the above fish-like stages in their development.

The facts of classification are commonly cited as evidence for evolution. Since classification is based on structure (anatomy), this is but an aspect of the general evidence from comparative anatomy and embryology. While the facts cannot be detailed here, they are striking and bear out the doctrine.

Another line of evidence is that of geological geographical distribution. The facts in this connection are utterly senseless and insulting to an intelligent Creator, if viewed

as a result of special creation. One can simply say, "God did it," and not ask why. But such explanations do not satisfy modern minds. On the other hand, their explanation in terms of evolution give reasonableness and consistency to a large body of facts. The fossils appear in such an order in time as to constitute evidence for evolution. Existing animals are distributed over the surface of the earth in a manner that confirms their geological origins.

The facts of physiology tell a similar story. Life and the living stuff is the same sort of thing wherever we find it, thus lending support to the idea that it has all descended from the same primitive source from which it has inherited its resemblances. A more striking line of physiological evidence is the recently discovered chemical resemblance between the blood of animals previously supposed to be closely related on grounds of their anatomical similarities, for example, apes and monkeys, birds and reptiles and the like. Two entirely independent lines of evidence are here found to interlock to such an extent that evolution is the one reasonable interpretation.

#### Experimental Evidence.

Finally there is the evidence from experimentation: Evolution has taken place before the eyes of men, during the period since animals and plants were first domesticated. The changes have not been profound, because the ten or twenty thousand years since the first animals and plants seem to have been brought under domestication is a brief span of time for evolutionary modification. But it is clear that such modification has occurred and is today occurring under the direction of skillful breeders. The modern science of genetics is beginning to solve the problem of how evolution takes place, although this question is one of extreme difficulty.

The foregoing summary of the various lines of evidence is hopelessly inadequate, since books could be written on each. The point to be

appreciated is that all the multitudinous facts of biology hang together in a consistent fashion when viewed in terms of evolution, while they are meaningless when considered as the arbitrary acts of a creator who brought them into existence all at once a few thousand years in the past. Modern biology has developed around two major generalizations, the cell doctrine, and the doctrine of organic evolution. Modern evolutionism dates not from Darwin's "Origin of Species," published in 1859, but from the historic Naturello of Buffen, the first volume of which appeared in 1749, and from the work of the other philosopher-naturalists of the eighteenth century. It is a sad comment upon the state of popular information that the practical facts of biological science are everywhere acknowledged, while the status of its greatest philosophical generalization remains so commonly unknown. In view of its implications and applications, the doctrine of evolution is second to none in modern thought, it has been established by a gradual but irresistible accumulation of facts.

At this point we may examine a common misunderstanding with reference to evolution and the work of Charles Darwin. Suppose we begin with an analogy, illustrating what many have termed the fact, the course and the causes in a progressive series of events. A ship leaves a European port and sails across the Atlantic to New York harbor. We may distinguish between: (1) The fact that the ship actually crossed the ocean, instead of being "created" in the harbor of New York; (2) the course the ship may have pursued, whether direct or indirect, and the like; and (3) the causes that made the ship go, whether an internal propelling force like steam or electricity, an external force like wind or current or even direction by wireless. Compared with the doctrine of evolution, we have: (1) the fact of evolution, as representing the historic series of events; (2) The course followed in evolution, for instance, whether the land vertebrates arose from the fish-like ancestors, birds

the causes of evolution or what made from reptiles, or the like; and (3) and makes it happen. These three aspects, like those in the voyage of a ship, are separate though related items. They must be constantly distinguished if there is to be any clear thinking on this matter by one who is not a scientist.

It is now possible to explain the misunderstanding above cited. The historical fact of evolution seems attested by overwhelming evidence. Science has nothing to conceal, it stands "strong in the strength of demonstrable facts," and invites you to view the evidence. The course pursued by evolution is known broadly in many instances, but in the nature of the case the evidence is limited and many of the steps will always remain uncertain, without, however, a calling in question of the historic fact. The causes of evolution present the most difficult problem of all and the one regarding which we know the least. The recent strictures of Prof. Bateson, which have been exploited by anti-evolutionists were directed wholly at current explanations of evolutionary causation and the course of evolution. He affirmed his belief in the historic fact when he said "our faith in evolution is unshaken"—meaning by "faith," of course, a reasonable belief resting upon evidence.

That such an interpretation of Prof. Bateson's views is the correct one, appears from the following communication:

"11 December, 1922,  
"The Manor House,  
"Merton,  
"London, S. W. 20.

"Dear Prof. Curtis:

"The papers you have sent me relating to the case of Mr. \_\_\_\_\_ give a curious picture of life under democracy. We may count ourselves happy if we are not all hanged like the Clerk of Chatham, with our pens and ink horns about our necks!

"I have looked through my Toronto address again. I see nothing in it which can be construed as expressing doubt as to the main fact of evolution. In the last paragraph

(copy enclosed) you will find a statement in the most explicit words I could find giving the opinion which appears to me forced upon us by the facts—an opinion shared, I suppose, by every man of science in the world.

"At Toronto I was addressing an audience, mainly professional. I took occasion to call the attention of my colleagues to the loose thinking and unproven assumptions which pass current as to the actual processes of evolution. We do know that the plants and animals, including most certainly man, have been evolved from other and very different forms of life. As to the nature of this process of evolution, we have many conjectures, but little positive knowledge. That is as much of the matter as can be made clear without special study, as you and I very well know.

"The campaign against the teaching of evolution is a terrible example of the way in which truth can be perverted by the ignorant. You may use as much of this letter as you like and I hope it may be of service.

Yours truly,  
W. BATESON."

The paragraph to which Prof. Bateson refers above is the concluding one of his address and runs as follows:

"I have put before you very frankly the considerations which have made us agnostic as to the actual mode and processes of evolution. When such confessions are made the enemies of science see their chance. If we cannot declare here and now how species arose, they will obligingly offer us the solutions with which obscurantism is satisfied. Let us then proclaim in precise and unmistakable language that our faith in evolution is unshaken. Every available line of argument converges on this inevitable conclusion. The obscurantist has nothing to suggest which is worth a moment's attention. The difficulties which weigh upon the professional biologist need not trouble the layman. Our doubts are not as to the reality or truth of evolution, but as to the origin of species,

a technical, almost domestic, problem. Any day that mystery may be solved. The discoveries of the last twenty-five years enable us for the first time to discuss these questions intelligently and on a basis of fact. That synthesis will follow on an analysis we do not and cannot doubt."

With this distinction between fact, course and causes clearly in mind, the significance of Darwin's work in the history of biological thought can be understood. Darwin's accomplishment was two-fold. In the first place he established organic evolution as the only reasonable explanation of the past history of living things. Secondly, he offered, in natural selection, what then appeared an adequate explanation for the origin of species, and, hence, for the causes of evolution. Darwin's evolutionary argument in his "Origin of Species" was that one species could give rise to another "by means" as he believed, "of natural selection or the preservation of favored races in the struggle for life." If one species could be shown to give rise to another, the same process could be continued. No limit could be set. The types thus produced could depart indefinitely from the parent form. Once the mutability of species be admitted the only reasonable conclusion is that evolution has taken place. His argument was supported by an immense collection of facts along observational and experimental lines. The total result was overwhelming, coming as it did, more than 100 years after setting forth of transmutation, and its repeated rejection by the main body of naturalists. Evolution was accepted so quickly by scientists that the world was startled. This sudden conversion gave rise to the impression, even among scientific workers, that no serious contribution to evolutionary theory had been made before the work of Darwin. Such an impression does not represent the facts and it does grave injustice to the pioneer thinkers of the eighteenth century, to whom we have alluded.

Darwin's second accomplishment,

natural selection, was accepted by science as a *causo-mechanical* explanation of evolutionary change. The cogent statement and the simplicity of the principle of selection were of great importance for its acceptance as the cause of evolution, along with the broader theory of evolution as the historic fact. Extended exposition of the selection process will not be attempted. It may be found in numerous elementary books, and in the early chapters of the "Origin of Species." The tabulation known as Wallace's chart, which is an admirable outline of the argument, may be cited in this connection:

**Wallace's Chart of Natural Selection. Proved Facts—**(a) Rapid increase of numbers; (b) total numbers stationary; (c) struggle for existence; (d) variation and heredity; (e) survival of the fittest; (f) change of environment.

**Consequences—**Struggle for existence; survival of the fittest (natural selection); structural modifications.

The importance of Darwin's work in the history of scientific thought is that it convinced science of the truth of organic evolution and proposed a then plausible theory of evolutionary causation. Since Darwin's time evolution as the historic fact has received confirmation on every hand. It is now regarded by competent scientists as the only rational explanation of an overwhelming mass of facts. Its strength lies in the extent to which it gives meaning to so many phenomena that would be meaningless without such an hypothesis.

But the case of natural selection is far different. Of recent years this theory of the causes of evolution has suffered a decline. No other hypothesis, however, has completely displaced it. It remains the most satisfactory explanation of the origin of adaptations, although its all-sufficiency is no longer accepted. The initial step in evolution is the appearance of individual variations which are perpetuated by heredity, rather than the selection of variations after

they have appeared. The interest of investigators has shifted to problems of variation and heredity, as exemplified by the rise of the science of genetics.

As a result of this situation there has been much discussion among scientists regarding the adequacy of what is often referred to as the Darwinian theory, meaning natural selection. In condemning selection as an inadequate explanation of the problem, biologists have often seemed to condemn evolution itself. It is not strange that the layman, for whom Darwinism and evolution are synonymous terms, believes that evolution has been rejected when he hears that belief in Darwinism is on the wane. He does not understand that what is thus meant by Darwinism is not the historic fact of evolution, but the proposed cause of evolution—natural selection. This point may not seem vital, but those interested in biological science frequently find the situation used to support claims that the entire concept of organic evolution has fallen into disrepute. There are many, even today, who rejoice at anything that appears to weaken this major generalization of biology.

Such then is the more strictly scientific status of the doctrine of evolution as a whole. The origin, by evolution, of the heavenly bodies and of our earth is evidenced by facts of astronomy and geology, as set forth in any elementary treatise on these sciences. Inorganic evolution, or the modification of nonliving matter, is thus supported by science and does not find serious opposition in the public mind. Organic evolution, or the origin of animal and plant life, receives a similar support from the facts of biology. If the origin of man were not involved, there would be presumably little serious opposition from nonscientific sources of the present day.

#### Human Evolution.

But with the evolution of all other living things, both animal and plant, overwhelmingly attested by the facts, it is not only impossible, but puerile

to separate man from the general course of events. Moreover, the evidence for man's origin is becoming clearer year by year. Comparative anatomy, embryology, classification, physiology, geographical distribution, fossils and the existing races of mankind tell the same story for man as for the rest of the animal world.

Huxley's essay, entitled "Man's Place in Nature," presents in a masterful manner the anatomical evidence for our kinship with the four species of tailless apes—the gibbon, gorilla, orang and chimpanzee—and his most significant conclusions are even more strongly established at the present day. If creation occurred at 9:00 a. m. on October 23rd of the year 4,004 B. C., as part of the divine plan, it is amazing that such success should have dogged the steps of the students of human skeletal and cultural remains during the last half century. The skeletons, in part or in whole, are known for a number of subhuman races and a vast array of implements and other remains, all showing a progressive advancement. By another fifty years it seems safe to expect that much more of the story will be unveiled. It is further amazing that investigations in Egypt show the existence of a flourishing civilization in the Nile valley as early as 5,000 B. C., and back of this a gradual development from the barbarism of the stone age.

On man's intellectual side, psychology is making increasingly evident the essential animal foundation of human intelligence. Man's claim to importance in the universe, revealed by science, lies not in the pretense that this planet was created for his convenience, but in the claim that he transcends the material universe in so far as he comprehends it. And the method of such comprehension that dominates modern thought is the method of science, not that of theology.

The question of human beginnings is one that is open to investigation, like any other historic or prehistoric event. In this connection a quotation from a famous essay by Herbert Spencer, published in 1852, is appro-

priate: "Those who cavalierly reject the theory of evolution," writes Spencer, "as not adequately supported by facts seem quite to forget that their own theory is supported by no facts at all. Like the majority of men who are born to a given belief, they demand the most rigorous proof of any adverse belief, but assume that their own needs none. Here we find, scattered over the globe, vegetable and animal organisms numbering, of the one kind (according to Humboldt), some 320,000 species, and of the other some 2,000,000 species (see Carpenter); and if to these we add the numbers of animal and vegetable species that have become extinct, we may safely estimate the number of species that have existed, and are existing on the earth, at not less than 10,000,000. Well, which is the most rational theory about these 10,000,000 of species? Is it most likely that there have been 10,000,000 of special creations? Or is it most likely that by continual modifications, due to a change of circumstances, 10,000,000 of varieties have been produced, as varieties are being produced still?"

And, one might add, if the evidence indicates that all other species have arisen by evolution, is it probable that man, whose bodily structure and functions are so nearly identical with those of the mamalia and particularly the primates—that man arose in a different fashion. We have, moreover, as above indicated, the positive evidence to support this general presumption.

Having outlined the evidence for human evolution and stated the presumption in its favor, let us turn to the evidence for special creation, as found in Genesis. Science and common sense alike inquire regarding the nature and sources of this account, if it be regarded as a true statement of the facts. Science faces the matter squarely, desiring only the right to investigate and draw unprejudiced conclusions. The results of such investigations are not in doubt. It appears that the races about the eastern Mediterranean, like other primitive peoples, had

their traditions of the origin of the world. The story in Genesis apparently descended to the early Hebrews and to their neighbors in Mesopotamia from a source far antedating the appearance of the Jews as a people and their sacred writings. Archeology and ethnology most reasonably indicate that in its origin this Hebrew-Babylonian tradition may be compared with the stories of many primitive peoples. We take the story in Genesis seriously as an account of prehistorical facts, because it is our story of creation passed down by tradition from our fathers. It is, and will remain, sacred and interesting, because it has been woven into the thought of western culture for almost 2,000 years and because of its intrinsic literary and moral qualities.

But the past history of events, whether of human or animal origins, is subject matter for scientific inquiry, and the answer of science is evolution. The very great antiquity of man, the existence at an earlier period of beings, manlike, but intermediate between man and primates, together with the facts of man's anatomy, his embryology, his physiological reactions, even his mentality, all point to his bodily kinship with the rest of living nature. It is not true men came from monkeys, but that men, monkeys and apes all came from a common mammalian ancestry millions of years in the past.

It is more reasonable to believe that the Bible is a human document representing the history of an advance from the concept of a barbarous and vengeful Jehovah of the earlier Old Testament, through the God of righteousness and justice of the later prophets, and culminating in the concept of a Father as preached by Jesus of Nazareth.

In the foregoing statement we have considered the intellectual aspects of the doctrine of organic evolution. There remains its social aspects. Evolution is one of the basic concepts in modern thought. Suppression of a doctrine established by such overwhelming evidence is a serious matter. From the standpoint

of the teacher the situation has more than academic interest.

Evolution has been generally accepted by the intellectually competent who have taken the trouble to inform themselves with an open mind. The following letter was written in response to a request to state his position, it having been alleged that he was not a believer in organic evolution:

"Washington, D. C.,  
August 29, 1922.

"My dear Prof. Curtis:

"May it not suffice for me to say, in reply to your letter of August 25th, that, of course, like every other man of intelligence and education, I do believe in organic evolution. It surprises me that at this late date such questions should be raised.

Sincerely yours,  
"WOODROW WILSON."

Prof. W. C. Curtis,  
Columbia, Mo.

In view of all the facts, may we not say that the present storm against organic evolution is but an expression of malign influences of prejudice and ignorance, hostile to what we may envision is the high destiny of our western world.

By Prof. Horatio Hackett Newman,  
Zoologist, University of Chicago.

(Biography—He was dean of the colleges of science at that university for nearly seven years, having charge especially of premedical and medical students. He has been teaching zoology since 1898. He received his bachelor's degree at McMaster university, and his doctor's degree at Chicago university. He has memberships and fellowships in the American Association for the Advancement of Science, the American Society of Zoologists, etc. He has attracted widespread attention in the scientific world by his studies of experimental embryology and in other zoological subjects. He was among the earliest in this country to organize large classes in various universities for the study of evolution and heredity. His publications in-

clude many technical monographs and the following books: "Evolution, Genetics and Eugenics," "Vertebrate Zoology," "Outline of General Zoology," "The Biology of Twins," "The Physiology of Twinning.")

The evolutionist stands for and believes in a changing world. Evolution is merely the philosophy of change as opposed to the philosophy of fixity and unchangeability. One must choose between these alternate philosophies, for there is no intermediate position; once admit a changing world and you admit the essence of evolution. The particular courses of change or the causes of any particular kinds of change are matters that the expert alone is in a position intelligently to discuss. We know with certainty some few things about the course of evolution, and we believe that we have discovered some important phases of the mechanism of evolution, but these are controversial matters and in no way effect the question as to the validity of the principle. Whether or not evolution may lay claim to rank as a law of nature depends upon the strength, the coherency and the abundance of the so-called evidences of evolution.

The Nature of the Proof of Organic Evolution.

There are two distinct types of evidences of evolution, one of which has to do with changes that have occurred during past ages, the other with changes that are going on at the present time. The evidences of changes that have taken place in the remote past must, in their very nature, be indirect and to some extent circumstantial, for there are no living eye-witnesses of events so far removed from the present and there are no documentary records written in human language. Records of past events are written, however, for him who has learned the language, in the rocks, in the anatomical details of modern species, in the development of animals and plants, in their classification, and in their geographical distribution, past and present. Evidences that species are

changing today are quite direct in character, for more or less radical hereditary changes have been seen in the act of taking place, though, as yet, we have little knowledge of the causes responsible for them. The discovery that species are changing at a noticeable rate at the present time is in itself strong evidence that they have changed in the past, and doubtless in the same ways and at the same rates of speed as those observable today; for even the convinced special creationist would hardly claim that species have remained immutable since their creation only to begin change during the present era. Little can be learned about the large changes involved in organic evolution by observing relatively small changes of the present, for it takes immense periods of time for the larger waves of change to run their course and reach their culmination. For the study of past evolutionary events we use the historical method so successfully employed in archaeology and ancient history; for the study of present evolution we make use of the methods of direct observation and experiment. The findings in one field strongly support and supplement the other.

When we admit that the evidences of past evolution are indirect and circumstantial, we should hasten to add that the same is true of all other great scientific generalizations. The evidences upon which the law of gravity are based are no less indirect than are those supporting the principle of evolution. Like all other great scientific generalizations, the law of gravity has acquired its validity through its ability to explain, unify and rationalize many observed facts of physical nature. If certain facts entirely out of accord with the law of gravity were to come to light, physicists would be forced either to modify the statement of the law so as to bring it into harmony with the newly-discovered facts, or else to substitute a new law capable of meeting the situation. Laws of nature are no more or less than condensed statements about the facts of nature and therefore are valid only

in so far as they agree with the facts. The nebular hypothesis and its modern rival, the planetesimal hypothesis, are both deductions from facts; they both seem to agree with many of the obscured data, but neither of them is as yet fully adequate for all. In the field of physical chemistry we had first the molecular theory, then the atomic theory, then the ionic theory and now the electron theory; each of those has appeared in direct response to the necessity of explaining new sets of facts, and none of them is so well founded as is the theory of evolution. No one has ever seen a molecule, an atom, an ion or an electron; the existence of and the properties of these entities have been deduced from the behaviors of various chemical substances when subjected to experimental conditions.

The principle of evolution stands in the first rank among natural laws not only in its range of applicability, but in the degree of its validity, the extent to which it may lay claim to rank as an established law. It is the one great law of life. It depends for its validity, not upon conjecture or philosophy, but upon exactly the same sorts of evidence as do other laws of nature.

Evolution has been tried and tested in every conceivable way for considerably over half a century. Vast numbers of biological facts have been examined in the light of this principle and without a single exception they have been entirely compatible with it. Think what a sensation in the scientific world might be created if some one were to discover even one well-authenticated fact that could not be reconciled with the principle of evolution. If the enemies of evolution ever expect to make any real headway in their campaign they should devote their energies toward the discovery of such a fact.

The exact nature of the proof of the principle of evolution is that when great masses of scientific data such as are involved in those branches of biology known as taxonomy, comparative anatomy, embryology, serology, paleontology and

geographic distribution, are looked upon as the result of evolutionary processes, they take on orderliness, reasonableness, unity and coherency. Not only this, but each subspecies becomes more closely linked with the others and all turn out to be but different aspects of the one great process. No other explanation of biological phenomena that in any sense rivals the evolution principle has ever been offered to the public. This principle cannot be abandoned until one more satisfactory comes forth to take its place. To revert to the thoroughly discredited and unscientific idea of special creation would be as utterly impossible as to revert to the ancient geocentric conception of the universe, according to which a flat earth was thought to occupy the center of the universe and the sun, moon and stars to revolve about it.

Let us reiterate that a theory or a principle is acceptable only so long as it accords with the facts already known and leads to the discovery of new facts and principles. Whether or not the principle of evolution meets these requirements the reader must judge for himself after a perusal of the facts that lie at the basis of the principle.

The evidences of evolution that we shall investigate are contained within the following fields of biology:

First—Comparative anatomy or morphology, the science of structure.

Second—Taxonomy, the science of classification.

Third—Serology, the science of blood tests.

Fourth—Embryology, the science of development.

Fifth—Paleontology, the science of extinct life.

Sixth—Geographic distribution, the study of the horizontal distribution of species upon the earth's surface.

Seventh—Genetics, the analytic and experimental study of evolutionary processes going on today.

A careful study of the situation reveals that the entire fabric of evolutionary evidences is woven about a single broad assumption: That

fundamental structure resemblance signifies blood relationship; that, generally speaking, the closeness of structural resemblance runs essentially parallel with closeness of kinship. Most biologists would say that this may once have been only an assumption, but that it is now so amply supported by facts that it has become axiomatic. However obvious the validity of this assumption may be, it is the plain duty of one who attempts to justify the evolutionary principle to avoid taking steps that are in the least open to serious criticism. If we cannot rely upon this principle we can make no sure progress toward the proof of evolution.

The assumption we are now discussing is tantamount to an affirmation of the principle of heredity; that like tends to produce like. We continually employ the principle in every day life. We fully expect the offspring of sparrows to be sparrows, of robins to be robins; and if we should ever find an instance to the contrary, we would be greatly surprised and shocked. Furthermore, we have learned by experience that offspring not only belong to the same species as the parents, but resemble the parents more closely than they do other people. Whenever we see two people whose resemblance is closer than usual we immediately come to the conclusion that such persons are relations, probably offspring of the same parents. Every one has had the experience of meeting two persons so strikingly alike that it is almost impossible to distinguish them apart, and the natural assumption is that such persons are duplicate or identical twins. Twins of this sort are vastly more closely related than are brothers or sisters, or even than are fraternal twins who are usually no more alike than are brothers and sisters of closely similar ages. It is practically established that duplicate twins are products of the early division of a single germ cell. No closer degree of kinship can well be imagined than this, for the two individuals bear the same relationship to each other as do the two bilateral halves of one body.

The writer has had an exceptional opportunity to determine the exact degrees of resemblance existing between separate offspring derived from a single egg. It so happens that a peculiar species of mammal, the nine-banded armadillo, almost always gives birth to four young at a time. These quadruplets are invariably all the same sex in a litter and are nearly identical in their anatomical details. A study of their embryonic history has proven beyond question that in every case the four embryos are produced by the division of a single normally fertilized egg. Large numbers of advanced sets of quadruplets fetuses were studied statistically with the idea of determining the exact degree or their resemblance. An average or a considerable number of determinations revealed the somewhat startling fact that their coefficient of correlation is .93, which is merely another way of saying that they are 93 per cent identical. The remarkable closeness of this resemblance may be fully appreciated when it is realized that the only structural resemblances belonging to this order of closeness are those existing between the right and left halves of single individuals, and that the next order of resemblance is that between siblings (brothers or sisters) who are only 50 per cent identical.

This, then, is a crucial test of the validity of the assumption that closeness of resemblance is a function of closeness of kinship, for here we have the closest approach to identity in connection with what is also the closest possible blood relationship.

Employing the principle of heredity in a somewhat broader way, and in a way that is hardly likely to be questioned even by the most captious, we account for the common possession of certain structural peculiarities by all members of a given kind or species of animal by saying that characters have been derived from a common ancestor. It is only a short step in logic to conclude that two closely similar kinds or species of animals have been derived one from the other or from a common

species. Once having taken this step we are on the road that leads inevitably to an evolutionary interpretation of natural groups. If the principle of heredity holds for fraternities, for races, for species, where are we to draw the line? It does not seem reasonable to admit that structural resemblances within the fraternity, the race, the species, are accounted for as a product of heredity, and to deny that equally plain resemblances among the species of a genus or among the genera of a family have a hereditary basis. It is logically impossible to draw the line at any level of organic classification, and say that fundamental structural resemblance is the product of heredity up to such and such a level, but that beyond some arbitrarily settled point heredity ceases to operate.

#### Evidences From Comparative Anatomy.

The foundation stones of comparative anatomy are the principles of homology and of analogy. The former implies heredity and the latter variation.

#### The Principle of Homology.

Any one who has at all seriously studied comparative anatomy must have been impressed with the fact that the animal kingdom exhibits several distinct types of architecture, each of which characterizes one of the grand divisions of the kingdom. Within each of these great assemblages of animals characterized by a common plan of organization there are almost innumerable structural diversities within the scope of the fundamental plan. These major or minor departures from the ideally generalized condition reminded one of variations upon a theme in music; no matter how elaborate the variations may be, the skilled musician recognizes the common theme running through it all. This fundamental unity amidst minor diversity of form or of function is looked upon as a common inheritance from a more or less remote ancestor. In animals belonging to the same group, and therefore having the

same general plan of organization, we find many organs having the same embryonic origin and the same general relations to other structures, but with vastly different superficial appearance and playing quite diverse functional roles. Such structures are said to be homologous.

A common example of homologous structures is presented by the forelimbs of various types of back-boned animals (vertebrates); such, for example, as that of man, that of the whale, that of the bird and that of the horse. The arm of man is by far the most generalized of these; it is not far from the ideal prototypic land vertebrate fore limb, and in that it is not specialized for any particular function, but is a versatile tool of the brain. The flipper of the whale is a short, broad, paddlelike structure, apparently without digits, wrist, forearm or upper arm; but on close examination it is seen to possess all of these structures in a condition homologous, almost bone for bone and muscle for muscle, with those of the human arm. The wing of the bird, a highly specialized organ of flight, appears superficially to have nothing in common with the arm of man; but a study of its anatomy shows the same bony architecture and muscle complex, modified rather profoundly for a different function and with the thumb and two of the fingers greatly reduced or entirely unrepresented in the adult stage. The fore-leg of the horse is a specialized cursorial appendage, and in accord with this function has but one functional toe with a heavy toenail or hoof. Two other toes are represented by the so-called split bones, mere vestiges of once useful structures. In other respects the horse's leg is quite homologous with that of other land vertebrates. The evolutionary explanation of the fact that these several types of limbs (each playing an entirely different role in nature and each so unlike the other in form and proportions) have the same fundamental architecture, is that they have all inherited these characters from some distant common ancestor. In each

case the inheritance has undergone modification in harmony with the life needs of the organism. This, of course, implies descent with modification, which is no more or less than evolution.

An equally significant situation comes to light in connection with the hind-limbs of vertebrates. The leg of man, a specialized walking appendage, is much less versatile than is the arm; yet it is closely homologous with the latter. The hind-limb of the whale is, in some species, entirely wanting in the adult or else is in vestigial condition. The leg of the bird is decidedly reptilian in structure and is believed to have retained, in large measure, the characteristics of that of the supposed reptilian ancestors. The hind-limb of the horse, though somewhat stronger and heavier than the fore-limb, resembles the latter closely both in form and function. Snakes are typically limbless vertebrates, but the python has small but clearly defined hind-limbs, somewhat reduced in number of bones and almost entirely hidden beneath the scaly integument.

No other attempt to explain homologies such as those briefly outlined above has been made except that of special creation, and this implies a slavish adherence to a preconceived ideal plan together with capricious departures from the plan in various instances. A systematic attempt to apply the special creation concept to all cases of homologies involves one in the utmost confusion of ideas and leads almost inevitably to irreverence, which is abhorrent to evolutionists as well as to special creationists.

#### Vestigial Structures.

These may be defined in functionless rudiments of structures whose homologues are found in a functional state in other members of a group with a common architectural plan. Thus the hind-limbs of the whale and of the python, the thumb of the bird, the split bones of the horse, are vestigial homologues of structures well developed in more generalized groups of vertebrates.

The case of the hind limb vestiges in the various species of whales may be emphasized as a crucial one. Several different degrees of rudimentation are found in different types of whales, ranging from a state in which the pelvic bones and those of most of the leg clearly recognizable as such down to one in which these bones are entirely absent in the adult condition. In the cases where the bones are obvious, the situation is just this—deeply buried beneath the thick cushion of blubber in the pelvic region there lies a little handful of bones, ridiculously minute in comparison with the giant proportions of the other parts of the skeleton. These bones are immovable because their muscular connections are atrophied; they do no service in supporting the frame of the animal; in short, they cannot possibly function as bones at all. The somewhat puerile argument of the antievolutionist that these vestigial limb bones play some useful, though unknown role, else they would never have been created, cannot seriously be entertained in this case, for what can they make of the fact that some whales entirely lack these structures? More difficult even than this for the special creationist to explain is the fact that, even in these whales that lack vestigial limb bones in the adult condition, posterior limb buds appear in the early embryonic period and then slowly atrophy. The case just described in in no way exceptional or peculiar. It is, on the contrary, quite typical of a very general phenomenon.

#### Vestigial Structures in Man.

There are, according to Wiedersheim, no less than 180 vestigial structures in the human body, sufficient to make of a man a veritable walking museum of antiquities. Among these are the vermiform appendix, the abbreviated tail with its set of caudal muscles, a complicated set of muscles homologous with those employed by other animals for moving their ears, but practically functionless in all but a few men; a complete equipment of scalp muscles used by other animals

for erecting the hair, but of very doubtful utility in man even in the rare instances when they function voluntarily; gill slits in the embryo the homologues of which are used in aquatic respiration; miniature third eyelids (nictitating membrane), functional in all reptiles and birds, greatly reduced or vestigial in all mammals; the lanugo, a complete coating of embryonic down or hair, which disappears long before birth and can hardly serve any useful function while it lasts. These and numerous other structures of the same sort can be reasonably interpreted as evidence that man has descended from ancestors in which these organs were functional. Man has never completely lost these characters; he continues to inherit them though he no longer has any use for them. Heredity is stubborn and tenacious, clinging persistently to vestiges of all that the race has once possessed, though chiefly concerned in bringing to perfection the more recent adaptive features of the race.

#### Homology Versus Analogy.

It is quite common to find different animals with certain structures that look alike and function alike, but are not homologous. The eye of the octopus, a cephaloped mollusk, has a chorion, a lens, a retina, an optic nerve, and a general aspect decidedly like that of a fish. As an optical instrument it must obviously function in the same manner as does the eye of an aquatic vertebrate; but not one part of the eye of a cephaloped is homologous with that of a vertebrate. Because those two types of eye look alike and function alike, but arise from quite different embryonic primordia adapted to meet a common function, they are known as analogous structures. They are to be sharply contrasted with homologous structures, which may be widely different in form and function so long as they arise from equivalent embryonic primordia. Both homologies and analogies imply changes in relation to the environment, and, therefore plainly favor the idea of descent with modification.

#### Connecting Links.

If one group of animals has been derived by descent from another there should be some form more or less intermediate between the two and with some characteristics of both groups. Many such connecting links actually exist at the present time. Almost every order of animals possesses some primitive members that have, doubtless, evolved at a slower rate than their relatives and have on that account retained a larger measure of ancestral traits than have the more typical representatives of the group. Thus there is a group of primitive annelid worms, represented by *Dinophilus*, *Protodrillus* and *Pollygordius*, that serve partially to bridge the gap between the two grand divisions, annelids and flatworms. The case of the several species of *Dinophilus* is especially noteworthy, for these little animals are so evenly balanced between the characteristics of one phylum and those of the other that some authors place them among the flatworms, others among the annelids and still others are inclined to place them in an anomalous group by themselves. There is an interesting genus of primitive centipedes, called *Peripatus*, which possess as many annelid features as anthropoid features. Among vertebrates we have the familiar example of the lung fishes with both the gills of fishes and lungs homologous with those of land vertebrates. And finally, we may mention those curious egg-laying mammals, *Momotremas*, of Australia and New Zealand, which though obviously mammalian in most respects, possess, in addition of laying eggs after the fashion of reptiles, many other decidedly reptilian traits. The reader interested in following up in more detail this interesting branch of comparative anatomy will find the subject skillfully handled by Geoffrey Smith in a volume entitled "Primitive Animals."

Comparative anatomy is a mature and well organized science and involves a vast amount of technical data. No one but a trained comparative anatomist can reasonably be

expected to appreciate the dependence of this subject upon the principle of evolution. Without evolution as a guiding principle, comparative anatomy would be a hopeless mass of meaningless and disconnected facts; with the aid of the principle of homology, an evolutionary assumption, it has grown to be one of the most scientific branches of biology. This may be taken as an illustration of the nature of the proof of organic evolution; that when it is used as a working hypothesis or guiding principle it really works in that it is not only consistent with all of the facts, but lends significance and interest to facts that would otherwise be drab and disconnected.

#### Evidences From Classification.

The object of classification is to arrange all species of animals and plants in groups of various degrees of inclusiveness which shall express as closely as possible the actual degrees of relationship existing between them. In pursuance of this object we begin by grouping together as one species all animals that are essentially alike in their anatomical details. As an example of the methods of classification we may take the following familiar instance: The European wolf is a particular kind of animal constituting a species called *lupus* (the Latin word for wolf), all members of which are more like one another than they are like wolves of other sorts, for the reason that they have a common inheritance. There are not a few other species of wolves, each given a Latin name, and all of these wolf species, including dogs (believed to be domesticated and, therefore, highly modified wolves), are placed in one genus, *Canis*. Several other genera of more or less wolflike animals, such as jackals and foxes, are grouped with the genus *Canis*, and constitute the family *Canidae*, the assumption being that they are all the diversified descendants of some common wolflike ancestor. Other families, such as the cat family (*Felidae*), the bear family (*Urisidae*) and several other

families of terrestrial beasts of prey constitute the suborder fissipedia. These, in turn, are grouped with the marine beasts of prey, such as seals, sea lions, walruses (suborder pinnipedia) to form the mammalian order, carnivora. Several other orders of animals with many characteristics in common are combined to form the class mammalia, which is one of several classes belonging to the subphylum vertebrata, a branch of the phylum chordata. A phylum is one of the grand subdivisions of the animals combined to form the class mammalia, with the same fundamental plan of organization, the common features of which are believed to be derived from a common ancestral type.

The underlying assumption of classification is the same that underlies comparative anatomy; that degrees of resemblance run parallel with degrees of blood relationship, that the most nearly identical individuals are most closely related and that those that bear the least fundamental resemblance to each other are either not genetically related at all or else had a common ancestor far back in the misty past when animal life was in process of origin. We have already shown that this assumption holds good in all cases where it has been possible to put it to the test. No further justification need be offered in this place for making use of the only adequate instrument of classification: the principle of homology.

#### What is a Species?

The species is the unit of classification, but there is serious doubt as to whether species have any reality outside of the minds of taxonomists. Certainly it is extremely difficult, if at all possible, exactly to draw sharp boundary lines between closely similar species. When we examine a large number of individuals belonging to a given species we find that there are no two exactly alike in all respects. As a rule there is a wide range of diversity within the limits of the group we call a species and the extreme variants are often so unlike the type

form that, were it not for the intergrading stops between them, they would often be adjudged distinct species. Moreover, the species of a prosperous genus are so variable that it becomes an almost impossible task to determine where one species ends and another begins, so closely do they intergrade one into another. A species, then, is not a fixed and definite assemblage such as one would expect it to be if specially created as an immutable thing. On the contrary, intensive study of any widely distributed species gives the impression of an intricate network of interrelated individuals changing in a great variety of ways.

The completed classification of any large group, such as the vertebrates, presents itself as an elaborately branching system whose resemblance to a tree is unmistakable. The phylum branches into subphyla, some of the latter into several classes, classes into orders, orders into families, families into genera, genera into species, species into varieties. We may compare the phylum to one of the main branches coming off from the trunk, while the varieties may be thought of as the terminal twigs. This tree-like arrangement is exactly what one would expect to find in a group descended from a common ancestry and modified along many different lines. It is in reality a genealogical tree. If this striking arrangement is a part of the plan of special creation it is indeed strangely unfortunate that it speaks so plainly of descent with modification.

#### Man's Place in the System of Classification:

There is no greater difficulty in connection with the classification of man than in that of any other living species. Indeed there are scores, even hundreds, of species whose exact affinities with other groups are far less obvious than those of the human species. Anatomically the genus homo bears a striking resemblance to the anthropoid apes. Bone for bone, muscle for muscle, nerve for nerve, and in

many special details man and the anthropoid apes are extremely similar. Homologies are so obvious that even the novice in comparative anatomy notes them at a glance. Man is many degrees closer anatomically to the great apes than the latter are to the true monkeys, yet the special creationist insists upon placing man in biological isolation as a creature without affinities to the animal world. If a man is a creature apart from all animals it is extremely difficult to understand the significance of the fact that he is constructed along lines so closely similar to those of certain animals; that his processes of reproduction are exactly those of other animals; that in his development he shows the closest parallelism step for step to the apes, that his modes of nutrition, respiration, excretion, involve the same chemical processes, and that even his fundamental psychological process are of the same kind, though differing in degree of specialization, as are those of lower animals.

Comparative anatomists recognize man as a vertebrate, for he has all of the characteristic features of that group. He is obviously a mammal, for he complies with qualifications of that class in having hair; in giving birth to living young after a period of uterine development; in suckling the young by means of mammary glands; in having two sets of teeth, one succeeding the other; in having the teeth differentiated into incisors, canines and molars; and in many other particulars of skeleton, muscular system, circulatory system, alimentary system, brain and other parts of the central nervous system. Among mammals, man belongs to the well-defined order of Primates, an order anatomically about halfway between the most generalized and the most specialized of the mammalian orders. Apart from his extraordinary nervous specialization, man is a relatively generalized mammal as compared with such highly specialized types as for example, the whales. The older taxonomists placed man and the other primates

at the top of the genealogical tree, assigning to him the central tip of the central branch as though the goal of all organic evolution were man. Accordingly, those mammals such as the whales, which are least like man, were considered the lowest members of the class. There has been within recent years a pronounced reversal of this anthropocentric point of view, which has resulted in a complete revision of the arrangement of mammalian orders, with the insectivora the lowest, the cetacea (whales) the highest, and the primates about intermediate in systematic position.

The order primates consists of two suborders—lemuroidae and anthropoidae. The lemurs or half apes are small arboreal animals with somewhat squirrel-like habits, but with flat nails and certain other primate characters. They serve to link up the primates with the most primitive of the mammalian orders, the insectivora, which are now believed, on anatomical and paleontological grounds, to be ancestral not only to the primates but to most of the other modern mammalian orders. The anthropoid or man-like primates are divided into four distinct families: The Hapalidae or marmosets; the Cercopithecidae or new world monkeys; the Simiidae or anthropoid apes, and the Homiidae or men. The family Homiidae includes four genera: The genus Pithecanthropus, represented by the fragmentary remains of an extinct Javan ape-man, the genus Eanthropus and the genus Homo, including in addition to the existing species, Homo sapiens, several different extinct human species known as the Dawn man, the Neanderthal man, the Rhodesian man, and others.

The species Homo sapiens consists of at least four subspecies or major varieties, each consisting of numerous minor races and admixtures of these. This high degree of diversity within the species is evidence of rapid evolution. If a little over 4,000 years ago, as the special creationists claim, one man was created and has become the an-

cestor of all men living today, evolution must have gone on at an extremely rapid rate in order to have produced so many widely different races, for there could scarcely have been more than 120 generations in that time. If species are believed to be immutable it is difficult to understand why man should be such a diversified group as he is.

#### Evidences from Blood Tests

The methods of classifying animals just outlined depend upon relatively gross criteria (homologies) as compared with the refinements characteristic of the serological technique used in blood testing. This latter method of classifying animals depends upon chemical similarities and differences in the bloods of various animals, and the basic assumption is once more that degrees of resemblance parallel degrees of blood relationship. Recent investigation has shown that certain materials in an animal's blood are even more sharply specific than are its visible structural characteristics. Chemical tests of extreme delicacy are used to reveal resemblances in blood. Thus, if we wish to find out what animals are most like man in blood composition we can find it out in the following manner: Human blood is drawn and allowed to clot, a process that separates the solid materials in the blood from the liquid serum. The latter watery fluid contains the specific human blood ingredients. Small doses of it are injected at two-day intervals into the blood vessels of a rabbit. At first the rabbit is sickened by the injection, thus showing a marked reaction to the foreign material. In the course of a short time, however, there is no further reaction, and we may conclude that the rabbit is immunized. What has happened is that some substance has been developed in the rabbit's blood which neutralizes the toxic effects of human blood. It is a sort of antitoxin and may be spoken of as antihuman serum, a material that may now be used as a delicate indicator of blood kinship. When this antihuman serum is mixed with serum

taken from the blood of any human being an immediate and definite white precipitate is formed; when mixed with that of any of the anthropoid apes the precipitate is similar to that formed with human serum, but less abundant and somewhat slower in appearing. The tests showed a less prompt and less abundant reaction with the blood of old world monkeys, a slight but definite reaction with that of new world monkeys, and no noticeable reaction with that of lemurs.

The tests further indicated that, if strong enough solutions are used and time enough allowed for the precipitate to settle, there is an unmistakable blood relationship among all mammals and that degrees of relationship run closely parallel with those based upon homologies. Not only this, but not a few affinities, the existence of which had been only vaguely suggested by comparative anatomy, are strongly emphasized by blood tests. One most remarkable revelation is that whales, the most specialized among mammals, are more closely related to the ungulates (hoofed animals), and especially to the swine family, than to any other group of the class mammalia—a diagnosis that had previously been made by several anatomists on what appeared to be rather slender morphological grounds.

At the present time the technique of blood testing for animal affinities is rather difficult and very few workers have attempted to make use of it. The results so far attained, however, are so definite and clean-cut that there is every reason to expect a great future for this new type of evolutionary evidence. Many groups of animals have already been tested and in general the affinities indicated closely parallel those based on homologies. There is, however, no exactness about this parallel; nor could we expect such to be the case. For that matter there is no exact parallelism between the teeth and the feet, between the head and the tail. No two systems of an organism exactly keep pace in their evolution; one may remain rela-

tively conservative while the other may become greatly specialized. Of all systems, the blood appears to have been the most conservative and to have retained most fully its ancestral characters. It is on this account that blood tests are so valuable in revealing relationships that can scarcely be determined in any other way.

Far more important than any information as to animal affinities revealed by blood tests is the fact that the classification of animals based on blood tests is essentially the same as that based on morphology. Suppose, for the sake of argument, that these two modes of classification had revealed quite contrary arrangements, what a blow to our confidence in the validity of evolution! Conversely, what a strong support of the evolution principle is afforded by the fact that the two systems of classification point to the same lines of descent!

#### Evidences from Embryology

There should be no sharp division between the evidences from comparative anatomy and those from embryology. Those two branches of biology are inseparable; one must be interpreted in the light of the other. Comparative anatomy deals with the adult structures of organisms. Whenever there is any question about homologies of fully developed structures recourse is had to younger and still younger stages, for when structures are really homologous, they tend to be more closely similar the younger they are. Structures that come from the same or similar embryonic are by definition homologous. Therefore the only certain test of homologies is a study of embryology.

It is necessary to bear in mind that an individual is not merely his adult condition; that a species is not fully defined by a description of its adult characteristics. The species characteristics include those of the egg and the sperm, the cleavage pattern, the particular modes of gastrulation and of further differentiation. In brief, the species is fully

defined only by a full description of its entire ontogeny. Very closely related species keep step nearly all the way through their ontogenous and diverge only toward the end of their courses. Distantly related forms diverge comparatively early in their developmental paths; while unrelated forms may have little or nothing in common from the beginning.

The most advanced groups of organisms travel a much longer journey before reaching their destination than do organisms of lower status. In many instances certain early stages in the development of an advanced organism resemble in unmistakable ways the end stages of less advanced organisms. There is, in fact, in the long ontogeny of members of high groups, a sort of rough-and-ready repetition of the characteristic features of many lower groups. This fact has so impressed some biologists that they have embodied it into a law, the so-called biogenetic law; that ontogeny recapitulates phylogeny. In less technical language this means that the various stages in the development of the individual are like the various ancestral forms from which the species is descended, the earliest embryonic stages being like the most remote ancestors and the latter stages like the more recent ancestors. In still other words, the concept may be stated as follows: The developmental history of the individual may be regarded as an abbreviated resume of its ancestral history.

In the first place it is obvious that no embryonic stage can be in any real sense the equivalent of any adult ancestor. The most we can affirm is that while some embryonic characters of the higher group strongly remind us of some adult features of lower groups, the tout ensemble of the former is not at all closely similar to that of the latter. In the second place, it should not be forgotten that the embryonic and larval stages of organisms have much more pressing demands upon them than that of recording their ancestral attainments—they must adapt themselves to their

surroundings if they are to survive. As a result of this pressing necessity many larvae and even embryos are so profoundly modified in adaptive ways that their ancestral characters are largely obscured. Various larval or fetal organs commonly furnish the outstanding characteristics of developmental histories, and these purely temporary organs not only tell no story of ancestries, but frequently so mask the ancestral story as to make it almost indecipherable. In the third place, different systems of organs develop at different rates, so that when one system has reached an advanced state of differentiation another system may be still in the primordial state. Thus, in the development of fishes the nervous system is far along its course of development before the circulatory system has even begun to differentiate. At such a stage as this the embryo is obviously not equivalent to any adult ancestor, for an organism with so discordant an organization could not survive.

In spite of its faults and limitations, however, the idea that ontogeny tends to repeat phylogeny, if used intelligently and not over-applied, is a very useful one. Organisms inherit not only their adult characters from their ancestors, but also their general development patterns. It is therefore inevitable that many features that have been outgrown or subordinated in modern types should be found in a state more nearly ancestral during the embryonic stages. And especially is this the case when particular systems are studied separately. Thus, we find that the human circulatory system develops through a series of stages that are much like the adult conditions of a series of ascending vertebrate classes.

The heart differentiates from a sheet of mesoderm lying beneath the pharynx. It has at first the form of two nearly straight tubes, which soon fuse for part of their length to form a single tube divided at the two ends into two tubes. Later the single tube differentiates lengthwise into two cavities, the auricle and the ventricle, and is now in the stage equivalent to that of an adult fish. The auricle

next divides into two chambers, thus resembling that of an amphibian. Finally the ventricle subdivides also, giving rise to the four-chambered heart characteristics of mammals. The main arteries and veins of the head region are at first laid down with reference to what are known as the bronchial arches, the structural framework of the bronchial or gill apparatus of aquatic vertebrates. Later, the whole architecture of this system becomes profoundly modified in adaptation for lung respiration. While the arteries and veins are in the fish-like condition there appear at the anterior end of the body in the prospective neck region four pairs of crevices, gill slits, which in fishes open directly into the pharynx and furnish a surface for gills. In the human embryo, however, these clefts never break through, but, after persisting for some time without playing any useful role, gradually disappear. The only persistent residue of the gill slits is the Eustacean tube, which connects the pharynx with the middle ear. Never at any time do the gill slits function in a respiratory capacity, for they never possess any bronchial tissue. Only one interpretation of these transitory gill slits of man can be seriously entertained, namely, that, although these structures are inherited from the early aquatic ancestry, adaptive demands have caused their suppression in favor of more useful structures. Inheritance causes their appearance; lack of function prevents their development and causes their disappearance or modification.

Nothing is to be gained by a multiplication of parallelisms such as the above. Suffice it to say that the nervous system, the alimentary system, the uregential system and other systems go through stages similar to those described above and that these resemble adult stages of lower classes of vertebrates. The embryology of man is now pretty thoroughly known in spite of the great difficulty of obtaining the early stages. Step for step it is almost precisely like that of other primates, especially like that of the anthropoids, and it is only in the latest stages that it takes on distinct-

ly human characteristics. This is not equivalent to saying that the expert embryologist is in any doubt as to the diagnosis of a human embryo no matter how early the stage, for there are specific features about all embryos from the egg stage on to the end of development that may be distinguished by any one sufficiently versed in the subject. In spite of these specific differences, however, there can be no question that the embryology of man and that of any of the anthropoid apes show the closest of resemblances at every stage and diverge sharply only in the late stages of prenatal life. So close a resemblance in developmental histories is found only in species that are members of the same ancestral stock, for they have both inherited the characteristic features of their development from their common ancestors.

The evidence of human evolution as derived from a study of embryology is in no wise exceptional; in the contrary, it is quite typical and may be taken as indicating that from the developmental standpoint man is at one with other animals.

#### Evidences from Paleontology

Paleontology is the science of ancient life. Its materials are the more or less complete preserved remains of animals and plants that once lived. We call those remains fossils. Fossils are real; they cannot be explained away. If evolution has taken place and samples of every species that has lived were preserved for study, it would still be a task of immense difficulty to work out the pedigrees of all types of organisms now living, and we might still be largely in the dark as to the causes of the observed changes. As it is, we have fossil remains of perhaps only about one out of each thousand extinct species, a mere random sampling of the types that prevailed during the various past ages. Considering how many factors have been at work to prevent fossilization of large groups of species and how erosion and metamorphosis have worked together to destroy those fossils already preserved, we marvel that our fossil record is

sufficiently complete to tell any sort of sequential story. The fact is that the record is surprisingly full and rich.

#### Age of the Earth

According to the most recent computations based on the rate of radium emanation, 1,000,000,000 years have elapsed since the earth attained its present diameter. Various estimates as to the time since the first life appeared upon the surface of the globe range from 50,000,000 years to about ten times that figure. Even the lowest figure gives ample time for any sort of evolutionary change, no matter how slow.

#### The Earth's Strata as Time Markers

The crust of the earth is arranged in a series of horizontal strata of varying thickness. The lowest layers are obviously the oldest, except in a few localities where breaks and tilts have occurred. Even in the most disturbed mountainous regions it is an easy task for the geologist to determine the original order of the strata.

First—None of the animals of the past are identical with those of the present. The nearest relationship is between a few species of the past which have been placed in the same genera as those of today.

Second—The animals and plants of each geologic stratum are at least generically different from those of any other stratum.

Third—The animals and plants of the oldest geologic strata represent all of the existing phyla except the vertebrates, but the representatives of the various phyla are relatively generalized as compared with modern representatives of the same phyla.

Fourth—There is a general progression toward more highly specialized forms as one proceeds from lower to higher strata.

Fifth—Many groups of animals reached the climax of their specialization long ages ago and have become extinct.

Sixth—Only the less specialized relatives of those most highly specialized types survived to become the progenitors of the modern representatives of the group.

Seventh—It is common to find a new group arising near the close of some geologic period when vast climatic changes were taking place. Such an incipient group almost regularly becomes the dominant group of the next period, presumably because it arose in response to the new conditions that accompanied the change from one period to another.

Eighth—The evolution of the vertebrate classes is more satisfactorily shown than that of any other group, probably because it arose within the period which is characterized by an abundant fossil record. Of the vertebrates, the mammals are best represented and show the most complete fossil pedigrees; this, because they are the most recent in origin and their remains have been least disturbed.

Ninth—Many practically complete fossil pedigrees have been worked out, connecting specialized types with simpler and more generalized ancestors. Such pedigrees have been worked out for the horse, the elephant, the camel, the rhinoceros and other equally specialized modern types. A single example of this type of evidence will be given, that of the horse. Many other pedigrees have been worked out that are equally complete and no less significant.

#### Pedigree of the Horse

As recorded by Dendy, the course of evolution of the horse family (Equidae) "has evidently been determined by the development of extensive, dry, grass-covered, open plains on the American continent. In adaptation of life on such areas structural modification has proceeded chiefly in two directions. The limbs have become greatly elongated and the foot uplifted from the ground, and thus adapted for rapid flight from pursuing enemies, while the middle digit has become more and more important and the others, together with the ulna and the fibula, have gradually disappeared or been reduced to mere vestiges. At the same time the grazing mechanism has been gradually perfected. The neck and head have been elongated so that

the animal is able to reach the ground without bending its legs, and the cheek teeth have acquired complex grinding surfaces and have greatly increased in length to compensate for increased rate of wear. As in so many other groups, the evolution of these special characters has been accompanied by gradual increase in size. Thus *Eohippus*, of lower eocene times, appears to have been not more than eleven inches high at the shoulder, while existing horses measure about sixty-four inches, and numerous intermediate genera for the most part show regular progress in this respect.

All of these changes have taken place gradually, and a beautiful series of intermediate forms indicating the different stages from *Eohippus* to the modern horse have been discovered. The sequence of these stages in geological time exactly fits in with the theory that each one has been derived from the one next below it by more perfect adaptation to the conditions of life. Numerous genera have been described, but it is not necessary to mention more than a few."

The first indisputably horse-like animal appears to have been *Hyracotherium* of the lower eocene of Europe. Another lower eocene genus is *Eohippus*, which lived in North America, probably having migrated across from Asia by the Alaskan land connection. In *Eohippus* the forefeet had four hoofed toes of nearly equal size, the homologue of the thumb having been reduced to a vestige. In the hind foot the great toe had entirely disappeared and the little toe had been reduced to a splint bone. Then came *Orehippus* of the upper eocene, *Mesehippus* of the lower miocene, *Prothohippus* of the lower pliocene, *Pliohippus* of the upper pliocene, and finally, *Equus* of the quaternary and recent. This history, in so far as it concerns the characters already described, furnishes all of the intermediate conditions and perfectly connects the horses of the past with those of the present. One could hardly ask for a

clearer or more conclusive story of evolution than this, and this is only one of many similar cases.

#### The Fossil Pedigree of Man.

There is nothing peculiar or exceptional about the fossil record of man. It is considerably less complete than that of the horse, the camel, the elephant and other purely terrestrial mammals, but it is far more complete than that of birds, bats and several types of arboreal mammals. Much has been said by the antievolutionists about the fragmentary nature of the fossil record of man, but many other animals have left traces far less readily deciphered and reconstructed.

The outstanding fact brought out by a study of human paleontology is that of man's antiquity. According to the most expert testimony available, the oldest fossil in the human series is about 500,000 years old; and even this estimate makes man a recent product of evolution as compared with many contemporaneous animals. The earliest fossil remains of the present species of man (*homo sapiens*) have been very conservatively estimated as 25,000 years old, while other species of extinct man date back to a period at least 100,000 years ago. In addition to several species of the genus *homo*, anthropologists distinguish three other genera of the man family (Hominidae): *Pithecanthropus*, *Paleanthropus* and *Eoanthropus*, all more primitive than any members of the genus *Homo*. A brief, but frank, statement about each of these links in the human pedigree is all that is necessary for our purposes.

#### The Java Man.

##### *Pithecanthropus erectus*.

This is the so-called Java man, formerly called the ape man or missing link, but now adjudged to be definitely human. The fossil remains consist of a complete calvarium or skull cap, three teeth and a left thigh bone. These were scattered over twenty yards of space and were discovered at different times. There is no proof that these remains belong to the same individ-

ual or even to the same species, but they are all human in their anatomical characters and they occurred in fossil-bearing rock about 500,000 years old. Many pages of scientific romance have been written about this species; all sorts of more or less justifiable pictures and models of this hypothetical species have been published. It is then refreshing to read the coldly scientific statement of Gregory:

"The association of gibbon-like, skull-top, modernized human femur and subhuman upper molars with reduced posterior moiety, if correctly assigned to one animal, may, perhaps, define *pithecanthropus* as an early side branch of the Hominidae, which had already been driven away from the center of dispersal in central Asia, by pressure of higher races. But whatever its precise systematic and phylogenetic position, *Pithecanthropus* or even its constituent parts, the skull-top, the femur and the molars, severally and collectively testify to the close relationship of the late Tertiary anthropoids with the pleistocene hominidae."

#### The Heidelberg Man.

##### *Paleanthropus Heidelbergensis*.

The genus and species, commonly known as the Heidelberg man, is based solely upon a single lower jaw in an excellent state of preservation, with all teeth in place. The strong points about this find are, first, that it was found in a stratum whose age had been well established; and second, that its discoverer ranks among the leading experts in the field. The age of this venerable relic has been determined as at least 400,000 years, a little more recent than *Pithecanthropus*. The jaw is very primitive, heavy and clumsily constructed as compared with that of modern man. It lacks the chin prominence, as does the jaw of the gorilla. The teeth are strictly human, though rather larger than those of modern man. This ape-like jaw with human teeth forms an authentic link in the series connecting man with the anthropoids.

### *Eoanthropus Dawnonis*, the Dawn Man.

The most ancient English human relic has been called the dawn man of Piltdown. Owing to the fact that the skull fragments had been badly damaged and scattered by workmen before they came into scientific hands, there has been a great deal of controversy as to their significance. Until the experts arrive at an agreement about this type it might be well for others to reserve judgment. There can be no doubt as to the fact that these remains show a curious admixture of simian and human characteristics, the jaw and teeth being even more simian than that of the Heidelberg man, while the skull, though primitive, is distinctly human. The age of the dawn man is placed at about 200,000 to 300,000 years.

In striking contrast with the fragmentary character of the remains just described are those of three distinct species of the genus homo, which are now to be briefly characterized.

### *Homo Neanderthalensis*, the Neanderthal Man.

The well-established race known as Neanderthal man is represented by many individual skeletons of varying degrees of completeness and showing a considerable range of diversity. Specimens have been found in France, Spain, Belgium, Germany and Austria. This species of primitive man was of low stature about five feet three inches in the males and less in the females.

The posture was somewhat stooping. The relatively large head was long and flat, with ape-like brow ridges and scarcely any forehead, and was borne on an immensely muscular neck in such a way that the face was thrust forward in simian fashion. The lower jaw was heavy and lacked a chin prominence. The teeth were of a type known as taurodont, adapted to a coarse vegetable diet and quite different in structure from those of modern man. The brain of this ancient homo-Neanderthalensis was large and specialized in some parts,

but deficient in those parts associated with the higher mental functions.

There can be no question that Neanderthal man was much more primitive, more simian in organization, than modern man. Expert opinion, as expressed by Keith looks upon him as "a separate and peculiar species of man which died out during or soon after the Mousterian period." This dates him back to about 50,000 years ago.

### *Homo Rhodesiensis*, the Rhodesian Man.

Rhodesian man is represented by a perfect skull and a nearly perfect lower jaw, the tibia, both ends of a femur collar bone and parts of the scapula and pelvis. Part of the upper jaw of a second specimen was found in the same locality, the Broken Hill mine in northern Rhodesia. This species is largely of technical interest, and need not be described in detail. Suffice it to say that in some respects it was as primitive as Neanderthal man, but in other respects showed distinct tendencies toward the modern condition. Anthropologists have as yet not reached a decision as to the exact taxonomic status of Rhodesian man, nor has its age been definitely determined.

### *Homo Sapiens*, the Modern Man.

The earliest fossil evidence of the existence of our own species dates back to about 25,000 years ago. At that time there lived a remarkable race, known to us as Cro-Magnons, a race said to be the most perfect physically of which we have any knowledge. Five essentially complete skeletons form the basis of the type description. This tall, strong, obviously intelligent, and artistic race, was different in several important particulars from any modern race. A detailed description of his characteristics would take us too far afield. Our chief interest in this race is that it serves to emphasize the antiquity of our own species.

In conclusion it may be said that the fossil evidences of man's ancestry are neither rich nor poor; that anthropology is a comparatively youthful science, and that new discoveries in the field are being made at a very satisfactory rate.

### Evidences from Geographic Distribution

Just as paleontology deals with the vertical distribution or distribution in time of species, so geographic distribution deals with their horizontal distribution upon the earth's surface at any given period of time. Geographic distribution is a sort of cross section of vertical distribution, giving a picture of the complex evolution of organisms at a given moment in the process. Explorers and collectors have amassed a vast amount of data as to the present and past ranges of animals and have mapped out the distribution of the majority of known species. A composite map of the geographic distribution of all known species would be the most intricate picture puzzle imaginable, and it would be almost impossible to make sense of it. A study of the distribution of limited groups, however, should lead to some reasonable explanation of their interrelations. Obviously animals are not distributed strictly according to climatic conditions or habitat complexes, for a given climate in one part of the world is associated with an entirely different fauna from a practically identical climate in another part of the world. Moreover, animals are not always or even very frequently located in those parts of the world that would offer them the best possible life conditions. This is borne out by the fact that not a few animals, when taken out of the normal range and transferred to a distant region, thrive much better than in their native territory. Thus European rabbits, when carried to Australia, thrive and multiplied beyond all expectation till they became a pest. Again, as may be easily observed, the English sparrow seems to find America much

more congenial than the British Isles.

If animals are not distributed according to habitats, how, then, can we account for their distribution? It is not at all likely that species retain the same ranges for long periods; they are continually changing their locations. We know, also, that the likeliest places to look for two closely similar species are adjacent territories, separated by geographic barriers. A study of the distribution of the species of a large genus usually reveals the fact that the most generalized or type species occupies the central part of the area and that the most specialized species occupy outlying areas adjacent to or connected with the main range of the genus. Taking these and related facts into consideration, we are able to offer as an explanation of the distribution of groups of allied species that a parent species originates in one place, multiplies and tends to migrate centrifugally in all directions, modifying as it goes to fit new conditions. Some of the extreme migrants become isolated from the main body of the species and, no longer interbreeding with them, become at first well-marked local varieties and in time new species. The above is the usual hypothesis employed in explaining geographic distribution, and it obviously implies evolution. When used as a means of unraveling the intricate tangle involved in the distribution of species it has thrown a flood of light upon situations otherwise quite inexplicable. In brief, the evolution hypothesis rationalizes geographic distribution, makes a science of what was formerly a hopeless jumble, and has thus proven itself a valuable scientific agent.

### The Inhabitants of Oceanic Islands

Oceanic Islands are small isolated bodies of land of volcanic origin, far from continents. They are the tops of oceanic mountains. All such islands have their inhabitants, and a study of these should furnish a crucial test of the validity of the rival theories of special creation and of evolution. Both creationists and

evolutionists agree that these islands must have obtained their populations from continental bodies. If then the island species are identical with those of the continent from which they have been derived, there is no reason to believe that evolution has taken place; if, however, they are different, the degree of difference should be an exact measure of the amount of evolutionary change that has taken place. What are the facts? Practically all species of animals inhabiting oceanic islands are types that are capable of transportation in the air during storms or on floating debris. All species belong to the faunistic groups characteristic of the most available continent, but the species are for the most part peculiar, that is, different from species anywhere else. They may belong to the same genus or family as do those of the continent, but they are at least specifically, frequently generally, different from the latter. Such being the case, we are forced to conclude that new species have originated under island conditions. The extreme case is that of the island of St. Helena, 1,100 miles from Africa. On this little body of land there are 129 species of beetles, all but one of which are peculiar. The species belong to thirty-nine genera, of which twenty-five are peculiar. There are twenty species of land snails, of which seventeen are peculiar. Of twenty-six species of ferns seventeen belong to peculiar genera. The Azores, Bermudas, Galapagos islands, Sandwich islands, all tell much the same story, but their populations are not quite so peculiar.

#### Evidences from Genetics

Genetics may be defined as to the experimental and analytical study of variation and heredity, the two primary causal factors of organic evolution. As such, genetics aim not so much at furnishing evidence of the fact of evolution as at discovering its causes. Incidentally, however, man takes a hand in controlling evolutionary processes and actually observes new heredity types taking origin from old, he is observing at

first hand the actual processes of evolution. We shall merely say that the geneticist is an eye-witness of present-day evolution and is able to offer the most direct evidence that evolution is a fact.

#### Summary of Evidences

All of the lines of evidence presented point strongly to organic evolution, and none are contrary to this principle. Most of the facts, moreover, are utterly incompatible with the only rival explanation, special creation. Not only do these evidences tell a straightforward story of evolution, but each one is entirely consistent with all of the others. Furthermore, each line of evidence aids in an understanding of the others. Thus embryology greatly illuminates comparative anatomy and classification; geographic distribution is aided by paleontology, and vice-versa; blood tests and classification throw mutual light the one upon the other. The evolution principle is thus a great unifying and integrating scientific conception. Any conception that is so far-reaching, so consistent, and that has led to so much advance in the understanding of nature, is at least an extremely valuable idea and one not lightly to be cast aside in case it fails to agree with one's prejudices.

The Court—Send for the jury.

Mr. Hays—May I have the consent of the other side to fix my record later and see that they are properly marked and introduced?

Mr. Darrow—Your honor, before you send for the jury, I think it my duty to make this motion. Off to the left of where the jury sits a little bit and about ten feet in front of them is a large sign about ten feet long reading, "Read Your Bible," and a hand pointing to it. The word "Bible" is in large letters, perhaps a foot and a half long, and the printing—

The Court—Hardly that long I think, general.

Mr. Darrow—What is that?

The Court—Hardly that long.

Mr. Darrow—Why, we will call it a foot.

The Court—Compromise on a foot.

Mr. Darrow—Well, we will call it a foot, I guess more, but I might be wrong again, judge.

The Court—Well, I believe there will be no insistence.

A Voice—Fourteen inches.

Mr. Darrow—I move that it be removed.

The Court—Yes.

Gen. McKenzie—If your honor please, why should it be removed? It is their defense and stated before the court, that they do not deny the Bible, that they expected to introduce proof to make it harmonize. Why should we remove the sign cautioning the people to read the Word of God just to satisfy the others in the case?

The Court—Of course, you know I stand for the Bible, but your son has suggested that we agree to take it down.

Gen. McKenzie—I do not agree with my son.

Mr. Malone—The house is divided against itself.

Mr. Darrow—The purpose, I do not know why it was put there, but I suggest that it be removed.

The Court—I do not suppose it was put there to influence the trial.

Gen. Stewart—Do I understand you to ask it to be removed?

Mr. Darrow—Yes.

The Court—What do you say about it being removed?

Gen. Stewart—I do not care for it being removed, I will be frank.

J. G. McKenzie—If your honor please, I believe in the Bible as strong as anybody else here but if that sign is objectionable to the attorneys for the defense, and they do not want to be repeatedly reminded of the fact that they should read their Bible, I think this court ought to remove it.

Mr. Malone—May your honor please—

Mr. Hays—May we make our record—

Mr. Malone (continuing)—I do not think that is the statement of the position of the attorneys for the defense. We are trying a case here which we believe has very definite

issues, aspects, we believe even though the court has moved downstairs for safety and comfort, that everything which might possibly prejudice the jury along religious lines, for or against the defense, should be removed from in front of the jury. The opinions of the members of the counsel for the defense, our religious beliefs, or Mr. Darrow's nonbelief, are none of the business of counsel for the prosecution. We do not wish that referred to again. The counsel for the defense are not on trial here. Mr. Scopes here is on trial and we are merely asking this court to remove anything of a prejudicial nature that we may try these issues and the court will be taken out of a prejudicial atmosphere. (Applause.)

J. G. McKenzie—If the court please, in reply to the statement of Mr. Malone, I want to withdraw my suggestion in regard to removing the sign, "Read Your Bible," for this reason: I have never seen the time in the history of this country when any man should be afraid to be reminded of the fact that he should read his Bible, and if they should represent a force that is aligned with the devil and his satellites—

Mr. Malone—Your honor, I object to that kind of language.

J. G. McKenzie (continuing)—Finally I say when that time comes that then is time for us to tear up all of the Bibles, throw them in the fire and let the country go to hell.

Mr. Hays—May I ask that our exception to those remarks be put on the record and I should like to move the court to expunge the last remarks.

The Court—Yes, expunge that part of Mr. McKenzie's statement from the record, where he said, if you were satellites of the devil. Any body else want to be heard?

Mr. Malone—Yes, I think it is all right for the individual members of the prosecution to make up their minds as to what forces we represent. I have a right to assume I have as much chance of heaven as they have, to reach it by my own goal, and my understanding of the Bible

and of Christianity, and I will be a pretty poor Christian when I get any Biblical or Christian or religious views from any member of the prosecution that I have yet heard from during this trial. (Applause and laughter, with Court Officer Kelso Rice rapping for order.)

Mr. Bryan—If the court, please—

The Court—Col. Bryan, I will hear you.

Officer Rice—People, this is no circus. There are no monkeys up here. This is a lawsuit, let us have order.

#### Both Sides Swearing By Bible?

Mr. Bryan—May it please the court. Very often in the course of a trial, questions come up which may be decided on one of several grounds. One is the ground as to what is right. There are certain technicalities that are sometimes observed, and then there are decisions made in the spirit of accommodation. I cannot see that there is any inconsistency, even subtechnically, between taking that "Bible" up there off for the defense, if the defense insists that there is nothing in evolution that is contrary to it. (Applause.) If their arguments are sound and sincere, that the Bible can be construed so as to recognize evolution, I cannot see why "Read Your Bible" would necessarily mean partiality toward our side. It seems to me that both of us would want to read the Bible if both of us find in it the basis of our belief. I am going to quote the Bible in defense of our position, and I am going to hold the Bible as safe, though they try to discard it from our wall. Paul said: "If eating meat maketh my brother to offend, I shall eat no meat while the world lasts." I would not go that far, that is, I would not say while the world lasts, but if leaving that up there during the trial makes our brother to offend, I would take it down during the trial.

Mr. Malone—May I make my exception?

Mr. Darrow—Let me say something. Your honor, I just want to make this suggestion. Mr. Bryan

says that the Bible and evolution conflict. Well, I do not know, I am for evolution, anyway. We might agree to get up a sign of equal size on the other side and in the same position reading, "Hunter's Biology," or "Read your evolution." This sign is not here for no purpose, and it can have no effect but to influence this case, and I read the Bible myself—more or less—and it is pretty good reading in places. But this case has been made a case where it is to be the Bible or evolution, and we have been informed by Mr. Bryan, who, himself, a profound Bible student and has an essay every Sunday as to what it means. We have been informed that a Tennessee jury who are not especially educated are better judges of the Bible than all of the scholars in the world, and when they see that sign, it means to them their construction of the Bible. It is pretty obvious, it is not fair, your honor, and we object to it.

Mr. Bryan—I am sure the gentleman does not mean to misrepresent me, but if he will get the record he will find that he has misquoted me.

Mr. Darrow—I am sorry if I did. Perhaps I did.

Mr. Bryan—I said any of the scholars whom the defense could or would call—that is different from the statement as made by the gentleman. Besides, the gentleman's statement is not pertinent. He said he would put up "Hunter's Biology." We are not both swearing by Hunter's Biology. We are swearing by the Bible. If we can accept in good faith what the defendant has said.

Mr. Darrow—Oh, no, there is a variance.

#### The Court Removes Sign.

The Court—The issues in this case, as they have been finally determined by this court, is whether or not it is unlawful to teach that man descended from a lower order of animals. I do not understand that issue involved the Bible. If the Bible is involved, I believe in it and am always on its side, but it is not for me to decide in this case. If the presence of the sign irritates anyone,

or if anyone thinks it might influence the jury in any way, I have no purpose except to give both sides a fair trial in this case. Feeling that way about it, I will let the sign come down. Let the jury be brought around.

(The sign was thereupon removed from the courthouse wall.)

Mr. Hays—Your honor, before you bring in the jury we have other matters to introduce which might bring up a question you may not wish for the jury to hear the argument on. It will not take very long.

The Court—What is it, Mr. Hays?

Mr. Hays—Your honor will remember that in my argument the other day I insisted there was no such thing as the Bible, that there are many bibles; but the court took judicial notice that the King James' version was the Bible. The court has the right to take judicial notice of other bibles, and I will ask the court to admit in evidence a translation of the Holy Bible from the Vulgate, which I understand is the Catholic Bible, as evidence in this case.

The Court—Is it in English?

Mr. Hays—Yes, sir.

The Court—Let it be filed.

Mr. Hays—We wish to treat as read the first two pages your honor.

The Court—I was just reading to see if there was any difference, for my own edification.

Mr. Hays—Your honor, we wish to introduce as evidence, likewise, the Hebrew Bible; and we are going to ask that the first two chapters, likewise, be regarded as in evidence. And we believe we can show, through these translations we wish read into the record, that the Bible was not accurately translated into English, and of particular interest on the question of evolution.

The Court—Is that in English?

Mr. Hays—That is not in English.

Mr. Bryan—Well, of course, you want it in English.

Mr. Hays—No, I want the translation of my witness, whose affidavit I have read. I offered it in evidence, but very little of it was in my statement.

The Court—Let it be put in evidence.

Mr. McKenzie—They cannot put that in as proof.

#### Has Right, Perhaps, to Show Other Bibles.

Mr. Hays—We have a right to do so to this extent: That if it should appear that the Catholic Bible is different in any part from the King James version, or that the Hebrew Bible is different in any part from the King James version, we have a right to show it. We should be permitted, in our argument, to show that there is a difference, and that it is not merely interpretative.

Mr. Bryan—If the Jewish Bible is to be used in this trial, I think we have a right to object to him bringing in some particular translations. We can get a Hebrew Bible translated into English. We have one and will be glad to give it to them; but I do not think they have a right to bring in some individual's private interpretation.

Mr. Hays—Our witness would swear to it on the stand that his translation is correct.

Mr. Bryan—I know, but your witness has not been sworn, and his testimony is for the record. If you are going before the jury with this, I submit that you cannot come with your private interpretation, but you should take the Jewish Bible that is used by the Jews of this country.

Mr. Hays—I think Mr. Bryan is right about that. We have here the Catholic Bible and the King James version, and I offer these for the purposes of the record, and to show what the translation should have been, and for no other purpose.

Mr. Darrow—Mr. Bryan, have you your translation here?

Mr. Bryan—I have it at the house. Gen. Stewart—Indictment was based on the King James version of the Bible.

The Court—I don't believe it is worth fussing over. I don't think there is any conflict in it. If there is no conflict—

Gen. Stewart—If there is no conflict, there is no use in discussing it.

Mr. Hays—But I say, if there is conflict anywhere in the words in the Bible as it was interpreted there, and in the Bible as it has been translated from time to time, then it is a matter for each individual to determine.

Gen. Stewart—I think that was settled when your honor took judicial notice of the Bible, and I make the point now because there is no use in making it before the jury.

The Court—The question is whether or not Mr. Scopes taught men descended from the lower order of animals.

Mr. Hays—And whether or not that is contrary to the theory in the St. James version.

The Court—No, not—

Mr. Malone—Your honor ruled that we could not go before the jury with it; that Mr. Scopes taught that man descended from a lower order of animals; and you ruled out important testimony for the defense.

#### Defense Wants Bryan as a Witness.

Mr. Hays—The defense desires to call Mr. Bryan as a witness, and, of course, the only question here is whether Mr. Scopes taught what these children said he taught, we recognize what Mr. Bryan says as a witness would not be very valuable. We think there are other questions involved, and we should want to take Mr. Bryan's testimony for the purposes of our record, even if your honor thinks it is not admissible in general, so we wish to call him now.

The Court—Do you think you have a right to his testimony or evidence like you did these others?

B. G. McKenzie—I don't think it is necessary to call him, calling a lawyer who represents a client.

The Court—If you ask him about any confidential matter, I will protect him, of course.

Mr. Darrow—I do not intend to do that.

The Court—On scientific matters, Col. Bryan can speak for himself.

Mr. Bryan—If your honor please, I insist that Mr. Darrow can be put

on the stand, and Mr. Malone and Mr. Hays.

The Court—Call anybody you desire. Ask them any questions you wish.

Mr. Bryan—Then, we will call all three of them.

Mr. Darrow—Not at once?

Mr. Bryan—Where do you want me to sit?

Mr. Bryan Willing.

The Court—Mr. Bryan, you are not objecting to going on the stand?

Mr. Bryan—Not at all.

The Court—Do you want Mr. Bryan sworn?

Mr. Darrow—No.

Mr. Bryan—I can make affirmation; I can say "So help me God, I will tell the truth."

Mr. Darrow—No, I take it you will tell the truth, Mr. Bryan.

Bryan Goes on Witness Stand.

Examination of W. J. Bryan by Clarence Darrow, of counsel for the defense:

Q—You have given considerable study to the Bible, haven't you, Mr. Bryan?

A—Yes, sir, I have tried to.

Q—Well, we all know you have, we are not going to dispute that at all. But you have written and published articles almost weekly, and sometimes have made interpretations of various things?

A—I would not say interpretations, Mr. Darrow, but comments on the lesson.

Q—If you comment to any extent these comments have been interpretations.

A—I presume that my discussion might be to some extent interpretations, but they have not been primarily intended as interpretations.

Q—But you have studied that question, of course?

A—Of what?

Q—Interpretation of the Bible.

A—On this particular question?

Q—Yes, sir.

A—Yes, sir.

Q—Then you have made a general study of it?

A—Yes, I have; I have studied the

Bible for about fifty years, or sometime more than that, but, of course, I have studied it more as I have become older than when I was but a boy.

Q—Do you claim that everything in the Bible should be literally interpreted?

A—I believe everything in the Bible should be accepted as it is given there; some of the Bible is given illustratively. For instance: "Ye are the salt of the earth." I would not insist that man was actually salt, or that he had flesh of salt, but it is used in the sense of salt as saving God's people.

Did Jonah Swallow the Whale?

Q—But when you read that Jonah swallowed the whale—or that the whale swallowed Jonah—excuse me please—how do you literally interpret that?

A—When I read that a big fish swallowed Jonah—it does not say whale.

Q—Doesn't it? Are you sure?

A—That is my recollection of it. A big fish, and I believe it, and I believe in a God who can make a whale and can make a man and make both do what He pleases.

Q—Mr. Bryan, doesn't the New Testament say whale?

A—I am not sure. My impression is that it says fish; but it does not make so much difference; I merely called your attention to where it says fish—it does not say whale.

Q—But in the New Testament it says whale, doesn't it?

A—That may be true; I cannot remember in my own mind what I read about it.

Q—Now, you say, the big fish swallowed Jonah, and he there remained how long—three days—and then he spewed him upon the land. You believe that the big fish was made to swallow Jonah?

A—I am not prepared to say that; the Bible merely says it was done.

Q—You don't know whether it was the ordinary run of fish, or made for that purpose?

A—You may guess; you evolutionists guess.

Q—But when we do guess, we have a sense to guess right.

A—But do not do it often.

Q—You are not prepared to say whether that fish was made especially to swallow a man or not?

A—The Bible doesn't say, so I am not prepared to say.

Q—You don't know whether that was fixed up specially for the purpose?

A—No, the Bible doesn't say.

Q—But do you believe He made them—that He made such a fish and that it was big enough to swallow Jonah?

A—Yes, sir. Let me add: One miracle is just as easy to believe as another.

Q—It is for me.

A—It is for me.

Q—Just as hard?

A—It is hard to believe for you, but easy for me. A miracle is a thing performed beyond what man can perform. When you get beyond what man can do, you get within the realm of miracles; and it is just as easy to believe the miracle of Jonah as any other miracle in the Bible.

Q—Perfectly easy to believe that Jonah swallowed the whale?

A—If the Bible said so; the Bible doesn't make as extreme statements as evolutionists do.

Mr. Darrow—That may be a question, Mr. Bryan, about some of those you have known?

A—The only thing is, you have a definition of fact that includes imagination.

Q—And you have a definition that excludes everything but imagination, everything but imagination?

Gen. Stewart—I object to that as argumentative.

The Witness—You—

Mr. Darrow—The witness must not argue with me, either.

Q—Do you consider the story of Jonah and the whale a miracle?

A—I think it is.

Did the Sun Stand Still?

Q—Do you believe Joshua made the sun stand still?

A—I believe what the Bible says. I suppose you mean that the earth stood still?

Q—I don't know. I am talking about the Bible now.

A—I accept the Bible absolutely.

Q—The Bible says Joshua commanded the sun to stand still for the purpose of lengthening the day, doesn't it, and you believe it?

A—I do.

Q—Do you believe at that time the entire sun went around the earth?

A—No, I believe that the earth goes around the sun.

Q—Do you believe that the men who wrote it thought that the day could be lengthened or that the sun could be stopped?

A—I don't know what they thought.

Q—You don't know?

A—I think they wrote the fact without expressing their own thoughts.

Q—Have you an opinion as to whether or not the men who wrote that thought—

Gen. Stewart—I want to object, your honor; it has gone beyond the pale of any issue that could possibly be injected into this lawsuit, except by imagination. I do not think the defendant has a right to conduct the examination any further and I ask your honor to exclude it.

The Court—I will hear Mr. Bryan.

The Witness—It seems to me it would be too exacting to confine the defense to the facts; if they are not allowed to get away from the facts, what have they to deal with?

The Court—Mr. Bryan is willing to be examined. Go ahead.

Mr. Darrow—Have you an opinion as to whether—whoever wrote the book, I believe it is, Joshua, the Book of Joshua, thought the sun went around the earth or not?

A—I believe that he was inspired.

Mr. Darrow—Can you answer my question?

A—When you let me finish the statement.

Q—It is a simple question, but finish it.

The Witness—You cannot measure the length of my answer by the length of your question.

(Laughter in the courtyard.)

“I Believe Bible Inspired.”

Mr. Darrow—No, except that the answer be longer.

(Laughter in the courtyard.)

A—I believe that the Bible is inspired, an inspired author, whether one who wrote as he was directed to write understood the things he was writing about, I don't know.

Q—Whoever inspired it? Do you think whoever inspired it believed that the sun went around the earth?

A—I believe it was inspired by the Almighty, and He may have used language that could be understood at that time.

Q—Was—

The Witness—Instead of using language that could not be understood until Darrow was born.

(Laughter and applause in the courtyard.)

Q—So, it might not, it might have been subject to construction, might it not?

A—It might have been used in language that could be understood then.

Q—That means it is subject to construction?

A—That is your construction. I am answering your question.

Q—Is that correct?

A—That is my answer to it.

Q—Can you answer?

A—I might say, Isaiah spoke of God sitting upon the circle of the earth.

Q—I am not talking about Isaiah.

The Court—Let him illustrate, if he wants to.

Mr. Darrow—Is it your opinion that passage was subject to construction?

A—Well, I think anybody can put his own construction upon it, but I do not mean that necessarily that is a correct construction. I have answered the question.

Q—Don't you believe that in order to lengthen the day it would have been construed that the earth stood still?

A—I would not attempt to say what would have been necessary, but I know this, that I can take a glass of water that would fall to the ground without the strength of my hand and to the extent of the glass

of water I can overcome the law of gravitation and lift it up. Whereas without my hand it would fall to the ground. If my puny hand can overcome the law of gravitation, the most universally understood, to that extent, I would not set power to the hand of Almighty God that made the universe.

Mr. Darrow—I read that years ago. Can you answer my question directly? If the day was lengthened by stopping either the earth or the sun, it must have been the earth?

A—Well, I should say so.

Q—Yes? But it was language that was understood at that time, and we now know that the sun stood still as it was with the earth.

Q—We know also the sun does not stand still?

A—Well, it is relatively so, as Mr. Einstein would say.

Q—I ask you if it does stand still?

A—You know as well as I know.

Q—Better. You have no doubt about it?

A—No. And the earth moves around.

Q—Yes?

A—But I think there is nothing improper if you will protect the Lord against your criticism.

Q—I suppose He needs it?

A—He was using language at that time the people understood.

Q—And that you call “interpretation?”

A—No, sir; I would not call it interpretation.

Q—I say, you would call it interpretation at this time, to say it meant something then?

A—You may use your own language to describe what I have to say, and I will use mine in answering.

What If Earth Had Stood Still?

Q—Now, Mr. Bryan, have you ever pondered what would have happened to the earth if it had stood still?

A—No.

Q—You have not?

A—No; the God I believe in could have taken care of that, Mr. Darrow.

Q—I see. Have you ever pondered what would naturally happen to

the earth if it stood still suddenly?

A—No.

Q—Don't you know it would have been converted into a molten mass of matter?

A—You testify to that when you get on the stand, I will give you a chance.

Q—Don't you believe it?

A—I would want to hear expert testimony on that.

Q—You have never investigated that subject?

A—I don't think I have ever had the question asked.

Q—Or ever thought of it?

A—I have been too busy on things that I thought were of more importance than that.

Q—You believe the story of the flood to be a literal interpretation?

A—Yes, sir.

Q—When was that flood?

A—I would not attempt to fix the date. The date is fixed, as suggested this morning.

Q—About 4004 B. C.?

A—That has been the estimate of a man that is accepted today. I would not say it is accurate.

Q—That estimate is printed in the Bible?

A—Everybody knows, at least, I think most of the people know, that was the estimate given.

Q—But what do you think that the Bible, itself, says? Don't you know how it was arrived at?

A—I never made a calculation.

Q—A calculation from what?

A—I could not say.

Q—From the generations of man?

A—I would not want to say that.

Q—What do you think?

A—I do not think about things I don't think about.

Q—Do you think about things you do think about?

A—Well, sometimes.

(Laughter in the courtyard.)

The Policeman—Let us have order.

Mr. Darrow—Mr. Bryan, you have read these dates over and over again?

A—Not very accurately, I turn back sometimes to see what the time was.

Q—You want to say now you have no idea how these dates were computed?

A—No, I don't say, but I have told you what my idea was. I say I don't know how accurate it was.

Q—You say from the generation of man—

Gen. Stewart—I am objecting to his cross-examining his own witness.

Mr. Darrow—He is an hostile witness.

The Court—I am going to let Mr. Bryan control—

The Witness—I want him to have all the latitude he wants. For I am going to have some latitude when he gets through.

Mr. Darrow—You can have latitude and longitude.

(Laughter.)

The Court—Order.

Gen. Stewart—The witness is entitled to be examined as to the legal evidence of it. We were supposed to go into the origin of the case, and we have nearly lost the day, your honor.

Mr. McKenzie—I object to it.

Gen. Stewart—Your honor, he is perfectly able to take care of this, but we are attaining no evidence. This is not competent evidence.

#### Bryan Charges Defense With Evil Motive.

The Witness—These gentlemen have not had much chance—they did not come here to try this case. They came here to try revealed religion. I am here to defend it, and they can ask me any question they please.

The Court—All right.

(Applause from the court yard.)

Mr. Darrow—Great applause from the bleachers.

The Witness—From those whom you call "yokels."

Mr. Darrow—I have never called them yokels.

The Witness—That is the ignorance of Tennessee, the bigotry.

Mr. Darrow—You mean who are applauding you? (Applause.)

The Witness—Those are the people whom you insult.

Mr. Darrow—You insult every man of science and learning in the world

because he does not believe in your fool religion.

The Court—I will not stand for that.

Mr. Darrow—For what he is doing?

The Court—I am talking to both of you.

Gen. Stewart—This has gone beyond the pale of a lawsuit, your honor. I have a public duty to perform, under my oath and I ask the court to stop it.

Mr. Darrow is making an effort to insult the gentleman on the witness stand, and I ask that it be stopped, for it has gone beyond the pale of a lawsuit.

The Court—To stop it now would not be just to Mr. Bryan. He wants to ask the other gentleman questions along the same line.

Gen. Stewart—It will all be incompetent.

The Witness—The jury is not here.

The Court—I do not want to be strictly technical.

Mr. Darrow—Then your honor rules, and I accept.

Gen. Stewart—The jury is not here.

#### What About the Flood?

Mr. Darrow—How long ago was the flood, Mr. Bryan?

A—Let me see Usher's calculation about it?

Mr. Darrow—Surely. (Handing a Bible to the witness.)

A—I think this does not give it.

Q—It gives an account of Noah. Where is the one in evidence, I am quite certain it is there?

The Witness—Oh, I would put the estimate where it is, because I have no reason to vary it. But I would have to look at it to give you the exact date.

Q—I would, too. Do you remember what book the account is in?

A—Genesis.

Mr. Hays—Is that the one in evidence?

Mr. Neal—That will have it; that is King James' version.

Mr. Darrow—The one in evidence has it.

The Witness—It is given here, as 2348 years B. C.

Q—Well, 2348 years B. C. You believe that all the living things that were not contained in the ark were destroyed.

A—I think the fish may have lived.

Q—Outside of the fish?

A—I cannot say.

Q—You cannot say?

A—No, except that just as it is, I have no proof to the contrary.

Q—I am asking you whether you believe?

A—I do.

Q—That all living things outside of the fish were destroyed?

A—What I say about the fish is merely a matter of humor.

Q—I understand.

The Witness—Due to the fact a man wrote up here the other day to ask whether all the fish were destroyed, and the gentleman who received the letter told him the fish may have lived.

Q—I am referring to the fish, too?

A—I accept that, as the Bible gives it and I have never found any reason for denying, disputing, or rejecting it.

Q—Let us make it definite, 2,348 years?

A—I didn't say that. That is the time given there (indicating a Bible) but I don't pretend to say that is exact.

Q—You never figured it out, these generations, yourself?

A—No, sir; not myself.

Q—But the Bible you have offered in evidence, says 2,340, something, so that 4,200 years ago there was not a living thing on the earth, excepting the people on the ark and the animals of the ark and the fishes?

A—There have been living things before that.

Q—I mean at that time?

A—After that.

Q—Don't you know there are any number of civilizations that are traced back to more than 5,000 years?

A—I know we have people who trace things back according to the number of ciphers they have. But I am not satisfied they are accurate.

Q—You are not satisfied there is any civilization that can be traced back 5,000 years?

A—I would not want to say there is because I have no evidence of it that is satisfactory.

Q—Would you say there is not?

#### Scientists Will Have to Get Closer.

A—Well, so far as I know, but when the scientists differ, from 24,000,000 to 306,000,000 in their opinion, as to how long ago life came here, I want them nearer, to come nearer together before they demand of me to give up my belief in the Bible.

Q—Do you say that you do not believe that there were any civilizations on this earth that reach back beyond 5,000 years?

A—I am not satisfied by any evidence that I have seen.

Q—I didn't ask you what you are satisfied with. I asked you if you believe it?

The Witness—Will you let me answer it?

The Court—Go right on.

#### No Evidence Satisfying.

The Witness—I am satisfied by no evidence, that I have found, that would justify me in accepting the opinions of these men against what I believe to be the inspired Word of God.

Q—And you believe every nation, every organization of men, every animal, in the world outside of the fishes—

The Witness—The fish, I want you to understand, is merely a matter of humor.

Q—I believe the Bible says so. Take the fishes in?

A—Let us get together and look over this.

Mr. Darrow—Probably we would better, we will after we get through.

#### Darrow Relentless on Question of Years.

Q—You believe that all the various human races on the earth have come into being in the last 4,000 years or 4,200 years, whatever it is?

A—No, it would be more than that.

Q—1927?

A—Some time after creation, before the flood.

Q—1,927 added to it?

A—The flood is 2,300 and something, and creation, according to the estimate there, is further back than that.

Q—Then you don't understand me. If we don't get together on it, look at the book. This is the year of grace 1925, isn't it? Let us put down 1,925. Have you a pencil?

(One of the defense attorneys hands Mr. Darrow a pencil.)

The Witness—Add to that 4,004?

Mr. Darrow—Yes.

A—That is the date (referring to the Bible) given here on the first page, according to Bishop Usher, which I say I only accept because I have no reason to doubt it. In that page he gives it.

Q—1,925 plus 4,004 is 5,929 years. If a fallible person is right in his addition. Now, then, what do you subtract from that?

A—That is the beginning.

Q—I was talking about the flood.

A—2,348 on that, we said.

Q—Less than that?

A—No; subtract that from 4,000; it would be about 1,700 years.

Q—That is the same thing?

A—No; subtracted it is 2,300 and something before the beginning of the Christian era, about 1,700 years after the creation.

The Policeman—Let us have order.

Mr. Darrow—If I add 2,300 years, that is the beginning of the Christian era?

A—Yes, sir.

Q—If I add 1,925 to that I will get it, won't I?

A—Yes, sir.

Q—That makes 4,262 years. If it is not correct, we can correct it.

A—According to the Bible there was a civilization before that, destroyed by the flood.

Q—Let me make this definite. You believe that every civilization on the earth and every living thing, except possibly the fishes, that came out of the ark were wiped out by the flood?

A—At that time.

Q—At that time. And then, what-

ever human beings, including all the tribes, that inhabited the world, and have inhabited the world, and who run their pedigree straight back, and all the animals, have come onto the earth since the flood?

A—Yes.

Q—Within 4,200 years. Do you know a scientific man on the face of the earth that believes any such thing?

A—I cannot say, but I know some scientific men who dispute entirely the antiquity of man as testified to by other scientific men.

Q—Oh, that does not answer the question. Do you know of a single scientific man, on the face of the earth that believes any such thing as you stated, about the antiquity of man?

A—I don't think I have ever asked one the direct question.

Q—Quite important, isn't it?

A—Well, I don't know as it is.

Q—It might not be?

#### No Interest in Remote Ancestors.

A—If I had nothing else to do except speculate on what our remote ancestors were and what our remote descendants have been, but I have been more interested in Christians going on right now, to make it much more important than speculation on either the past or the future.

Q—You have never had any interest in the age of the various races and people and civilization and animals that exist upon the earth today? Is that right?

A—I have never felt a great deal of interest in the effort that has been made to dispute the Bible by the speculations of men, or the investigations of men.

Q—Are you the only human being on earth who knows what the Bible means?

Gen. Stewart—I object.

The Court—Sustained.

To which ruling of the court counsel for the defendant duly excepted.

Mr. Darrow—You do know that there are thousands of people who profess to be Christians who believe the earth is much more ancient and

that the human race is much more ancient?

A—I think there may be.

Q—And you never have investigated to find out how long man has been on the earth?

A—I have never found it necessary.

Q—For any reason, whatever it is?

A—To examine every speculation; but if I had done it I never would have done anything else.

Q—I ask for a direct answer?

A—I do not expect to find out all those things, and I do not expect to find out about races.

Q—I didn't ask you that. Now, I ask you if you know if it was interesting enough, or important enough for you to try to find out about how old these ancient civilizations were?

A—No; I have not made a study of it.

Q—Don't you know that the ancient civilizations of China are 6,000 or 7,000 years old, at the very least?

A—No; but they would not run back beyond the creation, according to the Bible, 6,000 years.

Q—You don't know how old they are, is that right?

A—I don't know how old they are, but probably you do. (Laughter in the courtyard.) I think you would give the preference to anybody who opposed the Bible, and I give the preference to the Bible.

Q—I see. Well, you are welcome to your opinion. Have you any idea how old the Egyptian civilization is?

A—No.

#### Any Other Record of the Flood?

Q—Do you know of any record in the world, outside of the story of the Bible, which conforms to any statement that it is 4,200 years ago or thereabouts that all life was wiped off the face of the earth?

A—I think they have found records.

Q—Do you know of any?

A—Records reciting the flood, but I am not an authority on the subject.

Q—Now, Mr. Bryan, will you say if you know of any record, or have ever heard of any records, that describe that a flood existed 4,200 years ago, or about that time, which wiped all life off the earth?

A—The recollection of what I have read on that subject is not distinct enough to say whether the records attempted to fix a time, but I have seen in the discoveries of archaeologists where they have found records that described the flood.

Q—Mr. Bryan, don't you know that there are many old religions that describe the flood?

A—No, I don't know.

Q—You know there are others besides the Jewish?

A—I don't know whether these are the record of any other religion or refer to this flood.

Q—Don't you ever examine religion so far to know that?

A—Outside of the Bible?

Q—Yes.

A—No; I have not examined to know that, generally.

Q—You have never examined any other religions?

A—Yes, sir.

Q—Have you ever read anything about the origins of religions?

A—Not a great deal.

Q—You have never examined any other religion?

A—Yes, sir.

Q—And you don't know whether any other religion ever gave a similar account of the destruction of the earth by the flood?

#### Christian Religion Sufficient.

A—The Christian religion has satisfied me, and I have never felt it necessary to look up some competing religions.

Q—Do you consider that every religion on earth competes with the Christian religion?

A—I think everybody who does not believe in the Christian religion believes so—

Q—I am asking what you think?

A—I do not regard them as competitive because I do not think they have the same source as we have.

Q—You are wrong in saying "competitive"?

A—I would not say competitive, but the religious unbelievers.

Q—Unbelievers of what?

A—In the Christian religion.

Q—What about the religion of Buddha?

A—I can tell you something about that, if you want to know.

#### Confucious or Buddha?

Q—What about the religion of Confucious or Buddha?

A—Well, I can tell you something about that, if you would like to know.

Q—Did you ever investigate them?

A—Somewhat.

Q—Do you regard them as competitive?

A—No, I think they are very inferior. Would you like for me to tell you what I know about it?

Q—No.

A—Well, I shall insist on giving it to you.

Q—You won't talk about free silver, will you?

A—Not at all.

Gen. Stewart—I object to him—counsel going any further with this examination and cross-examining his own witness. He is your own witness.

#### Have Right to Cross-Examine Hostile Witness.

Mr. Darrow—Well, now, general, you understand we are making up a record, and I assume that every lawyer knows perfectly well that we have a right to cross-examine a hostile witness. Is there any doubt about that?

Gen. Stewart—Under the law in Tennessee if you put a witness on and he proves to be hostile to you, the law provides the method by which you may cross-examine him. You will have to make an affidavit that you are surprised at his statement, and you may do that.

Mr. Bryan—Is there any way by which a witness can make an affidavit? That the attorney is also hostile?

Mr. Darrow—I am not hostile to you. I am hostile to your views, and I suppose that runs with me, too.

Mr. Bryan—But I think when the gentleman asked me about Confucius I ought to be allowed to answer his question.

Mr. Darrow—Oh, tell it, Mr. Bryan, I won't object to it.

#### Reciprocity and the Golden Rule.

Mr. Bryan—I had occasion to study Confucianism when I went to China. I got all I could find about what Confucius said, and then I bought a book that told us what Menches said about what Confucius said, and I found that there were several direct and strong contrasts between the teachings of Jesus and the teaching of Confucius. In the first place, one of his followers asked if there was any word that would express all that was necessary to know in the relations of life, and he said, "Isn't reciprocity such a word?" I know of no better illustration of the difference between Christianity and Confucianism than the contrast that is brought out there. Reciprocity is a calculating selfishness. If a person does something for you, you do something for him and keep it even. That is the basis of the philosophy of Confucius. Christ's doctrine was not reciprocity. We were told to help people not in proportion as they had helped us—not in proportion as they might have helped us, but in proportion to their needs, and there is all the difference in the world between a religion that teaches you just to keep even with other people and the religion that teaches you to spend yourself for other people and to help them as they need help.

Q—There is no doubt about that; I haven't asked you that.

A—That is one of the differences between the two.

#### How Old is Confucianism?

Q—Do you know how old the Confucian religion is?

A—I can't give you the exact date of it.

Q—Did you ever investigate to find out?

A—Not to be able to speak definitely as to date, but I can tell you something I read, and will tell you.

Q—Wouldn't you just as soon answer my questions? And get along?

A—Yes, sir.

Q—Of course, if I take any advantage of misquoting you, I don't object to being stopped. Do you know how old the religion of Zoroaster is?

A—No, sir.

Q—Do you know they are both more ancient than the Christian religion?

A—I am not willing to take the opinion of people who are trying to find excuses for rejecting the Christian religion when they attempt to give dates and hours and minutes, and they will have to get together and be more exact than they have yet been able, to compel me to accept just what they say as if it were absolutely true.

A—Are you familiar with James Clark's book on the ten great religions?

A—No.

Q—He was a Unitarian minister, wasn't he? You don't think he was trying to find fault, do you?

A—I am not speaking of the motives of men.

Q—You don't know how old they are, all these other religions?

A—I wouldn't attempt to speak correctly, but I think it is much more important to know the difference between them than to know the age.

Q—Not for the purpose of this inquiry, Mr. Bryan? Do you know about how many people there were on this earth at the beginning of the Christian era?

A—No, I don't think I ever saw a census on that subject.

Q—Do you know about how many people there were on this earth 3,000 years ago?

A—No.

Q—Did you ever try to find out?

A—When you display my ignorance, could you not give me the facts, so I would not be ignorant any longer? Can you tell me how many people there were when Christ was born?

Q—You know, some of us might get the facts and still be ignorant.

A—Will you please give me that? You ought not to ask me a question when you don't know the answer to it.

Q—I can make an estimate.

A—What is your estimate?

#### How Many People 5,000 Years Ago?

Q—Wait until you get to me. Do you know anything about how many people there were in Egypt 3,500 years ago, or how many people there were in China 5,000 years ago?

A—No.

Q—Have you ever tried to find out?

A—No, sir. You are the first man I ever heard of who has been interested in it. (Laughter.)

Q—Mr. Bryan, am I the first man you ever heard of who has been interested in the age of human societies and primitive man?

A—You are the first man I ever heard speak of the number of people at those different periods.

Q—Where have you lived all your life?

A—Not near you. (Laughter and applause.)

Q—Nor near anybody of learning?

A—Oh, don't assume you know it all.

Q—Do you know there are thousands of books in our libraries on all those subjects I have been asking you about?

A—I couldn't say, but I will take your word for it.

Q—Did you ever read a book on primitive man? Like Tyler's Primitive Culture, or Boaz, or any of the great authorities?

A—I don't think I ever read the ones you have mentioned.

Q—Have you read any?

A—Well I have read a little from time to time. But I didn't pursue it, because I didn't know I was to be called as a witness.

#### Never Interested in Primitive Peoples.

Q—You have never in all your life made any attempt to find out about the other peoples of the earth—how old their civilizations are—how long they had existed on the earth, have you?

A—No, sir, I have been so well satisfied with the Christian religion that I have spent no time trying to find arguments against it.

Q—Were you afraid you might find some?

A—No, sir, I am not afraid now that you will show me any.

Q—You remember that man who said—I am not quoting literally—that one could not be content though he rose from the dead—you suppose you could be content?

A—Well, will you give the rest of it, Mr. Darrow?

Q—No.

A—Why not?

Q—I am not interested.

A—Why scrap the Bible—"they have Moses and the prophets"?

Q—Who has?

A—That is the rest of the quotation you didn't finish.

Q—And so you think if they have Moses and the prophets they don't need to find out anything else?

A—That was the answer that was made there.

Q—And you follow the same rule?

"All the Information I Need."

A—I have all the information I want to live by and to die by.

Q—And that's all you are interested in?

A—I am not looking for any more on religion.

Q—You don't care how old the earth is, how old man is and how long the animals have been here?

A—I am not so much interested in that.

Q—You have never made any investigation to find out?

A—No, sir, I have never.

Q—All right?

A—Now, will you let me finish the question?

Q—What question was that. If there is anything more you want to say about Confucius I don't object.

A—Oh, yes, I have got two more things.

Mr. Darrow—If your honor please I don't object, but his speeches are not germane to my question.

Mr. Hicks (Sue K.)—Your honor, he put him on.

The Court—You went into it and I will let him explain.

Mr. Darrow—I asked him certain specific questions about Confucius.

Mr. Hicks (Sue K.)—The questions he is asking are not germane, either.

Mr. Darrow—I think they are.

#### Other Differences.

The Witness—I mentioned the word reciprocity to show the difference between Christ's teachings in that respect and the teachings of Confucius. I call your attention to another difference. One of the followers of Confucius asked him "what do you think of the doctrine that you should reward evil with good?" and the answer of Confucius was "reward evil with justice and reward good with good. Love your enemies. Overcome evil with good," and there is a difference between the two teachings—a difference incalculable in its effect and in—The third difference—people who scoff at religion and try to make it appear that Jesus brought nothing into the world, talk about the Golden Rule of Confucius. Confucius said "do not unto others what you would not have others do unto you." It was purely negative. Jesus taught "do unto others as you would have others do unto you." There is all the difference in the world between a negative harmlessness and a positive helpfulness and the Christian religion is a religion of helpfulness, of service, embodied in the language of Jesus when he said "let him who would be chiefest among you be the servant of all." Those are the three differences between the teachings of Jesus and the teachings of Confucius, and they are very strong differences on very important questions. Now, Mr. Darrow, you asked me if I knew anything about Buddha.

Q—You want to make a speech on Buddha, too?

A—No, sir; I want to answer your question on Buddha.

Q—I asked you if you knew anything about him?

A—I do.

Q—Well, that's answered, then.

A—Buddha—

Q—Well, wait a minute, you answered the questions—

The Court—I will let him tell what he knows.

Mr. Darrow—All he knows?

The Court—Well, I don't know about that.

The Witness—I won't insist in telling all I know. I will tell more than Mr. Darrow wants told.

Mr. Darrow—Well, all right, tell it, I don't care.

#### Buddism is Agnostic.

The Witness—Buddism is an agnostic religion.

Q—To what?—what do you mean by agnostic?

A—I don't know.

Q—You don't know what you mean?

A—That is what "agnosticism" is—I don't know. When I was in Rangoon, Burma, one of the Buddhists told me that they were going to send a delegation to an agnostic congress that was to be held soon at Rome and I read in an official document—

Q—Do you remember his name?

A—No, sir, I don't.

Q—What did he look like, how tall was he?

#### As Tall As You, But Not So Crooked.

A—I think he was about as tall as you but not so crooked.

Q—Do you know about how old a man he was—do you know whether he was old enough to know what he was talking about?

A—He seemed to be old enough to know what he was talking about. (Laughter.)

Mr. Darrow—If your honor please, instead of answering plain specific questions we are permitting the witness to regale the crowd with what some black man said to him when he was traveling in Rang—who, India?

The Witness—He was dark-colored, but not black.

The Court—I will let him go ahead and answer.

The Witness—I wanted to say that I then read a paper that he gave me, an official paper of the Buddhist church and it advocated the sending of delegates to that agnostic congress at Rome, arguing that it was an agnostic religion and

I will give you another evidence of it. I went to call on a Buddhist teacher.

#### Objects to Bryan Making Speeches.

Mr. Darrow—I object to Mr. Bryan making a speech every time I ask him a question.

The Court—Let him finish this answer and then you can go ahead.

The Witness—I went to call on a Buddhist priest and found him at his noon meal, and there was an Englishman there who was also a Buddhist. He went over as ship's carpenter and became a Buddhist and had been for about six years and while I waited for the Buddhist priest I talked to the Englishman and I asked him what was the most important thing in Buddhism and he said the most important thing was you didn't have to believe to be a Buddhist.

Q—You know the name of the Englishman?

A—No, sir, I don't know his name.

Q—What did he look like? What did he look like?

A—He was what I would call an average looking man.

Q—How could you tell he was an Englishman?

A—He told me so.

Q—Do you know whether he was truthful or not?

A—No, sir, but I took his word for it.

The Court—Well, get along, Mr. Darrow, with your examination.

Mr. Darrow—Mr. Bryan ought to get along.

#### Tower of Babel.

Q—You have heard of the Tower of Babel haven't you?

A—Yes, sir.

Q—That tower was built under the ambition that they could build a tower up to heaven, wasn't it? And God saw what they were at and to prevent their getting into heaven he confused their tongues?

A—Something like that, I wouldn't say to prevent their getting into heaven. I don't think it is necessary to believe that God was afraid they would get to heaven—

Q—I mean that way?

A—I think it was a rebuke to them.

Q—A rebuke to them trying to go that way?

A—To build that tower for that purpose.

Q—Take that short cut?

A—That is your language, not mine.

Q—Now when was that?

A—Give us the Bible.

Q—Yes, we will have strict authority on it—scientific authority?

A—That was about 100 years before the flood, Mr. Darrow, according to this chronology. It is 2247—the date on one page is 2218 and on the other 2247 and it is described in here—

Q—That is the year 2247?

A—2218 B. C. is at the top of one page and 2247 at the other and there is nothing in here to indicate the change.

Q—Well, make it 2230 then?

A—All right, about.

Q—Then you add 1500 to that—

A—No, 1925.

Q—Add 1925 to that, that would be 4,155 years ago. Up to 4,155 years ago every human being on earth spoke the same language?

A—Yes, sir, I think that is the inference that could be drawn from that.

Q—All the different languages of the earth, dating from the Tower of Babel, is that right? Do you know how many languages are spoken on the face of the earth?

A—No, I know the Bible has been translated into 500 and no other book has been translated into anything like that many.

Q—That is interesting, if true? Do you know all the languages there are?

A—No, sir, I can't tell you. There may be many dialects besides that and some languages, but those are all the principal languages.

Q—There are a great many that are not principal languages?

A—Yes, sir.

Q—You haven't any idea how many there are?

A—No, sir.

Q—How many people have

spoken all those various languages?

A—No, sir.

Q—And you say that all those languages of all the sons of men have come on the earth not over 4,150 years ago?

A—I have seen no evidence that would lead me to put it any further back than that.

Q—That is your belief anyway—that that was due to the confusion of tongues at the tower of Babel. Did you ever study philology at all?

A—No, I have never made a study of it—not in the sense in which you speak of it.

Q—You have used language all your life?

A—Well, hardly all my life—ever since I was about a year old.

Q—And good language, too, and you have never taken any pains to find anything about the origin of languages?

A—I have never studied it as a science.

Q—Have you ever by any chance read Max Mueller?

A—No.

Q—The great German philologist?

A—No.

Q—Or any book on that subject?

A—I don't remember to have read a book on that subject, especially, but I have read extracts, of course, and articles on philology.

#### How Old is Earth?

Q—Mr. Bryan, could you tell me how old the earth is?

A—No, sir, I couldn't.

Q—Could you come anywhere near it?

A—I wouldn't attempt to. I could possibly come as near as the scientists do, but I had rather be more accurate before I give a guess.

Q—You don't think much of scientists, do you?

A—Yes, sir, I do, sir.

Q—Is there any scientists in the world you think much of?

A—I do.

Q—Who?

A—Well, I think the bulk of the scientists—

Q—I don't want that kind of an answer, Mr. Bryan, who are they?

A—I will give you George M. Price, for instance.

Q—Who is he?

A—Professor of geology in a college.

Q—Where?

A—He was out near Lincoln, Neb.

Q—How close to Lincoln Neb.?

A—About three or four miles. He is now in a college out in California.

Q—Where is the college?

A—At Lodi.

Q—That is a small college?

A—I didn't know you had to judge a man by the size of the college—I thought you judged him by the size of the man.

Q—I thought the size of the college made some difference?

A—It might raise a presumption in the minds of some, but I think I would rather find out what he believed.

Q—You would rather find out whether his belief corresponds with your views or prejudices or whatever they are before you said how good he was?

A—Well, you know the word "prejudice" is—

Q—Well, belief, then.

A—I don't think I am any more prejudiced for the Bible than you are against it.

Q—Well, I don't know?

A—Well, I don't know either, it is my guess.

Q—You mentioned Price because he is the only human being in the world so far as you know that signs his name as a geologist that believes like you do?

A—No, there is a man named Wright, who taught at Oberlin.

Q—I will get to Mr. Wright in a moment. Who publishes his book?

A—I can't tell you. I can get you the book.

Q—Don't you know? Don't you know it is Revell & Co., Chicago?

A—I couldn't say.

Q—He publishes yours, doesn't he?

A—Yes, sir.

Gen. Stewart—Will you let me make an exception. I don't think it is pertinent about who publishes a book.

Says Bryan Quotes Montebank.

Mr. Darrow—He has quoted a man that every scientist in this country knows is a Montebank and a pretender and not a geologist at all.

The Court—You can ask him about the man, but don't ask him about who publishes the book.

Q—Do you know anything about the college he is in?

A—No, I can't tell you.

Q—Do you know how old his book is?

A—No, sir, it is a recent book.

Q—Do you know anything about his training?

A—No, I can't say on that.

Q—Do you know of any geologist on the face of the earth who ever recognized him?

A—I couldn't say.

Q—Do you think he is all right? How old does he say the earth is?

A—I am not sure that I would insist on some particular geologist that you picked out recognizing him before I would consider him worthy if he agreed with your views?

Q—You would consider him worthy if he agreed with your views?

A—Well, I think his argument is very good.

Q—How old does Mr. Price say the earth is?

A—I haven't examined the book in order to answer questions on it.

Q—Then you don't know anything about how old he says it is?

A—He speaks of the layers that are supposed to measure age and points out that they are not uniform and not always the same and that attempts to measure age by those layers where they are not in the order in which they are usually found makes it difficult to fix the exact age.

Q—Does he say anything whatever about the age of the earth?

A—I wouldn't be able to testify.

Q—You didn't get anything about the age from him?

A—Well, I know he disputes what you say and has very good evidence to dispute it—what some others say about the age.

Q—Where did you get your information about the age of the earth?

A—I am not attempting to give you information about the age of the earth.

Wright of Oberlin?

Q—Then you say there was Mr. Wright, of Oberlin?

A—That was rather I think on the age of man than upon the age of the earth.

Q—There are two Mr. Wrights, of Oberlin?

A—I couldn't say.

Q—Both of them geologists. Do you know how long Mr. Wright says man has been on the earth?

A—Well, he gives the estimates of different people.

Q—Does he give any opinion of his own?

A—I think he does.

Q—What is it?

A—I am not sure.

Q—What is it?

A—It was based upon the last glacial age—that man has appeared since the last glacial age.

Q—Did he say there was no man on earth before the last glacial age?

A—I think he disputes the finding of any proof—where the proof is authentic—but I had rather read him than quote him. I don't like to run the risk of quoting from memory.

Q—You couldn't say then how long Mr. Wright places it?

A—I don't attempt to tell you.

Q—When was the last glacial age?

A—I wouldn't attempt to tell you that.

Q—Have you any idea?

A—I wouldn't want to fix it without looking at some of the figures.

Q—That was since the tower of Babel, wasn't it?

A—Well, I wouldn't want to fix it. I think it was before the time given in here, and that was only given as the possible appearance of man and not the actual.

Q—Have you any idea how far back the last glacial age was?

A—No, sir.

Q—Do you know whether it was more than 6,000 years ago?

A—I think it was more than 6,000 years.

Q—Have you any idea how old the earth is?

A—No.

Bible Gives Age of Earth?

Q—The book you have introduced in evidence tells you, doesn't it?

A—I don't think it does, Mr. Darrow.

Q—Let's see whether it does; is this the one?

A—That is the one, I think.

Q—It says B. C. 4004?

A—That is Bishop Usher's calculation.

Q—That is printed in the Bible you introduced?

A—Yes, sir.

Q—And numerous other Bibles?

A—Yes, sir.

Q—Printed in the Bible in general use in Tennessee?

A—I couldn't say.

Q—And Scofield's Bible?

A—I couldn't say about that.

Q—You have seen it somewhere else?

A—I think that is the chronology usually used.

Q—Does the Bible you have introduced for the jury's consideration say that?

A—Well, you will have to ask those who introduced that.

Q—You haven't practiced law for a long time, so I will ask you if that is the King James version that was introduced? That is your marking, and I assume it is?

A—I think that is the same one.

Mr. Darrow—There is no doubt about it, is there, gentlemen?

Mr. Stewart—That is the same one.

Q—Would you say that the earth was only 4,000 years old?

A—Oh, no; I think it is much older than that.

Q—How much?

A—I couldn't say.

Q—Do you say whether the Bible itself says it is older than that?

A—I don't think the Bible says itself whether it is older or not.

Q—Do you think the earth was made in six days?

Bryan—"Not Six Days of Twenty-four Hours."

A—Not six days of twenty-four hours.

Q—Doesn't it say so?

A—No, sir.

Gen. Stewart—I want to interpose another objection. What is the purpose of this examination?

Mr. Bryan—The purpose is to cast ridicule on everybody who believes in the Bible, and I am perfectly willing that the world shall know that these gentlemen have no other purpose than ridiculing every Christian who believes in the Bible.

Mr. Darrow—We have the purpose of preventing bigots and ignoramuses from controlling the education of the United States and you know it, and that is all.

Mr. Bryan—I am glad to bring out that statement. I want the world to know that this evidence is not for the view Mr. Darrow and his associates have filed affidavits here stating, the purposes of which I understand it, is to show that the Bible story is not true.

Mr. Malone—Mr. Bryan seems anxious to get some evidence in the record that would tend to show that those affidavits are not true.

Bryan Wants World to Know He Is Not Afraid.

Mr. Bryan—I am not trying to get anything into the record. I am simply trying to protect the word of God against the greatest atheist or agnostic in the United States. (Prolonged applause.) I want the papers to know I am not afraid to get on the stand in front of him and let him do his worst. I want the world to know. (Prolonged applause.)

Mr. Darrow—I wish I could get a picture of these clackers.

Gen. Stewart—I am not afraid of Mr. Bryan being perfectly able to take care of himself, but this examination cannot be a legal examination and it cannot be worth a thing in the world, and, your honor, I respectfully except to it, and call on your honor, in the name of all that is legal, to stop this examination and stop it here.

Mr. Hays—I rather sympathize with the general, but Mr. Bryan is produced as a witness because he is a student of the Bible and he presumably understands what the Bible means. He is one of the foremost students in the United States, and we hope to show Mr. Bryan, who is a student of the Bible, what the Bible really means in connection with evolution. Mr. Bryan has already stated that the world is not merely 6,000 years old and that is very helpful to us, and where your evidence is coming from, this Bible, which goes to the jury, is that the world started in 4004 B. C.

Mr. Bryan—You think the Bible says that?

Mr. Hays—The one you have taken in evidence says that.

Mr. Bryan—I don't concede that it does.

Mr. Hays—You know that that chronology is made up by adding together all of the ages of the people in the Bible, counting their ages; and now then, let us show the next stage from a Bible student, that these things are not to be taken literally, but that each man is entitled to his own interpretation.

Gen. Stewart—The court makes the interpretation.

Mr. Hays—But the court is entitled to information on what is the interpretation of an expert Bible student.

Stewart Bitterly Opposes Proceedings.

Gen. Stewart—This is resulting in a harangue and nothing else.

Mr. Darrow—I didn't do any of the haranging; Mr. Bryan has been doing that.

Gen. Stewart—You know absolutely you have done it.

Mr. Darrow—Oh, all right.

Mr. Malone—Mr. Bryan doesn't need any support.

Gen. Stewart—Certainly he doesn't need any support, but I am doing what I conceive my duty to be, and I don't need any advice, if you please, sir. (Applause.)

The Court—That would be irrelevant testimony if it was going to the jury. Of course, it is excluded from

the jury on the point it is not competent testimony, on the same ground as the affidavit.

Mr. Hicks—Your honor, let me say a word right there. It is in the discretion of the court how long you will allow them to question witnesses for the purpose of taking testimony to the supreme court. Now, we as taxpayers of this county, feel that this has gone beyond reason.

The Court—Well, now, that taxpayer doesn't appeal to me so much, when it is only fifteen or twenty minutes time.

Mr. Darrow—I would have been through in a half-hour if Mr. Bryan had answered my questions.

Gen. Stewart—They want to put in affidavits as to what other witnesses would swear, why not let them put in affidavits as to what Mr. Bryan would swear?

Mr. Bryan—God forbid.

Mr. Malone—I will just make this suggestion—

Gen. Stewart—It is not worth anything to them, if your honor please, even for the record in the supreme court.

Mr. Hays—Is not it worth anything to us if Mr. Bryan will accept the story of creation in detail, and if Mr. Bryan, as a Bible student, states you cannot take the Bible necessarily as literally true?

Mr. Stewart—The Bible speaks for itself.

Mr. Hays—You mean to say the Bible itself tells whether these are parables? Does it?

Gen. Stewart—We have left all annals of procedure behind. This is a harangue between Col. Darrow and his witness. He makes so many statements that he is forced to defend himself.

Mr. Darrow—I do not do that.

Gen. Stewart—I except to that as not pertinent to this lawsuit.

The Court—Of course, it is not pertinent, or it would be before the jury.

Gen. Stewart—It is not worth anything before a jury.

The Court—Are you about through, Mr. Darrow?

Mr. Darrow—I want to ask a few

more questions about the creation.

The Court—I know. We are going to adjourn when Mr. Bryan comes off the stand for the day. Be very brief, Mr. Darrow. Of course, I believe I will make myself clearer. Of course, it is incompetent testimony before the jury. The only reason I am allowing this to go in at all is that they may have it in the appellate courts, as showing what the affidavit would be.

#### Bryan Insists He Is Not Afraid of Agnostics or Atheists.

Mr. Bryan—The reason I am answering is not for the benefit of the superior court. It is to keep these gentlemen from saying I was afraid to meet them and let them question me, and I want the Christian world to know that any atheist, agnostic, unbeliever, can question me any time as to my belief in God, and I will answer him.

Mr. Darrow—I want to take an exception to this conduct of this witness. He may be very popular down here in the hills. I do not need to have his explanation for his answer.

The Court—Yes.

Mr. Bryan—If I had not, I would not have answered the question.

Mr. Hays—May I be heard? I do not want your honor to think we are asking questions of Mr. Bryan with the expectation that the higher court will not say that those questions are proper testimony. The reason I state that is this, your law speaks for the Bible. Your law does not say the literal interpretation of the Bible. If Mr. Bryan, who is a student of the Bible, will state that everything in the Bible need not be interpreted literally, that each man must judge for himself; if he will state that, of course, then your honor would charge the jury. We are not bound by a literal interpretation of the Bible. If I have made my argument clear enough for the attorney-general to understand, I will retire.

Gen. Stewart—I will admit you have frequently been difficult of comprehension, and I think you are as much to blame as I am.

Mr. Hays—I know I am.

Gen. Stewart—I think this is not legal evidence for the record in the appellate courts. King James' versions of the Bible, as your honor says—

The Court—I cannot say that.

Gen. Stewart—Your honor has held the court takes judicial knowledge of King James' version of the Bible.

The Court—No, sir; I did not do that.

Gen. Stewart—Your honor charged the grand jury and read from that.

The Court—I happened to have the Bible in my hand, it happened to be a King James' edition, but I will charge the jury, gentlemen, the Bible generally used in Tennessee, as the book ordinarily understood in Tennessee, as the Bible, I do not think it is proper for us to say to the jury what Bible.

Gen. Stewart—Of course, that is all we could ask of your honor. This investigation or interrogation of Mr. Bryan as a witness, Mr. Bryan is called to testify, was of the counsel for the prosecution in this case, and has been asked something, perhaps less than a thousand questions, of course, not personal to this case, and it has resulted in an argument, and argument about every other question cannot be avoided. I submit your honor, it is not worth anything in the record at all, if it is not legal testimony. Mr. Bryan is willing to testify and is able to defend himself. I accept it, if the court please, and ask your honor to stop it.

Mr. Hays—May I ask a question? If your contention is correct that this law does not necessarily mean that the Bible is to be taken literally, word for word, is not this competent evidence?

Gen. Stewart—Why could you not prove it by your scientists?

Mr. Darrow—We are calling one of the most foremost Bible students. You vouch for him.

Mr. Malone—We are offering the best evidence.

Gen. McKenzie—Do you think this evidence is competent before a jury?

Mr. Darrow—I think so.

The Court—It is not competent evidence for the jury.

Gen. McKenzie—Nor is it competent in the appellate courts, and these gentlemen would no more file the testimony of Col. Bryan as a part of the record in this case than they would file a rattlesnake and handle it themselves.

Messrs. Darrow, Hays and Malone (In Unison)—We will file it. We will file it. File every word of it.

Mr. Bryan—Your honor, they have not asked a question legally, and the only reason they have asked any question is for the purpose, as the question about Jonah was asked, for a chance to give this agnostic an opportunity to criticize a believer in the word of God; and I answered the question in order to shut his mouth so that he cannot go out and tell his atheistic friends that I would not answer his question. That is the only reason, no more reason in the world.

Mr. Malone—Your honor on this very subject, I would like to say that I would have asked Mr. Bryan—and I consider myself as good a Christian as he is—every question that Mr. Darrow has asked him for the purpose of bringing out whether or not there is to be taken in this court only a literal interpretation of the Bible, or whether, obviously, as these questions indicate, if a general and literal construction cannot be put upon the parts of the Bible which have been covered by Mr. Darrow's questions. I hope for the last time no further attempt will be made by counsel on the other side of the case, or Mr. Bryan, to say the defense is concerned at all with Mr. Darrow's particular religious views or lack of religious views. We are here as lawyers with the same right to our views. I have the same right to mine as a Christian as Mr. Bryan has to his, and we do not intend to have this case charged by Mr. Darrow's agnosticism or Mr. Bryan's brand of Christianity. (A great applause.)

The Court—I will pass on each question as asked, if it is objected to.

Mr. Darrow:

Q—Mr. Bryan, do you believe that the first woman was Eve?

A—Yes.

Q—Do you believe she was literally made out of Adam's rib?

A—I do.

Where Did Cain Get His Wife?

Q—Did you ever discover where Cain got his wife?

A—No, sir; I leave the agnostics to hunt for her.

Q—You have never found out?

A—I have never tried to find.

Q—You have never tried to find?

A—No.

Q—The Bible says he got one, doesn't it? Were there other people on the earth at that time?

A—I cannot say.

Q—You cannot say. Did that ever enter your consideration?

A—Never bothered me.

Q—There were no others recorded, but Cain got a wife.

A—That is what the Bible says.

Q—Where she came from you do not know. All right. Does the statement, "The morning and the evening were the first day," and "The morning and the evening were the second day," mean anything to you?

A—I do not think it necessarily means a twenty-four-hour day.

Q—You do not?

A—No.

Q—What do you consider it to be?

A—I have not attempted to explain it. If you will take the second chapter—let me have the book. (Examining Bible.) The fourth verse of the second chapter says: "These are the generations of the heavens and of the earth, when they were created in the day that the Lord God made the earth and the heavens," the word "day" there in the very next chapter is used to describe a period. I do not see that there is any necessity for construing the words, "the evening and the morning," as meaning necessarily a twenty-four-hour day, "in the day when the Lord made the heaven and the earth."

Q—Then, when the Bible said,

for instance, "and God called the firmament heaven. And the evening and the morning were the second day," that does not necessarily mean twenty-four hours?

A—I do not think it necessarily does.

Q—Do you think it does or does not?

A—I know a great many think so.

Q—What do you think?

A—I do not think it does.

Q—You think those were not literal days?

A—I do not think they were twenty-four-hour days.

Q—What do you think about it?

A—That is my opinion—I do not know that my opinion is better on that subject than those who think it does.

Q—You do not think that?

A—No. But I think it would be just as easy for the kind of God we believe in to make the earth in six days as in six years or in 6,000,000 years or in 600,000,000 years. I do not think it important whether we believe one or the other.

Q—Do you think those were literal days?

A—My impression is they were periods, but I would not attempt to argue as against anybody who wanted to believe in literal days.

Q—Have you any idea of the length of the periods?

A—No; I don't.

Q—Do you think the sun was made on the fourth day?

A—Yes.

Q—And they had evening and morning without the sun?

A—I am simply saying it is a period.

Q—They had evening and morning for four periods without the sun, do you think?

A—I believe in creation as there told, and if I am not able to explain it I will accept it. Then you can explain it to suit yourself.

Q—Mr. Bryan, what I want to know is, do you believe the sun was made on the fourth day?

A—I believe just as it says there.

Q—Do you believe the sun was made on the fourth day?

A—Read it.

Q—I am very sorry; you have read it so many times you would know, but I will read it again: "And God, said, let there be lights in the firmament of the heaven, to divide the day from the night; and let them be for signs, and for seasons, and for days, and years.

"And let them be for lights in the firmament of the heaven, to give light upon the earth; and it was so.

"And God made two great lights; the greater light to rule the day, and the lesser light to rule the night; He made the stars also.

"And God set them in the firmament of the heaven, to give light upon the earth, and to rule over the day and over the night, and to divide the light from the darkness; and God saw that it was good. And the evening and the morning were the fourth day."

Do you believe, whether it was a literal day or a period, the sun and the moon were not made until the fourth day?

A—I believe they were made in the order in which they were given there, and I think in dispute with Gladstone and Huxley on that point—

Q—Cannot you answer my question?

A— I prefer to agree with Gladstone.

Q—I do not care about Gladstone.

A—Then prefer to agree with whoever you please.

Q—Can not you answer my question?

A—I have answered it. I believe that it was made on the fourth day, in the fourth day.

Q—And they had the evening and the morning before that time for three days or three periods. All right, that settles it. Now, if you call those periods, they may have been a very long time.

A—They might have been.

Q—The creation might have been going on for a very long time?

A—It might have continued for millions of years.

Eve and the Serpent.

Q—Yes. All right. Do you believe the story of the temptation of Eve by the serpent?

A—I do.

Q—Do you believe that after Eve ate the apple, or gave it to Adam, whichever way it was, that God cursed Eve, and at that time decreed that all womankind thenceforth and forever should suffer the pains of childbirth in the reproduction of the earth?

A—I believe what it says, and I believe the fact as fully—

Q—That is what it says, doesn't it?

A—Yes.

Q—And for that reason, every woman born of woman, who has to carry on the race, the reason they have childbirth pains is because Eve tempted Adam in the Garden of Eden?

A—I will believe just what the Bible says. I ask to put that in the language of the Bible, for I prefer that to your language. Read the Bible and I will answer.

Q—All right, I will do that: "And I will put enmity between thee and the woman"—that is referring to the serpent?

A—The serpent.

Q—(Reading) "and between thy seed and her seed; it shall bruise thy head, and thou shalt bruise his heel. Unto the woman he said, I will greatly multiply thy sorrow and thy conception; in sorrow thou shalt bring forth children; and thy desire shall be to thy husband, and he shall rule over thee." That is right, is it?

A—I accept it as it is.

Q—And you believe that came about because Eve tempted Adam to eat the fruit?

A—Just as it says.

Q—And you believe that is the reason that God made the serpent to go on his belly after he tempted Eve?

Bryan Insists on Bible Being Quoted Verbatim.

A—I believe the Bible as it is, and I do not permit you to put your language in the place of the

language of the Almighty. You read that Bible and ask me questions, and I will answer them. I will not answer your questions in your language.

Q—I will read it to you from the Bible: "And the Lord God said unto the serpent, because thou hast done this, thou art cursed above all cattle, and above every beast of the field; upon thy belly shalt thou go and dust shalt thou eat all the days of thy life." Do you think that is why the serpent is compelled to crawl upon its belly?

A—I believe that.

Q—Have you any idea how the snake went before that time?

A—No, sir.

Q—Do you know whether he walked on his tail or not?

A—No, sir. I have no way to know. (Laughter in audience).

Q—Now, you refer to the cloud that was put in the heaven after

the flood, the rainbow. Do you believe in that?

A—Read it.

Q—All right, Mr. Bryan, I will read it for you.

Mr. Bryan—Your honor, I think I can shorten this testimony. The only purpose Mr. Darrow has is to slur at the Bible, but I will answer his question. I will answer it all at once, and I have no objection in the world, I want the world to know that this man, who does not believe in a God, is trying to use a court in Tennessee—

Mr. Darrow—I object to that.

Mr. Bryan—(Continuing) to slur at it, and while it will require time, I am willing to take it.

Mr. Darrow—I object to your statement. I am exempting you on your fool ideas that no intelligent Christian on earth believes.

The Court—Court is adjourned until 9 o'clock tomorrow morning.