Ancient DNA and the Young Earth

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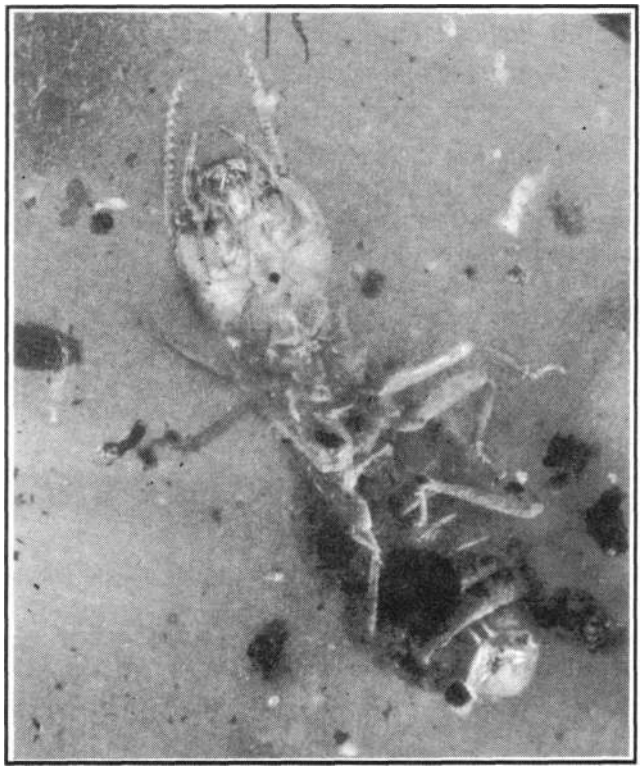
Insects trapped in amber (fossilised tree resin) have been reported as having DNA still present, even though they are allegedly millions of years old. DNA has been sequenced from a bee in amber and a termite, each 'dated' at 25-30 million years, and from a fossil weevil in amber allegedly 120 million years old.

The first report of DNA from an object supposedly millions of years old was in 1990; the object concerned was a magnolia leaf geologically dated at 17-20 million years.[1]

Brian Sykes, an Oxford geneticist writing in *Nature* indicated that according to the rate at which DNA is shown to break down in the laboratory, there should be none left after 10,000 years.[2] At that time he somewhat sarcastically suggested that it was just as well most scientists had been unaware of this, or they might not have looked for DNA in specimens millions of years old!

In the light of this apparent conundrum, there would seem to be only three possibilities:



Termite in Dominican amber
(photo: Dr Joachim Scheven)

Possibility 1: The 'millions of years' scenario (and thus the whole system by which dates are assigned to fossil-bearing layers) is wrong; the reason we are able to find DNA in some insects in amber is because they are only a few thousands of years old, not millions.

Since this would undermine the entire evolutionary dating scheme, it will tend to be excluded *a priori* from discussion in the general technical literature.

Possibility 2: No truly ancient DNA has yet been found — the results are in error, possibly due to contamination.

Tomas Lindahl, a biochemist with the Imperial Cancer Research Fund in London, has expressed skepticism about all of the ' ancient' DNA results, suggesting that they might simply be due to contamination with traces of modern DNA.[3]

The Polymerase Chain Reaction (PCR), which is used to detect traces of ancient DNA by making millions of copies from even a single DNA molecule, is not fussy about which DNA it multiplies. A droplet from a sneeze, a worker's fingerprint or even one bacterium contamination can give a positive result for DNA. However, when that DNA is sequenced (most DNA fragments recovered so far have been around 200-800 base pairs, rather than the tens of thousands in living tissues) the species can potentially be identified.

Those who have published the finding of insect DNA in ancient amber point out that they have been able to pinpoint the species from the sequence in each case. That is, the DNA found in the termite was definitely termite DNA, not human, bacterial or any other type of DNA.

To this, Lindahl retorts that the insect DNA could have easily come about by contamination from the nearby entomology lab affecting workers' clothing. However, if that were true, then the sequence of, for example, the allegedly ancient weevil DNA should match modern sequences, and it does not — there are a few base pair differences. This seems to confirm that the weevil DNA obtained was not from modern weevils. (From a creationist viewpoint, assuming the '120 million year old' weevil was entombed around the time of the Flood, there have been a huge number of insect generations in which mutational 'noise' has been able to accumulate, accounting for the minor base pair differences.)

Possibility 3: There is some yet-unknown mechanism which prevents DNA breaking down in some of these specimens, which would allow DNA to last for millions of years.

A number of suggestions have been made, but they are not convincing. For example, since the presence of water greatly enhances the breakdown of DNA, it has been suggested that sugars in the original tree resin might remove enough water by osmosis to protect the DNA by dehydrating it. However, studies of resin make it doubtful that it contains enough sugar,[4] and in any case, dehydration by itself will not be sufficient to stop DNA breaking down over vast ages, as will become apparent shortly.

RELENTLESS BREAKDOWN

Rebecca Cann, prominent for her work on the 'African Eve' theory based on mitochondrial DNA, concedes that *'after 25 million years, there shouldn't be any DNA left at all'*.[5] That certainly is true if it is all already broken down after 10,000 years as Sykes has already pointed out! Lindahl's scepticism (about the results, not the ages, of course) is fuelled by his experiments on DNA which led him to conclude that under the most favourable conditions, some useful DNA sequences could possibly be recovered from fossils tens of thousands of years old — but this is at the very outside.[6]

The debate continues

In a sharp retort to Lindahl's critique of his '17 million year old' DNA discovery in a fossil magnolia leaf, Golenberg* cites other work to show that the *'rate of decay of DNA is not linear over time'*. This appears to have involved comparisons of DNA preservation in specimens ranging up to thousands, not millions of years in assigned age — which begs the question of the accuracy of the assigned ages.

* Golenberg, E. M., 1994. Antediluvian DNA research. **Nature,** 367:692.

Since *'over time, water and oxygen damage DNA'*,[7] some have wondered whether in fact amber could act as a perfect seal to prevent oxygen getting to the DNA. Harold Hopfenberg, a diffusion expert at North Carolina University, showed in 1988 that amber is really quite porous to gas. He estimates that *'oxygen could permeate a chunk of amber within weeks'*.[8] This makes the argument against the millions of years even stronger. Gary Landis of the US Geological Survey admits that oxygen getting into amber would mean that after millions of years *'the genetic material would be history'*.[9]

It should also be pointed out that even if the DNA could be hermetically sealed in, with its water removed and no gas allowed access, it would still break down from thermodynamic considerations. As Swee-Eng Aw, former professor of biochemistry at the University of Singapore, stated recently, the breakdown of DNA 'is *intrinsic to itself. Whether it is protected from oxygen or not, whether sealed from the environment or not It is an intrinsic instability, just because it is a polymer* (long-chain molecule)'.[10] He went on to indicate that as far as science is concerned, it would appear that if one finds DNA in fossils they cannot be millions of years old.

Furthermore, over huge time-spans, radiation would damage even hermetically sealed DNA, and it seems inconceivable that any fossil-bearing location could be free from the penetrating effects of cosmic radiation. The bottom line, as Lindahl puts it, is that *'nothing is completely dry, completely oxygen-free, and completely shielded from radiation'*.[11] He also points out that the survival of DNA for an alleged 17 million years in the case of the magnolia leaf is particularly incredible, since it was in a deposit that was still wet! For this reason, he says, the findings (of sequenced magnolia DNA in this leaf) *'don't make any sense'*. The paradox is, of course, only present within the long-age framework of belief.

FACTORS CAUSING / ENHANCING DNA BREAKDOWN

(assuming the absence of bacteria)

- Oxygen
- Water
- Radiation (including cosmic)
- Intrinsic thermodynamic instability

Meanwhile, in addition to the published reports claiming definite sequenced DNA in a variety of multi-million-year-old fossils (mentioned earlier), preliminary positive results for fish DNA have been reported from '200-million-year-old' fish fossils, and a project is underway at the Smithsonian to amplify DNA from '400 million-year-old' brachiopods.[12]

In much of the literature, the comments tend to be circular — that is, 'we know that there must be some way in which DNA hangs around for millions of years because it's found in specimens millions of years old.' However, that would only be true if the great ages assigned were correct.

It needs to be stressed that the argument that DNA should break down totally in thousands of years is supported by powerful arguments which are based upon existing laws, mechanisms and observations. This is why Lindahl's sceptical assaults are becoming harder to ignore. These same arguments may be legitimately employed to argue strongly against the millions of years assigned to the fossils. It seems unlikely that Lindahl and others will be able to show that the near-identical (but not actually iden-

tical) DNA sequences in each case probably arose by contamination. Creationists should strongly support Lindahl's calls for others to repeatedly attempt to duplicate the results with the most stringent of safeguards, in view of the importance of this issue to the crucial matter of fossil age.

From a creationist point of view, one would expect that DNA which was entombed at the time of the Rood a few thousand years ago would be likely to be heavily degraded, most often not detectable at all — but in principle, it could still be detectable in a few specimens fossilised under very favourable conditions. It is the conditions, not the alleged evolutionary age, which should make the difference. A fossil dated at 40 million years is likely to be roughly the same age, according to Rood geology, as one dated at 200 or 400 million years, so it is just as likely or unlikely (all else being equal) for DNA to be found in the 'older' specimens as in the younger ones.

CONCLUSION

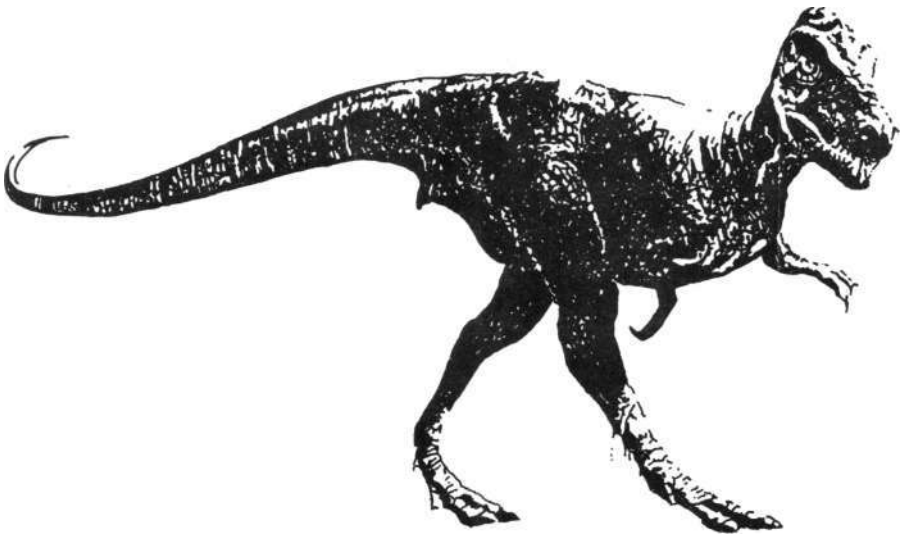
Whenever DNA is positively identified in a fossil specimen, that in itself would seem to deny the possibility that it is even a few million years old. The greater the alleged age over which this fragile molecule is claimed to have survived, the sharper the argument against the old ages.

Bearing in mind that the creation model does not necessarily predict the survival of any DNA in fossils (since even 4,000 years is a very long time), I would judge, on the basis of the results so far, that it is likely that the DNA discovered in the amber fossils to date has not been the result of contamination, and would predict that this will probably continue to be confirmed by the ongoing discovery of carefully sequenced non-modern DNA in some fossils. If that happens the search would doubtless continue for ways around the conundrum, and it would strengthen the argument for the creation model.

REFERENCES

1. Lewin, R., 1994. Fact, fiction and fossil DNA. **New Scientist, 141** (1910):38-41.
2. Sykes, B., 1991. The past comes alive. **Nature, 352**:3813.
3. Lindahl, X, 1993. Recovery of antediluvian DNA. **Nature, 365**:700
4. Fischman, J., 1993. Going for the old: ancient DNA draws a crowd. **Science, 262**:655-656.
5. Morell, V, 1992. 30-million-year old DNA boosts an emerging field. **Science, 257**:1860-1862.
6. Lewin, Ref. 1, p. 40.
7. Stroebel, G., 1993. Ancient DNA research: growing pains. **Science News, 144(18)**:285.
8. Monastersky, R., 1993. Oxygen-extinction theory draws counterfire. **Science News, 144(14)**:294.
9. Yulsman, T., 1994. Did the dinosaurs suffocate? **Earth, 3(2)**: 12. Landis uses this to argue that, since the DNA is millions of years old, the studies showing that amber is porous to oxygen must be wrong. (He relies on analyses of air bubbles in amber to support his Tele' theory of atmospheric change to explain dinosaur extinction.)
10. Aw, Swee Eng — personal communication transcribed from taped interview, Brisbane, Australia.
11. Lewin, Ref. 1, p. 40.
12. Morell, Ref. 5.

APPENDIX: Recreating a Dinosaur?



Bringing dinosaurs back to life from fossil DNA was the theme of the Michael Crichton thriller Jurassic Park, made into a blockbuster movie by Steven Spielberg.

It's not only Hollywood that gets carried away with science-fiction ideas — like recreating a dinosaur from DNA extracted from a hypothetically dinosaur-dining mosquito preserved (what a drillbit!) in amber. Well-known Australian palaeontologist Michael Archer (who seldom resists the opportunity for a less-than-informed dig at creationists) writes[1] that *'nothing excites me more'* than the possibility of such *'spectacular'* genetic engineering.[1]

Archer waxes enthusiastic about the possibilities of restocking some Australian rainforests with unusual extinct marsupials, like the 'thingodontans'. He devotes considerable space to defending the possibility — even the likelihood — that dinosaurs will one day be reconstructed from their DNA.

Given the pace of technological advance, is it possible or wise to state categorically that such things will never occur? Doesn't yesterday's science fiction tend to become today's reality? While not wishing to dampen anyone's ardour, there are some facts about biological development (overlooked or unknown to Crichton and Archer) which

indicate that it is an *inprincipio* impossibility.

Let us generously sidestep the overwhelming unlikelihood of ever being able to reconstruct from small fragments (without knowing what the original sequence was) a full dinosaur genome. Say we had a full set of *T. rex* genes — what then?

As pointed out in a recent insightful paper,[2] organisms are much more than their DNA code. The biological context in which the DNA message is deciphered is crucial. We inherit more from our parents than two sets of DNA — we also inherit a functioning cellular architecture via the maternal egg cell, which exerts a great deal of control over early embryonic development.

Experimental evidence indicates conclusively that even if one had the perfectly preserved genome of a mammoth and replaced the nucleus of an African elephant egg with it, the result would be African elephants, not mammoths.[3] The bottom line is that *'dinosaur DNA does not describe a dinosaur, it* ***prescribes*** *a dinosaur, within the context of another dinosaur. So to reconstruct Baby Dinosaur, all you need is Mommy Dinosaur. Tough.'*[4]

REFERENCES AND FOOTNOTES

1. Archer, M., 1994. Lazarus lizards and undead dinos. **Australian Natural History, 24(8):60-**61.
2. Cohen, J. and Stewart, I., 1994. Our genes aren't us. **Discover,** 15(4):78-84. Cohen is a senior visiting research fellow (biology) at the University of Warwick (England), where Stewart is Professor of Mathematics.
3. Mammoths and modern elephants are/were almost certainly descendants of the same created kind; mammoth DNA differs from elephants only slightly, being roughly an equal distance from that of both African and Indian elephants. We are not suggesting that, for example, wolf DNA substituted for the nucleus of an elephant egg would give rise to elephants, or indeed, anything viable.
4. Cohen and Stewart, Ref. 2, p. 84.

A female mosquito in Caribbean amber — source of **Jurassic Park's** fictional dino DNA (photo: Dr Joachim Scheven)

QUOTABLE QUOTE: The Role of Bias in Science

'But ***I*** *would also reject any claim that personal preference, the root of aesthetic judgment, does not play a key role in science. True, the world is indifferent to our hopes — and fire burns whether we like it or not. But our ways of learning about the world are strongly influenced by the social preconceptions and biased modes of thinking that each scientist must apply to any problem. The stereotype of a fully rational and objective "scientific method", with individual scientists as logical (and interchangeable) robots, is self-serving mythology. '*

— Gould, S. J., 1994. In the mind of the beholder. **Natural History, 103(2), p. 15.**

QUOTABLE QUOTE: The Origin of the Genetic Code

'So it is disappointing, but not surprising, that the origin of the genetic code is still as obscure as the origin of life itself.'

— Maddox, J., 1994. The genetic code by numbers. **Nature, 367,** p. 111.