tribution with which the first as well as the last particle in the chain can exchange momentum by a realistic collision mechanism[7]. The conductivity coefficient was shown to depend on the mass ratio and temperature of the heat bath, but most importantly, it was independent of the chain length and therefore an intrinsic property of the chain. The results in ref.2 are calculated for quite large mass-differences. For the case of only small mass differences the influence of the non-integrability is not strong enough and additional heat transport is possible via slowly decaying solitary excitations.

This effect is most dramatically seen in the case of the monatomic chain where the mean kinetic energy of the particles is constant along the chain. At larger mass-differences, however, and when the heat baths are at high temperatures, there was no influence of solitary transport in the heat current. As well as studying the current through the first particle, we examined the difference of the current through the first and the last particle. This difference became equal to zero with small oscillations after a certain time of integration. Comparisons with experimental values for the conductivity were quite satisfactory. Interestingly, in all our computer-experiments we found a certain surface layer with rather high thermal resistivity.

Both systems[1,2] are coupled to the randomly acting heat baths and therefore the dynamical system itself is only a transport mechanism to these random collisions. It would be very interesting (but much more complicated) to study the behavior of the diatomic Toda chain in phase space without external disturbances. Preliminary results indicate that the system starting from an arbitrary state relaxes to a state with equally distributed kinetic energy, it behaves like a thermodynamical system. But again one has to be very careful in studying this effect since another random influence, namely the numerical errors in the computational procedure, may change the conclusions. It would therefore be desirable to have some analytic results on these systems that can be compared to studies in which thermal conduction is studied in a system of oscillators interacting by a stochastic process[8].

Finally, it should be noted that the two systems so far studied are one-dimensional and the influence of higher dimensions remains to be determined[9]. It is known that in higher dimensions solitary excitations decay much more rapidly and this might help the normal thermal conduction; but numerical computer experiments in this case need much larger computers than we have available.

In summary, we think that some progress has been made in interpreting Fourier's law for thermal conduction. But it is worth remembering Peierls comment in 1960: "It seems there is no problem in modern physics for which there are on record as many false starts and as many theories which overlook some essential features as in the problem of thermal conductivity of non-conducting crystals"[10].

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On the hand of *Archaeopteryx*

SIR — Hecht and Tarsitano[1] complain that Howgate[2] has misrepresented their views[3,4] on the structure of the hand in *Archaeopteryx*. Howgate also discussed our interpretation of the *Archaeopteryx* hand[5], yet we find that his inaccuracies are trivial when measured against those of Hecht and Tarsitano.

According to Hecht and Tarsitano[1], palaeontologists unfailingly identify the three hand digits of theropods, *Archaeopteryx* and birds as numbers 1-2-3 (relative to a primitive pentadactyl format). Indeed, they maintain that palaeontologists are "convinced" of this fact in *Archaeopteryx*. This is not entirely true, for we have argued[5] that the digits are numbers 2-3-4. Hecht and Tarsitano are certainly aware of our arguments because they have cited them in their published work[4]. Yet on this occasion[1], in chiding Howgate, they chose to overlook such irksome details. In fact we are justified in claiming that Hecht and Tarsitano have misrepresented our views. We suggested[5] that the longest metacarpal should be identified as number 3 — and not the longest *digit*, as was stated by Hecht and Tarsitano[4]. However, this part of our argument, along with the rest, was dismissed by these authors as "merely changing the numbering of the digits".

Next, Hecht and Tarsitano plead that they "only stated the possibility" of there being a break in the outermost finger of the *Archaeopteryx* hand[1]. Yet their illustrations of the hands in the Berlin specimen (Figs 3,4 in ref.3) show the feature in question unequivocally labelled as "break". Their description (ref.3, p.155) is equally assertive: the feature "is apparently a break, not a joint... contrary to the opinions of Heilmann[6], Wellnhofer[7] and Ostrom[8]". Evidently Howgate did not misrepresent the views of Hecht and Tarsitano.

Hecht and Tarsitano accuse Howgate of attempting to make their explanations appear "ludicrous". But if the problematical feature in the outermost finger is a joint (and not a break) then their explanation *is* ludicrous: it would maintain[1] that a finger-joint "was caused by forces during stalling, impact upon the water, or as a result of preservation".

Finally Hecht and Tarsitano are not accurate in summarizing the issue. The important point is not whether the three digits in question are numbers 1-2-3 or numbers 2-3-4; it is whether or not the three fingers are homologous in theropods, birds and *Archaeopteryx*. Some biologists maintain that they are, whether they be 1-2-3 (ref.9) or 2-3-4 (ref.5). Hecht and Tarsitano disagree, contending that the three fingers of birds (including *Archaeopteryx*) are not homologous with the three fingers of theropods. But their argument is not convincing: it entails a complex explanation (convergence) where a simple one might suffice; it conflicts with the cladistic methodology that Hecht and Tarsitano claim to espouse (ref.5, p.621); and it implies that theropods differed from all other tetrapods (except syndactylous marsupials) in their pattern of digital reduction (ref.3, p.161). Despite these difficulties Hecht and Tarsitano have sought to defend their opinions. It is unfortunate that they should do so by ignoring any arguments to the contrary and by claiming that others have misrepresented and distorted their views.

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Scientific Correspondence

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