One theory about the origin of the AIDS pandemic is that the virus responsible, HIV, was transmitted to humans from chimpanzees through contaminated polio vaccine. That theory fails some crucial tests.

Defenders of the OPV hypothesis hold that the alternative route of cross-species virus transfer, an accidental infection from a chimpanzee, seems equally unlikely. Most
of today’s human infections, however, have come from various animal sources within the past 10,000 years or so1, a split-second on the evolutionary timescale. So SIV,29 may have infected humans on numerous occasions in human history without becoming firmly established in our species, rather like the Lassa fever and Ebola viruses. What may have helped HIV-1 group M to take off epidemically could have been the use of non-sterile needles and syringes in Africa in the mid-twentieth century14. This mode of transmission is currently behind the explosive spread of HIV-1 in parts of Russia and China. So one can envisage the involvement of an unintended medical factor in the adaptation of HIV to humans after it had crossed species from chimpanzees.

The new data13–15 may not convince the hardened conspiracy theorist who thinks that contamination of OPV by chimpanzee virus was subsequently and deliberately covered up. But those of us who were formerly willing to give some credence to the OPV hypothesis will now consider that the matter has been laid to rest. One may expect to hear an argument that chimpanzee kidney cells could have been used locally in Africa to amplify the batches of OPV prepared at the Wistar Institute in macaque cells, and that it was these vaccine samples that became contaminated. But the facilities for this type of cell culture did not exist in the Congo in 1957–59; besides, the evolutionary analysis of HIV-1 group M contradicts such a view.

The irony is that these new studies would almost certainly not have been undertaken if Hooper1 had not called for the analysis of DNA in stored OPV stocks, on the suggestion of the late Bill Hamilton. So we owe Hooper and Hamilton a debt of gratitude for pressing the case for those tests. When the preliminary results of the investigations were announced at the Royal Society in London last September, Hooper nonetheless dismissed them as “irrelevant to the OPV hypothesis”. But that simply isn’t so — on the contrary, some beautiful facts have destroyed an ugly theory.

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Ruffling feathers

Hans-Dieter Sues

The evolution of feathers and flight were generally thought to be inextricably linked. But new fossils from China show that feathers pre-dated the origin of flight and of birds.

One of the liveliest debates in palaeontology has concerned the origin of birds. There is now overwhelming anatomical evidence that birds evolved from small predatory dinosaurs known as theropods, and that the two groups are linked by a remarkable series of transitional forms1. Most palaeontologists accept this evidence. Only a small (if vocal) group continues to argue that birds have no close relationship to dinosaurs2.

Feathers are the most distinctive attribute of living birds. Traditionally, their evolution has been linked to the origin of flight3, but there have always been a few dissenting opinions4–6. Two new studies, one published last month7 and the other in this issue8, now confirm that true feathers already existed in the non-flying dinosaurian relatives of birds and thus pre-dated the origin of birds and avian flight.

In recent years, there have been several reports of feathers and feather-like integumentary structures in various non-avian theropod dinosaurs from the Yixian Formation of Liaoning province in northeastern China9–11. The Yixian Formation is of Early Cretaceous age (dated at 125 million years ago) and consists of a series of layered lake sediments and volcanic ashes. These deposits contain many remarkably preserved fossils of an amazing array of terrestrial, flying and aquatic animals. The fine-grained sedimentary rocks often retain traces of soft tissue and, in some cases, even identifiable gut contents.

One of the theropod dinosaurs from the Yixian Formation, Sinosornithoides, showed unbranched fibre-like structures fringing the back of the head, neck, back and tail, which some researchers considered to be proto-feathers but others dismissed as frayed internal fibres of collagen, a structural protein found in connective tissue. However, two other theropod dinosaurs from the same deposits, Caudipteryx and Protoarchaeopteryx, undoubtedly possessed true feathers. In both, the body was covered by small feathers. Caudipteryx also had primary feathers attached to the second (longest) finger of its hands and sported a fan of feathers at the end of its tail. The tail of Protoarchaeopteryx bore symmetrical, vaned feathers in a fan-like arrangement. Opponents of the theropod–bird connection have suggested that Caudipteryx was actually a flightless bird12, but this claim is not supported by its skeletal structure.

The critics also noted that no feathers were known in dromaeosauurs, which share scores of derived skeletal features with early birds and thus are generally considered to be their closest relatives13. Dromaeosauurs were a group of small- to medium-sized, non-avian theropods, which include Velociraptor, the reptilian villain in the blockbuster movie Jurassic Park. They were especially characterized by the presence of a greatly enlarged claw on the second toe of the foot. Dromaeosauurs had long arms and long, grasping hands, but their forelimbs were not modified into wings.

In a report published last month, Xu et al.14 documented the presence of compound filamentous integumentary structures in the somewhat scattered but well preserved remains of the type specimen of the dromaeosaur Sinornithosaurus millenii15 from the Yixian Formation. These structures exhibit two kinds of feather-like branching: filaments joined in a basal tuft, and several filaments joined at their bases in series along a central filament. What makes them particularly remarkable is their close correspondence to transitional stages II and IIIA predicted by a developmental model16 for the evolutionary origin of feathers in birds (Fig. 1).

In the second of the new papers, Ji et al.17 (page 1084 of this issue) report on the latest remarkable find from the Yixian Formation — a nearly complete, articulated skeleton of an unidentified dromaeosaur, most of the body of which is densely covered with feather-like structures. The complex filamentous structures on the arms and tail of the new fossil are especially striking. Most of them exhibit a radiating pattern of filaments originating from a single point. The structures on the arms appear to show a herring-bone pattern around a central stem, which is similar to bird feathers with their central rachis and serially attached barbs. Feathers are the only kind of covering found on living vertebrates that shows such a branching structure. So Ji et al. explicitly equate the filamentous structures of the new dromaeosaur to the feathers of birds.

The exceptionally preserved fossils from...