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## HOW ARCHAEOPTERYX CLIMBED TREES

Attempts to reconstruct the peculiarities of the *Archaeopteryx*'s locomotion have been undertaken in a number of studies ([1], [5], [6], [8], [10], [12], [13] etc.). Most of the researchers agreed upon *Archaeopteryx* as a creature capable of running on the ground as well as of perching in canopies. However, Martin [10] suggested, that *urvogel* walked in an upright (mammal-like) posture with slightly sprawled hind limbs (fig. 1). This adaptation to tree-trunk climbing corresponded to the thickened anterior border of acetabular rim and explained why pubis of *Archaeopteryx* started rotation towards opisthopubic position. Otherwise, forwardly directed pubis would have prevented *Archaeopteryx* from climbing tree trunks with sprawled hind limbs.

Our research, based on 4 specimens of *Archaeopteryx* residing in Germany, did not support Martin's hypothesis on the way the *urvogel* climbed tree trunks. Legs, sprawled in primate-like manner, would move femur in an awkward position, which requires serious shifts in retractors' insertions of its shaft. No such shifts are detectable. On the contrary, pelvic muscles' insertions on femoral shaft remarkably resemble those in *Deinonychus*, which considered as a capable runner. Pubis of *Archaeopteryx* is not that backwardly directed (fig. 2), as Martin showed on the reconstruction [10] (fig. 1). This, however, does not reject the hypothesis of climbing *Archaeopteryx* but modifies it. No doubt, *urvogel* was capable of tree-trunk climbing, but in the manner some of the dromaeosaurids did, evidences for the support of the arboreal habits of which are numerous ([2], [3], [4], [9], [14], Karhu, pers. comm.).



Fig. 1 Skeletal reconstruction of *Archaeopteryx* in primate-like posture (after Martin, 1995).

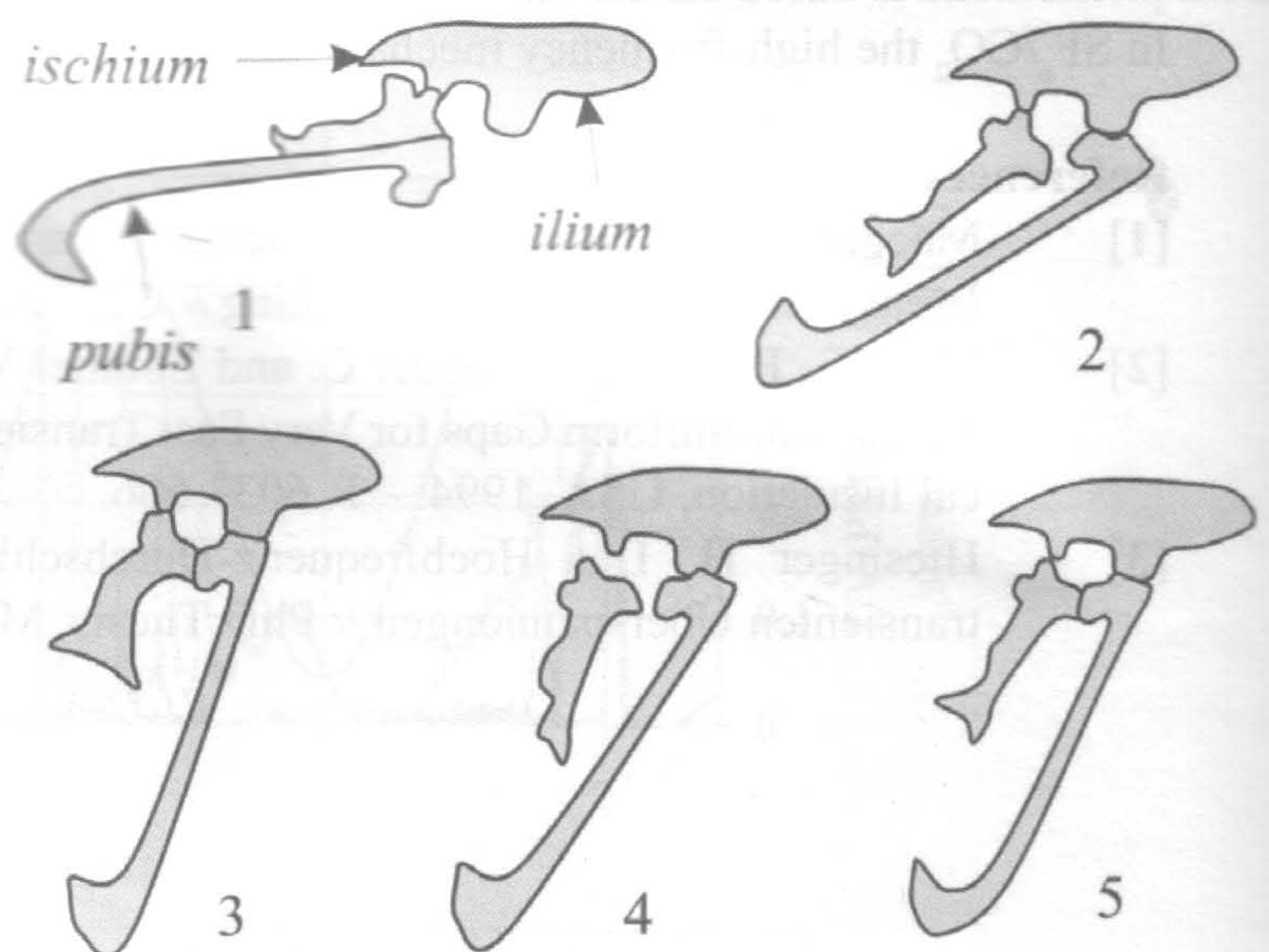


Fig. 2 Outlines of pelvic bones of London (1), Berlin (2), Solnhofen-Aktien-Verein (3), Solnhofen (4) and Eichstätt (5) specimens. Specimens 3 and 5 are less disturbed and show the closest to natural position of *pubis*.



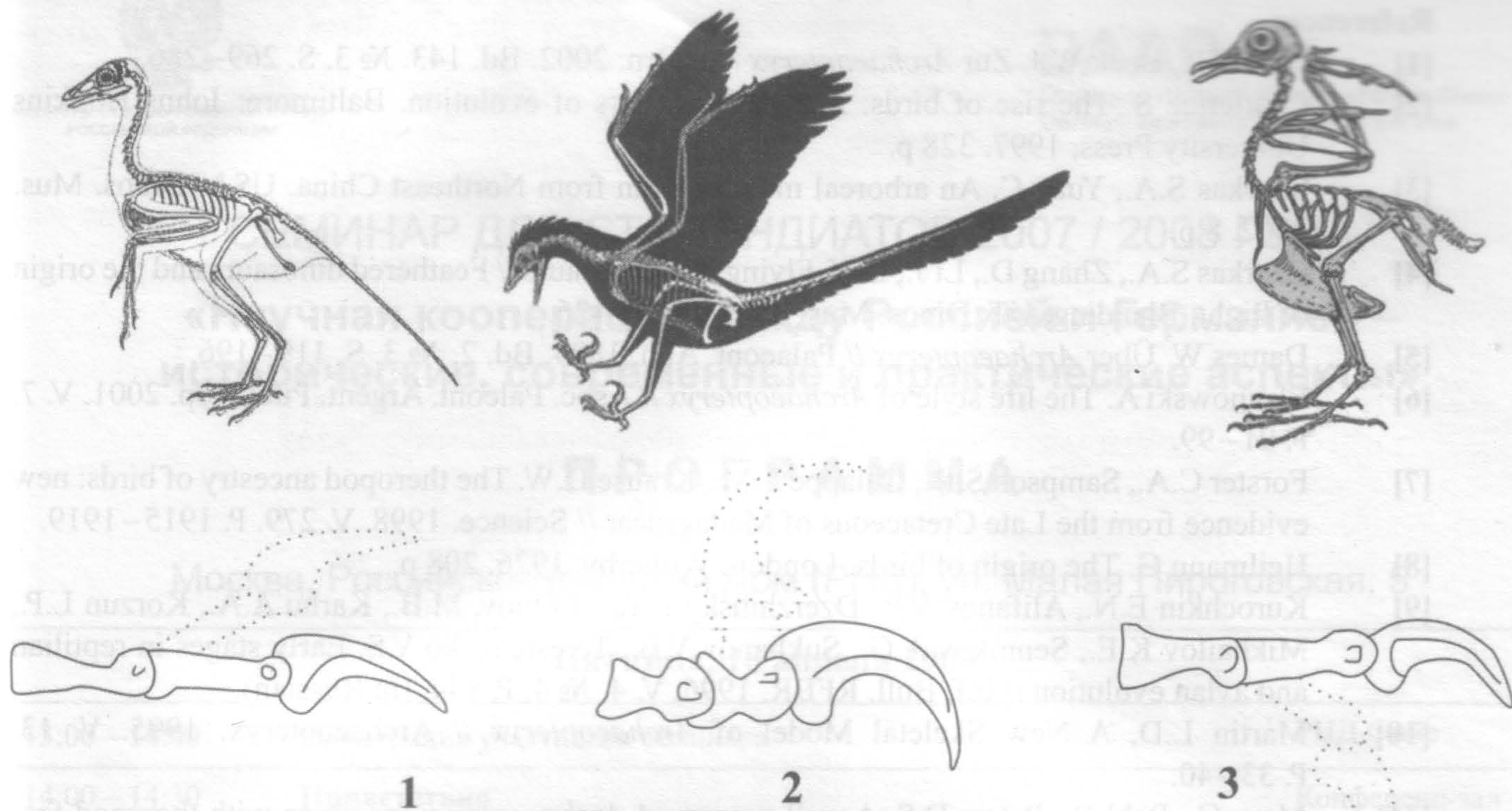


Fig. 3. Hyperextension of the second toe in *Archaeopteryx* (1) and *Rahoavis* (2) in relation to the modern birds (3).

Morphology of hind limbs gives us a clue to understanding of how *Archaeopteryx* climbed tree trunks. Its second toe is specialized to hyperextension as it is in *Deinonychus* or *Rahoavis* [7], although the corresponding claw is not that enlarged [11] (fig. 3). Other toes also allowed more degree of extension than that, observed in modern birds. Thus, *Archaeopteryx* did climb tree trunks not with sprawling but brought under the body legs. Protruding pubis, in this case, would not contact a surface of trunk. Simultaneous push by both hind limbs propelled *Archaeopteryx*'s body upwards along the trunk, whereas elongated forelimbs with needle-sharp claws (f.i. as in tree-trunk climbing woodpeckers) prevented the creature from falling backwards (fig. 4). Tail obviously did not play a significant role in this way of climbing. Modern avian climbers such as woodpeckers and tree-creepers use stiffened tail feathers to provide support for the body. Such a support in *Archaeopteryx* was provided by forelimbs, actively used in climbing. Lack of stiffened tail feathers in *Archaeopteryx*'s specimens with preserved tail plumage supports this assumption.

Relatively small, elevated and directed medially hallux does not allow us to treat *Archaeopteryx* as a true perching creature, like modern passerines, or even some dromaeosaurids (see [3] for the review). More likely it moved in canopies with an aid of clawed forelimbs, being able to run along considerably thick branches.



Fig. 4. Mode of *Archaeopteryx*'s tree-trunk climbing as hypothesized in present study.



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