

## h20 Cuvier's identification of a marsupial in France

He knew it at once, as strongly as he knew that fire burned and kindness was good.

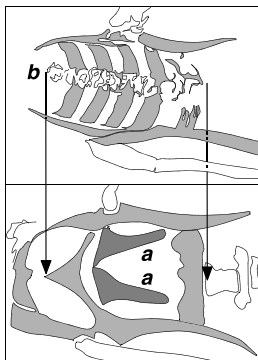
—Philip Pullman, *The Subtle Knife*.<sup>1</sup>

M. [for Monsieur] le Baron Cuvier in *Discourse on the revolutionary upheavals on the surface of the globe and on the changes which they have produced in the animal kingdom*, 1825, tells in the chapter *Principle of the Correlation of Parts* how “each sort of creature could in a pinch be recognized by each fragment of each of its parts.” This is so as “the entirety of an organic being forms a coordinated whole, a unique and closed system, in which the parts mutually correspond and work together in the same specific action through a reciprocal relationship. None of these parts can change without the others changing as well.” For example, “if the intestines of an animal are organized in such a way as to digest only fresh meat, it is necessary also that its jaws be constructed to devour its prey; its claws to seize and tear it apart; its teeth to cut and chew it; the entire system of its organs of motion to rush and catch the prey; its sense organs to perceive it from far away. It is even necessary that nature has placed in its brain the required instinct to know how to hide itself and set traps for its victims. Such will be the universal conditions for the kingdom of the carnivores; all animals destined for this kingdom will infallibly combine them, because its race would not have been able to survive without them. But under these general conditions, there exist particular ones, relative to the size, species, and habitat of its prey, for which the animal is structured. And from each of these particulars result the modifications of detail in the forms which derive from the general conditions. Thus not only the class, but the order and the genus, up to [“down to” in English parlance] and including the species are found expressed in the form of each part.”<sup>2</sup>

But this principle of determination of organic structures is flawed because animals are not, as Cuvier believed, so distinct and well suited to their particular function that, as he would have it, evolution is disproved thereby. However, the great length of time (denied by Cuvier) over which evolution can operate does rescue his method, but imperfectly (*recall* Footnote *f6.1*, p. 311).

Cuvier earned his showman renown, beginning in 1804, when he received from the fossil-mammal bearing gypsum (for plaster-of-Paris) and fossil marine-shell limestone (for building-stones) quarries of Montmartre a broken-in-two block of gypsum (of earliest Cenozoic age) that revealed the continuation of a fossil mammal at the break: hips and legs and bits of spine partly protruding in one piece, and a shoulder, an arm, and part of its jaw and teeth showing in the other piece. Cuvier first chipped away at the concealing rock to reveal the jaw and teeth. His careful sketches and records show that his first revelation was that the bump, a feature called the *condyle*, on the rear of the jaw where it hinged with the skull, projected hardly at all above the tooth row.<sup>3</sup> This condition is so in moles, hedgehogs, bats and opossums but at once rules out mammals such as cats and dogs. The lower jaw, when fully freed, exposed sets of teeth consistent with that ruling: the teeth were triangular and not sharp edged like a carnivore's, nor flattened like those of a grass-chewing cow, but with three hooklike cusps. On such teeth, a mole has seven cusps. So does a bat. A hedgehog has four. The only mammals that have three are certain marsupials: the opossums of North and South

America and their relatives, and the dasyurids of Australasia (a group that includes the inappropriately maligned, furry, carrion scavenging, timid, Tasmanian devil). “I stopped my work on the teeth before I occupied myself with the rest of the skeleton,” Cuvier wrote later, “but I could have predicted everything else [**Figure h20.1**] from this sole index. Number of parts, forms, proportions—all this the surface of the rock offered us, was found entirely answered in that first sight.”<sup>4</sup> So, Honoré de Balzac (1799-1850) was impressed and rightly not only for the florid reasons of his art when he exclaimed that Cuvier “rebuilt like Cadmus, cities from a tooth.”<sup>5</sup>



**Figure h20.1**<sup>6</sup> After Cuvier's drawings of a fossil mammal from the Plaster Stone quarry near Paris, as exposed before (top) and after (bottom) he had excavated below part of the backbone (b) to expose the marsupial pelvic bones (a, a) that he had predicted.