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Haeckel's embryos: fraud rediscovered. (German biologist Ernst **Haeckel's** drawings of embryonic development discredited) *Elizabeth Pennisi*.

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Generations of biology students may have been misled by a famous set of drawings of embryos published 123 years ago by the German biologist Ernst **Haeckel**. They show vertebrate embryos of different animals passing through identical stages of development. But the impression they give, that the embryos are exactly alike, is wrong, says Michael Richardson, an embryologist at St. George's Hospital Medical School in London. He hopes once and for all to discredit **Haeckel's** work, first found to be flawed more than a century ago.

Richardson had long held doubts about **Haeckel's** drawings because they didn't square with his understanding of the rates at which fish, reptiles, birds, and mammals develop their distinctive features. So he and his colleagues did their own comparative study, reexamining and photographing embryos roughly matched by species and age with those **Haeckel** drew. Lo and behold, the embryos "often looked surprisingly different," Richardson reports in the August issue of *Anatomy and Embryology*.

One striking deviation from reality, Richardson says, appears in **Haeckel's** drawings of embryos in the "tail bud" stage, which he depicted as identical for different species. While real embryos do share many features at this stage, such as a tail and identifiable body segments, they also have key differences. Human embryos, for example, have tiny protrusions called limb buds, says Richardson, particularly if they have developed to the point of having as many body segments as **Haeckel** gives them. But **Haeckel** did not include limb buds. And in his drawings, the chick embryo eye is blackened, like a mammal's, but it wouldn't be pigmented this early," Richardson says. He adds that **Haeckel** has given the bird embryo a curl in the tail that resembles a human's.

Not only did **Haeckel** add or omit features, Richardson and his colleagues report, but he also fudged the scale to exaggerate similarities among species, even when there were 10-fold differences in size. **Haeckel** further blurred differences by neglecting to name the species in most cases, as if one representative was accurate for an entire group of animals. In reality, Richardson and his colleagues note, even closely related embryos such as those of fish vary quite a bit in their appearance and developmental pathway. "It looks like it's turning out to be one of the most famous fakes in biology," Richardson concludes.

This news might not have been so shocking to **Haeckel's** peers in Germany a century ago: They got **Haeckel** to admit that he relied on memory and used artistic license in preparing his drawings, says Scott Gilbert, a developmental biologist at Swarthmore College in Pennsylvania. But **Haeckel's** confession got lost after his drawings were subsequently used in a 1901 book called *Darwin and After Darwin* and reproduced widely in English language biology texts.

The flaws in **Haeckel's** work have resurfaced now in part because recent discoveries showing that many species share developmental genes have renewed interest in comparative developmental biology. And while some researchers -- following **Haeckel's** lead -- like to emphasize the similarities among species, Richardson thinks studying the contrasts may be more interesting. Gilbert agrees: "There is more variation [in vertebrate embryos] than had been assumed." For that reason, he adds, "the Richardson paper does a great service to developmental biology."