without major environmental change.

The populations regaining their fitness via small compensatory mutations necessarily ended up at new adaptive peaks, says Chao, which represent different ways of attaining the same fitness. "The only way to go back to the same peak you started on" is via a "back mutation" that reinstates the gene in its original form—which should occur only in a single, big step, he explains. In contrast, "a compensatory mutation implies that you're headed toward a new peak." He adds, "At least in this one case, it seems that Fisher's model fits with Wright's view of an evolutionary landscape."

"It's absolutely intriguing," says Hope Hollocher, an evolutionary biologist at Princeton University. "Chao has opened the door toward merging these two viewpoints." She notes, however, that his experiments need some fine-tuning before biologists will be convinced that Fisher and Wright aren't always at odds.

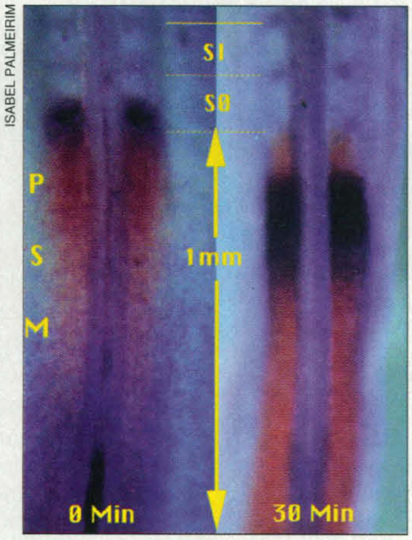
–Virginia Morell

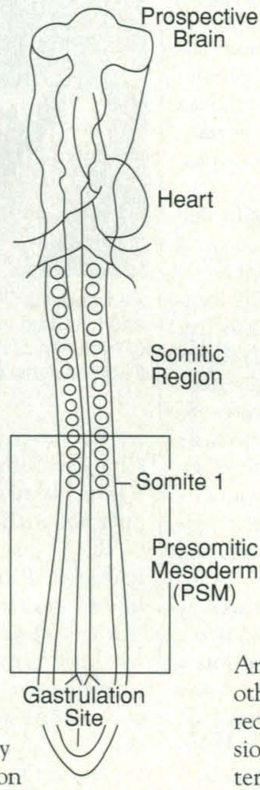
DEVELOPMENTAL BIOLOGY

New Developmental Clock Discovered

Biological clocks are turning up all over, and in the most unexpected places (see p. 1560). But they all typically keep to a 24-hour schedule, which is logical because it helps keep organisms in tune with the normal day length. But now, a team of French and British scientists has come across a new kind of biological clock, one that not only has a much shorter cycle—only 90 minutes—but also appears to be driven by a different kind of mechanism.

In today's issue of *Cell*, Olivier Pourquié, a developmental biologist at the Developmental Biology Institute of the University of Marseille in France, and his colleagues report evidence indicating that such a clock paces the development of the somites, blocks of tissue that form in regular arrays along the spinal cord of vertebrate embryos and give rise to vertebrae and muscles. The researchers found that in the developing chick embryo, a gene called *chairy* undergoes repeated 90-minute cycles of activity, its expression narrowing each time to a thin band that defines the rear edge of a new somite. These cycles seem to specify the orderly delineation of somites in the growing embryo.





Moving target. Two embryos differing in age by about 30 minutes have different patterns of *chairy* expression (dark blue). Embryo images correspond to the boxed area in the diagram *(right)*.

Now the Pourquié team and others are eager to know what makes this clock tick. "It's the first time that very clearly there is a clock associated with a developmental process," says clock biologist Paolo Sassone-Corsi of the University of Strasbourg in France.

The finding also has evolutionary consequences, because *chairy* is the chicken equivalent of a fruit fly gene called *hairy* (*chairy* is short for *chick hairy*), which helps drive formation of the segmented insect body plan. Developmental biologists have long debated whether the segmentlike somites of higher organisms and insect segments arose independently or had a common origin. Until now, they have failed to find common genes involved in forming these structures, but the new *chairy* results provide just such a link. "It's cool stuff," says Eddy De Robertis, a developmental biologist at the University of California, Los Angeles, who has proposed a common origin for insect and somite segmentation (*Science*, 4 July, p. 34).

David Ish-Horowicz's team at the Imperial Cancer Research Fund Laboratory in London originally cloned *hairy* more than a decade ago and showed that it is expressed in a series of stripes that help define the segments of the developing fruit fly embryo. He and Domingos Henrique in his lab then used *hairy*'s sequence to track down *chairy*, a comparable gene in the chicken. But neither they nor Pourquié, a collaborator on another project, could make sense of *chairy*'s seemingly variable expression pattern in the chick embryo.

To try to sort out the problem, Pourquié and his student Isabel Palmeirim divided chick embryos, fixing one half while maintaining the other in culture. When they then compared the gene's expression in the two halves at different times, the link to somite formation emerged. As chick embryos grow, cells are added behind the head to form a long, broad "tail." Once this tail reaches a certain size, somites begin to form one at a time, starting with the one closest to the head and working tailward. Each somite—there are 50 of these visible blocks of tissue in all—takes about 90 minutes to appear.

When the Pourquié team monitored *chairy* expression as the somites formed, they found that the gene was pacing the process. It first becomes active across the rear 70% of the presomatic tissue, starting from the tip of the tail. Over the next 30 to 40 minutes, that band of expression narrows and shifts forward toward the head, where the next somite will develop. Finally, after 90 minutes, the expression band becomes a thin stripe marking the rear edge of the new somite. At the same time this stripe appears, the gene comes back on again over the same broad region where it was initially expressed and begins the cycle anew until all 50 somites develop. "[Expression] spreads along the tissue in a very coordinated fashion," Pourquié says. This repeated, coordinated expression, he suggests, dictates to cells when it is their turn to form a somite. But he has yet to determine what coordinates the gene expression.

It's not controlled by signals from elsewhere in the chick embryo, because *chairy* cycled on and off even after the tissue where it was expressed was teased out of the embryo and grown separately. And it's not a clock like those found in other organisms, because those clocks require protein synthesis. Gene expression still followed this repeating pattern even when protein synthesis was blocked, his group reports.

But these results make the find all the more intriguing, say other researchers. They suggest that this developmental clock keeps time using a new clock type of mechanism, one that Pourquié and his colleagues are working hard to pin down. Sassone-Corsi also predicts that this new developmental clock will inspire other researchers to look for other types of clocks and timing mechanisms, and that, he adds, "is exciting."

–Elizabeth Pennisi