Abstractions

FIRST AUTHOR
Alicia Soderberg, an astronomy student at the California Institute of Technology, bet her PhD on capturing brilliant, long bursts of light from a relatively close dying star. Such bursts are expected from only a rare type of supernova — the gamma-ray burst (GRB). By studying local supernovae, Soderberg and her team aimed to pinpoint the physical mechanism distinguishing an ordinary supernova from a GRB or its X-ray flash (XRF) subclass. The tell-tale signal eventually came from the second-nearest GRB ever recorded (see page 1014). Soderberg talked to *Nature* about her results.

How did you catch the bursts?
We coordinated our efforts across many of the most powerful observatories in the Northern and Southern Hemispheres. We also used simultaneous observations from several satellites, including the Chandra X-ray Observatory in Massachusetts and NASA's Swift X-ray Telescope. The 'afterglow' light from GRBs and XRFs fades quickly, so rapid, coordinated reponses are essential. When the Swift satellite detects a new burst, it rings our cellphones, so we can immediately begin coordinating our observational response.

What sorts of things were you doing when the satellite rang you?
Mostly sleeping! The Swift satellite tends to find bursts at night, so optical telescopes can begin observing the afterglow immediately.

How long have you been working on this?
I've spent four to five years observing new supernovae, looking for the tell-tale sign of an accompanying GRB or XRF.

What was your reaction to the data?
I was excited and relieved! When I began my thesis I wondered whether GRBs and XRFs might be lurking in a significant fraction of local supernovae. But after studying about 150 supernovae and finding no sign of a GRB or XRF, I wondered if I would ever find one.

How hard was it piecing together data from so many instruments?
It can be very confusing. Often the data don't fit the classical models.

What drew you to this field in the first place?
The GRB field is young, so every event brings new discoveries.

What's the most significant thing you learned?
Supernovae and GRBs might not be as different as was believed. We now know that there are explosions that bridge the gap between ordinary supernovae and the powerful GRBs and XRFs. ■

MAKING THE PAPER

Martin Cohn

Fish fossils and sharks offer clues to the origin of vertebrate limbs.

Chinese fossil finds and the lamprey genome both provided insight into a quest to understand the evolution of fins. In the course of their research, developmental biologist Martin Cohn, based at the University of Florida, and his graduate students Renata Freitas and GuangJun Zhang even attempted to fluorescently label shark embryos. Their efforts identified a surprise 'recycling' of genetic mechanisms involved in the formation of median and, much later in evolution, paired fins (see page 1033).

Before this, most fin-development work had focused on the zebrafish. But Cohn and his colleagues wanted to understand the gene-expression patterns that give rise to paired fins, so they turned to the shark, the most primitive living vertebrate with such fins. During their initial gene-expression screen, they noticed that genes expressed in paired fins are also active in median fins.

While they were redirecting their efforts to study median fins, an exciting find of fossil fishes in China confirmed that median fins arose about 100 million years before paired fins. This suggested that median fins might hold the key to the origin of fins and limbs, and, therefore, the first steps towards vertebrate locomotion.

Those interested in locomotion had paid little attention to median fins, but one previous study of zebrafish had determined that neural-crest cells — embryonic cells that give rise to cranial skeletal and connective tissues — are involved in median fin development. "That one experiment gave rise to the idea that neural-crest cells form the median fins," says Cohn. To determine whether neural-crest cells and/or somitic cells — embryonic cells that develop into muscles and vertebrae — have a role, the researchers first attempted to microinject shark eggs with a fluorescent label.

But working with unusual animal models often introduces time-delaying technical hurdles. Sharks are seasonal breeders, which limits the availability of embryos. And, as Cohn and his colleagues found, embryos could not survive the saltwater intrusion that occurred during introduction of the fluorescent label.

So they pursued a molecular approach, cloning various genes that mark distinct cell types to determine which give rise to median fins. They found that although neural-crest cells do make a contribution, this is minor; somitic cells form the bulk of the fin. Cohn was most surprised to find that the genetic programme for fin development was first assembled in the somitic cells, then later in evolution redeployed to the tissue that gives rise to paired fins and limbs.

The scientists went on to document gene expression in lampreys, eel-like organisms with median fins but no paired fins. The shark and lamprey straddle the origin of paired-fin nodes along the evolutionary time scale. The lamprey's median fins also proved to originate from somitic cells.

The next question for Cohn's group is 'how old is fin development?' To find out, they'll study median fin development in amphioxous, the closest living invertebrate relative of vertebrates. "What's been most exciting for us is the flow of information between developmental biology and palaeobiology," says Cohn, adding that the strength of evolution and development research is the integration of a wide range of disciplines in an effort to address evolutionary questions. ■

KEY COLLABORATIONS

Finding and analysing gamma-ray bursts requires cooperation, but also creates competition, as shown by four papers in this issue (see pages 1008–1020). All of these groups started at the same point — with a signal from NASA's Swift satellite, which reports pulses of energy from dying stars within the cosmos.

Various groups scrambled to get in touch with someone at an observatory in an ideal position to measure the waves emitted from the bursts. Many teams shared instruments, such as the Very Large Array Telescope in New Mexico, or teamed up with observers who were sometimes on the other side of the world.

Some groups had access to their own ground-based telescopes. As a result of these alliances, the effort yielded overlap among some of the 107 authors involved. Three authors appear on two of the papers, representing a collaboration between Pennsylvania State University, the Goddard Space Center in Greenbelt, Maryland, and the California Institute of Technology.

The other two papers share seven authors as a result of collaborations between the Max Planck Institute for Astrophysics in Germany, the University of Tokyo in Japan, the University of California, Berkeley, and the National Institute of Astrophysics in Trieste, Italy. ■