



The fabulous fish guy

Last year's movie smash *Finding Nemo* impressed many marine biologists with its scientific accuracy. Alison Abbott meets the young expert in fish biomechanics who helped to breathe life into the film's stars.

Adam Summers doesn't own a television. And he had never seen an animated movie until a chance encounter propelled him into the studios of Pixar, as scientific adviser on the company's film, *Finding Nemo*.

The film tells a stirring tale of the efforts of Marlin, a widowed barrier-reef clown fish, to rescue his only son Nemo who has been 'abducted', and taken to live in a dental surgery's aquarium in Sydney. It was the highest-grossing film of 2003, and is in contention for four Oscars at the Annual Academy Awards on 29 February.

In early 2000, Summers was beginning a postdoc in fish biomechanics at the University of California, Berkeley. He rented an apartment owned by a woman who was an art teacher at Pixar. At that time, the studio had just approved a script starring a fish—and the director and animators urgently wanted to know more about their subject matter.

Summers' landlady acted as a go-between, and invited him to give a lecture.

Summers didn't know quite what to expect when he first stepped in front of director and scriptwriter Andrew Stanton and his team in the luxurious screening rooms of the Pixar studios in Emeryville, California. But the film-makers devoured his words like sharks in a feeding frenzy. Summers told them about fish locomotion, behaviour, physiology and coloration. "It was the most engaged class I've ever taught," he says. "I could only get out two or three sentences before a hand would shoot up—and it was graduate-level stuff."

Tales from the deep

Summers also talked about fish oddities, such as the deep-sea anglerfish that live in such darkness that finding a mate is difficult. The tiny males swim up trails of pheromones left by the large females, and then latch on to them so tightly that they

eventually grow into each other. The male becomes little more than a parasitic testicle, able to fertilize eggs whenever the female is ready to lay them. "They loved these stories," says Summers, who is now an assistant professor at the University of California, Irvine. "My one-hour lecture stretched to two and a half hours."

He thought that would be it, but two days later, his landlady knocked on his door again: the studio wanted more. And so Summers found himself giving a three-year course in ichthyology. He organized some 20 lectures on subjects ranging from swimming mechanics to the social behaviour of fish. Some of the topics he suggested himself; others were requested by Pixar employees. All of the talks were recorded so that newcomers could catch up, but Summers was still asked to repeat some lectures—such as his popular discourse on fish locomotion—two or three times.

"In every movie, you need as much research as possible: for every fact you use, you have ten more you need to know about," says Stanton. "We had to traverse a whole ocean in the movie, so we needed a lot of knowledge."

Summers even organized a few makeshift 'labs'. Light quality is immensely important for animators, particularly the 'shaders' who have to worry about how light is reflected from surfaces. So they wanted to know, in huge detail, how fish scales reflect light. Summers brought in a selection of different fish and some microscopes, set up trestle tables and launched into a practical dissecting class



Making a splash: Marlin the clown fish's fantastic voyage was made more realistic thanks to Adam Summers (left) — although the story did bend some rules for sharks and whales.

research to extremes. It was a long swim to Sydney, so Marlin was helped on the last leg of his journey by a passing whale, who swept him into his vast mouth; later the fish was expelled through the whale's blow hole into the city's harbour. Cooper told Summers that she needed first-hand experience of the texture of the inside of a whale.

A whale of a time

Berkeley's Museum of Vertebrate Zoology, where Summers was working, is always alerted when creatures wash up from the sea. So he was able to take Cooper to look inside a newly beached dead grey whale, which had appeared on the shore near Marin, north of San Francisco Bay. Venturing her camera-bearing arm through the whale's blowhole, its mouth, and even bits of its rotting flesh, Cooper took scores of digital shots. The experience gave her a perfect feel for the reflective properties of the inside of a whale. "But she ended up quite smelly," Summers recalls.

Marine biologists appreciate the film for its lack of obvious scientific inaccuracies. "Most of my colleagues have seen it and loved it — there's some front-line fish biology in there," comments Bob Cashner, a former president of the American Society of Ichthyologists and Herpetologists, and a vice-chancellor at the University of New Orleans.

"I'm just amazed at how rigorous these people were," says Summers. One detail involved a female anglerfish whose fluorescent 'lure' — a protuberance extending from its dorsal fin used to attract prey — was used by Marlin to help him find the goggles of

Nemo's abductor in the murky depths. As described in Summers' initial lecture, she has a parasitic male clamped onto her body, just above her anal fin.

After one talk, Summers recalls, when *Nemo* was well along the production road, the director asked him and his guest lecturer, Mike Graham of the Moss Landing Marine Laboratories on Monterey Bay, California, if there was one thing that the film might get wrong that would really disturb them.

Quick as a flash, Graham said the most intolerable outrage would be to see kelp — a type of seaweed that grows only in cold waters — depicted in a coral reef. There was an uncomfortable shuffling in the audience. Then a voice from the back called out: "Better not go see the movie, then." But if you check out your video or DVD, you'll see that there is no kelp. After Graham raised his objection, every frond was carefully removed from each scene, at considerable cost.

Artistic licence

Sometimes, though, it was not possible for the film-makers to be true to the science and keep the story moving. Take Marlin's expulsion into Sydney Harbour. In fact, there is no connection between a whale's mouth and its blowhole. But Nemo's father had to get out into the harbour somehow, and whales can't spit. So in order to drive the plot, Stanton decided to defy nature.

Another compromise: the film's male sharks had no claspers — the fin extensions used to direct sperm into females during mating. It was not a matter of prudery — Summers' objections were silenced when the film-makers showed him that the sharks needed to be depicted much shorter than reality so that they would remain recognizable to viewers as they moved and span. "Because of the shortening, the claspers would have looked like umbrellas trawling around after them — so of course they had to go," says Summers.

It was a similar story with the hammerhead shark's nostrils, which should have been positioned at the far ends of the hammer. This would have left the character unable to make the facial expressions required for his role. Those fish that didn't have to act — the extras, if you like — had more realistic faces. "The 'lies' were always conscious, always a trade-off with the story," says Summers.

Indeed, so concerned were the film-makers about accuracy that Summers remained in hot demand throughout the production process. And although he won't be at the Oscar ceremony, he has been rewarded with a morsel of immortality. Right at the end of the film's long list of credits, below the voices, the technical directors and the caterers, comes: "Adam Summers — Fabulous Fish Guy." ■

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► www.pixar.com/featurefilms/nemo

► ecoevo.bio.uci.edu/Faculty/Summers/Summers.html

to explain how the optical properties of fish scales can give rise to 'structural' colours. In another lab, his pupils dissected fish heads to understand the limits of jaw movement.

Summers enlisted help for some of the lectures. "I didn't feel comfortable lecturing on some topics outside my personal expertise to such an inquisitive audience," he says. He invited experts to teach on whales, on the mechanics of waves, and on jellyfish movement and taxonomy.

Stanton was a constant presence, and attendance grew with each lecture to around two dozen people — animators, shaders, colourists, programmers, producers, writers and character developers all joined their director at various times. "We lucked out with Adam," says Stanton. "He was so enthusiastic as well as knowledgeable."

Head shader Robin Cooper took her