Profile

JZ Young 1907–1997

Jennifer Altman

JZ Young died on 4th July. Although 90 in March, and recently in poor health, he was still working. With long-time collaborators, he was preparing two books and two papers for publication. Three of these are on cephalopod brains and biology, the fourth on the autonomic nervous system of dogfish, an early interest to which he returned after his retirement in 1974.

John Young (known as JZ to colleagues and students) considered himself first and foremost an invertebrate zoologist. This will surprise many, for he is perhaps most widely known for his seminal textbooks, *Life of Vertebrates* and *Life of Mammals*, and for 29 years he was Professor of Anatomy at University College London (UCL). But his research career, spanning almost 70 years, was largely devoted to the nervous systems of the cephalopod molluscs.

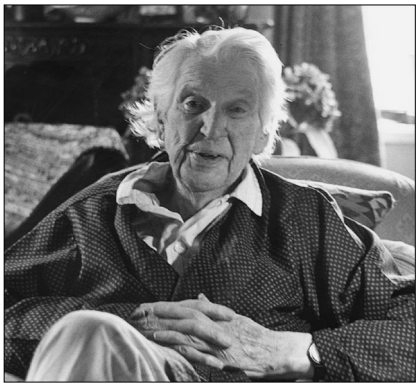
The driving principle in Young's research and extensive writings was the relationship between structure and function. He remained adamant that physiology cannot be understood without a sound anatomical foundation, and that both are moulded by evolution through the need to maintain homeostasis in specific environments. This was well exemplified in his studies on squid species from different depths in the ocean and is the theme of the forthcoming book, co-authored with Marion Nixon, *The Brains and Lives of Cephalopods*.

His two biggest research contributions were his discovery of the giant fibre system in squids, while working at the Stazione Zoologica in Naples in 1928, and his extensive studies of learning and memory in the octopus. The squid giant fibre quickly became the classic preparation for fundamental research into the ionic basis of electrical activity in neurons, work that was based on Young's exact description of the system, published in 1939 in *Philosophical Transactions of the Royal Society of London*. Fascination with learning in the cuttlefish, *Sepia officinalis*, led to the experimental and anatomical work on octopus brain and memory that occupied most of the years he was at UCL. In collaboration with Brian Boycott, Martin and Joyce Wells and many others, he built up a detailed picture of the separate systems for visual and tactile memory, and showed that memory storage was distributed through several lobes of the brain.

One disappointment was the difficulty of obtaining stable intracellular recordings from octopus neurons, but the wheel may now have turned full circle as Ulli Budelmann and colleagues at Galveston, Texas have recently developed brain-slice recordings from the cuttlefish. Shortly before his death, Young was working with Budelmann on an atlas of the cuttlefish brain.

During the Second World War, Young's attention turned to the repair of nerves damaged by bullet wounds, which introduced him to clinical studies and contributed to his controversial appointment in 1945 to the Chair of Anatomy at UCL. He was the first scientist without medical qualifications to occupy such a post in Britain. He rapidly built up a department with an excellent reputation for both research and teaching, and which included one of the first electron microscopy units, established in 1955.

Although JZ was modest about his achievements as a teacher, many students, myself included, are indebted to his inspiration and insights, and his graduates have populated anatomy and neuroscience departments in Britain and the USA. For medical students, he introduced teaching anatomy by investigation rather than demonstration. His



Young at ninety. (Photograph courtesy of Giorgio Gabella.)

lectures to medical students on aspects of human biology such as population numbers and evolution were hugely popular and often attended by graduate students and staff; they were published as *An Introduction to the Study of Man*.

The Anatomy BSc students also enjoyed the unforgettable experience of assisting in the octopus lab in Naples. The work was hard and dirty but JZ invited them to the local wineshop in the evenings, to meet the scientists visiting the Stazione Zoologica and join in discussions about science, philosophy and Italian politics. *Il Professore* is still remembered by the Neapolitans and was delighted to have recently been made an Honorary Citizen in recognition of his long connection with the city.

Another concern was "to show how knowledge of the brain can help in everyday human affairs." Starting in 1950 with his Reith lectures for the BBC, *Doubt and Certainty in Science*, he wrote several books exploring "how the whole range of human capacities can be related to known cerebral activities." These reflect his conviction that brain and mind are inseparable, even for attributes such as loving, suffering, worship and the creation of art, on which he lectured at the Tate Gallery, London in 1981.

To the end of his life, he thought about memory mechanisms. From reverberatory circuits, which he

proposed in the 1930s, through the 'mnemons' of the 1960s and selection among large numbers of neurons in the 1970s, he developed theories of memory storage based on the anatomy of the circuits in the cephalopod brain. Finally, he saw the octopus memory system as a series of matrices with recurrent inputs, an organization it shares with the insect mushroom bodies and the vertebrate hippocampus and cerebellum.

In their time, each of these ideas has challenged us to think in different ways about how the brain works — possibly JZ's most enduring and least acknowledged contribution to neuroscience.

Jennifer Altman is a freelance writer, based in London. She interviewed JZ Young shortly before his death, for a *Current Biology* Profile intended to celebrate his 90th Birthday.

Turning points

First steps into the signalling maze

Robin Irvine

There was no blinding flash of inspiration, but with the benefit of hindsight I can clearly perceive two papers, both read when I was an undergraduate studying Biochemistry in Oxford, as setting the course of my research career even as it began. One was a paper by Jamshad Tata [1], to which my attention was drawn by an undergraduate friend as being a particularly clear indication that cyclic AMP was probably not the be-all and end-all of how hormones transduced their signals. That anyone might have thought it was may sound rather strange, especially in today's complex world of cell signalling, but as a student in the early 1970s I had to wade through numerous reviews, full of amazingly complex arguments that sought to fit every recorded effect of every known hormone into a paradigm that centred around cyclic AMP. It was the only known second messenger, so it had to do it all. Try reading a review from that time and you'll see what I mean.

Anyway, what Tata [1] showed was that if you treat rats with growth hormone or tri-iodothyronine, each of these hormones causes an increase in phospholipid synthesis/turnover in the same tissue (liver), but over markedly different time courses. Moreover, if the two hormones were administered together, a sum of the two independent patterns was the result — in essence the two hormones do their own thing, and ignore each other. Thus it appeared very unlikely that they were working solely by controlling the levels of the same second messenger (cyclic AMP).

After graduating, I joined Daphne Osborne's lab in Cambridge to do a PhD on plant hormones (I had wanted to work on plants since I was at school, where I was taught by an inspirational biology teacher with an enthusiasm for botany). At that time there was some controversy about the interrelationship between two plant hormones, auxin and ethylene. In particular, there was an argument about whether ethylene was a mediator of some, or even all, of auxin's effects.

There was already evidence in the literature that some plant hormones could stimulate phospholipid turnover, so I decided to apply Jam Tata's approach to plants — that is, to monitor the timecourse of any changes in phospholipid synthesis caused by ethylene and auxin, applied independently or together, and thus learn something about their proposed interrelationship. Unfortunately, auxin didn't do much to phospholipid synthesis, but ethylene did (which led to my first paper [2]), and all this got me into the business of what we now know as phospholipids and signal transduction.

The other key paper I perused as an undergraduate was a review by Rex Dawson on phospholipid synthesis and breakdown [3]. This is by any criteria a classic, as it summarized and introduced many key aspects of the topic. For example, Dawson crystallised there the whole concept of the influence of substrate structure on the activity of phospholipases and other phospholipid-metabolising enzymes, a concept that still haunts and confuses all of us who work with phospholipids. Naturally, this review was a help to me in my adventures with plant phospholipids (above), but more specifically it made me aware of Rex Dawson as a pioneer in phospholipid biochemistry (not least, in the context of subsequent events in my career, he was the discoverer of phosphoinositidase C and the co-discoverer of phosphatidylinositol 4,5-bisphosphate). With his laboratory being only the other side of Cambridge, in Babraham, where could it be more logical for me to go to do a post-doctoral fellowship? And so, in 1975, I was transduced eight miles south, and that much further down the road (or into a fractal maze, depending on your viewpoint) of phospholipids and signal transduction; I don't seem to have deviated much from it since.

References

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2. Irvine RF, Osborne DJ: **The effect of ethylene on [1-^{14}C]glycerol incorporation into phospholipids of etiolated pea stems.** *Biochem J* 1973, **136**:1133–1135.
3. Dawson RMC: **The metabolism of animal phospholipids and their turnover in cell membranes.** In *Essays in Biochemistry* Vol 2. Edited by Campbell PN, Greville GD. London and New York: Academic Press; 1966:69–115.

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The editors of *Current Biology* have invited a number of biologists to reveal the papers that have influenced them most profoundly in their careers. These brief essays are being published in the *Turning points* series.