that the paying customers make a contribution to the conservation of the species.

A recent research paper shows, however, that the process has not led to any successful re-integration of lions into the wild, because captive-bred lions and their offspring are ill-suited for survival compared with their wild-born peers (Oryx (2012) doi:10.1017/S0030605312000695). "The simple fact is, 'lion encounter' type programs do little to help conserve wild lions," said Luke Hunter, senior author of the study and president of Panthera. "We show that any sincere effort to re-establish lions simply has no reason to resort to captive animals; wild lions are already much better equipped to be wild. Releasing captive animals unnecessarily increases the costs, risks of failure and the danger — to both lions and humans." The paper argues that reintroduction of lions should be based on translocation of wild individuals from a similar genetic and ecological background.

Cats and people

Around the world, habitat loss and conflict with human interests are the main factors contributing to the disappearance of the once-dominant cat species. Mohammad Farhadinia and colleagues from the Iranian Cheetah Society (ICS; www.wildlife.ir) and Cheetah Conservation Fund (CCF) have studied the feeding habits of the critically endangered Asiatic cheetah in northeast Iran. "The government has spent years of working to save the creature as the symbol of wildlife in the country," Farhadinia explains. "Presently, the Asiatic cheetahs have been reported from more than 15 different areas, all have been upgraded as a protected area. However, their numbers are so low that no more than 70 individuals can be expected for the entire country, meaning for the entire Asian continent, making it the second most critically endangered cat in the world, just after the Amur leopard."

The cheetahs would normally hunt medium-sized ungulates, but in recent years, the decline of their prey species has led them to take livestock instead, as Farhadinia and colleagues report (J. Arid Environ. (2012) *87*, 206–211). As with other big cats, small mammals can occasionally help to fill their stomachs, but can't provide a sustainable diet in the long term. In other areas of Iran, the cheetahs are luckier in that they have fairly stable prey populations, particularly wild sheep.

On the other side of the Persian Gulf, the Sultanate of Oman invited Earthwatch to come and set up an ambitious research and capacity development project to help save the Arabian Leopard (*P. p. nimr*) from extinction in the wild. Working closely with Omani and international researchers, and collaborating with the National Field Research Centre for Environmental Conservation and the Diwan of Royal Court, the project is creating an ecological framework to support the conservation of the leopard, concentrating on key species-level factors, such as leopard population density and distribution, genetic composition, prey distribution and density, and leopard dietary requirements. Camera trapping and genetic analysis of scats are being used to estimate leopard population density and distribution, genetic composition and prey distribution. Earthwatch aims to help save this critically endangered species and foster a new generation of Omani field scientists and conservationists.

"Some of the main threats to the Arabian leopard include the fragmentation and loss of wildlife habitat in Jebel Samhan caused by development and an increase in livestock grazing," conservation biologist Tessa McGregor explains. "These conservation threats are anthropogenic, therefore Earthwatch is working to develop a conservation programme that can manage the impact of human activity on and balance the needs of human resource users, wildlife and other elements within the ecosystem."

The unstoppable spread of *Homo sapiens* has been bad news for the wild felids, and in the long term, some species may only survive in captivity. Only one species benefited and gained a new, perfectly comfortable and secure habitat: *Felis catus*, also known as the house cat.

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For regular updates on cat conservation, consult Cat News (http://www.catsg.org/catnews/, free access).

Q & A

David L. Glanzman

David Glanzman graduated with a bachelor's degree in Psychology from Indiana University in 1973, and received his PhD, also in Psychology, in 1980 from Stanford University. He did postdoctoral research with Frank Krasne at UCLA and later with Eric Kandel at Columbia University. In 1990 he returned to UCLA as an Assistant Professor in the Department of Kinesiology (now the Department of Integrative Biology and Physiology). He is currently a Professor in the Department of Integrative Biology and Physiology, and the Department of Neurobiology at UCLA, as well as a member of the Brain Research Institute and Co-Director of the UCLA Integrative Center for Learning and Memory. In 2004 he received the Senator Jacob Javits Award in Neuroscience from the National Institute of Neurological Disorders and Stroke. His major research interest is the neurobiology of learning and memory, particularly the mechanisms that underlie the persistence of memory.

How did you become interested in science? As a young man I had no interest in science. I began my academic career at Oberlin College in Ohio as an English and film major. My ambition was to make films, not Hollywood movies but, rather, experimental films (then known as 'underground' films). After my sophomore year I decided I didn't need a college degree to be a filmmaker, so I left Oberlin and moved to New York City. There, after a stint as a silk screen printer, I got a job as a messenger boy and apprentice film editor at Kaleidoscope Films, a well-known trailer production company. I lived in a walkup tenement building in the East Village. My plan was to eventually join the Motion Pictures Editors Guild, the union for film editors, which would provide me with a decent income while giving me the freedom to make experimental films on the side. For various reasons this plan didn't work out and I decided to return to college. My father, viewing the two years I had spent at Oberlin, an expensive private college, as a waste of his money, refused to pay for me to return there.

I did not protest; two winters in a small college town on the bleak plains of northern Ohio were enough for me. So I enrolled at Indiana University, a large, relatively inexpensive, public university in my home state; I also switched my academic major to psychology because I believed, somewhat naively, that psychology could teach me something useful about the mind, generally, and about my own in particular. My second undergraduate experience was far more satisfactory than my first. I had some excellent professors in my courses at I.U. and I took my studies seriously, with the result that upon graduation I was accepted into Stanford's psychology PhD program.

Why did you decide to go into neuroscience? My original intent in graduate school was to study psycholinguistics and cognitive psychology. However, by the end of my first semester at Stanford I was bored. It seemed to me that cognitive psychology lacked rigor and, specifically, that the results of the experiments were often too weak to decide among competing hypotheses. My eyes were opened to an alternative approach to the mind by a first-year graduate course in visual perception that I took with Barbara Sakitt, a visual psychophysicist and then one of the few women in the US with a PhD in physics. The reading in this class included the pioneering psychophysical paper of Hecht, Schlaer and Pirrene demonstrating that rods in the human eye could respond, on average, to a single photon of light (Sakitt, together with Horace Barlow, published an important follow-up to Hecht *et al.*'s study); the electrophysiological studies in the horseshoe crab by Ratliff and colleagues showing that Mach bands were created by lateral inhibition within the retina; and the magnificent papers by Hubel and Wiesel describing the receptive field properties of neurons in the mammalian visual cortex.

These works were nothing less than revelatory for me; they proved that psychological phenomena could be analyzed rigorously, using the tools of physics and biology. I resolved to go into neuroscience, a field for which my academic training had left me almost entirely unprepared. Fortunately, the Stanford psychology faculty, after nearly voting to throw me out of the program, in part for not turning in the required first year research project — I had determined not to waste any more of my time on cognitive psychology — decided, to their credit, to give me sufficient rope to hang myself; I was permitted to do my PhD research in the laboratory of Kao Liang Chow, a professor of neurology at Stanford. (Interestingly, Chow, a visual neurophysiologist, was a physiological psychologist by training; his PhD mentor had been Karl Lashley, the legendary early seeker of the engram.) In preparation for my doctoral research, during which I quantified the linearity of spatial summation in neurons of the rabbit's visual cortex, I began to take graduate courses in neuroscience. For the next two years I recall always feeling like the dumbest student in the room; undoubtedly I was the most ignorant.

Can you name any particular scientific paper that influenced you the most? No single paper, but rather a set of papers, those of Hubel and Wiesel on the organization and development of the visual cortex. As I said, Hubel and Wiesel's monumental studies helped me to realize that a psychological phenomenon such as perception could be usefully investigated using the tools of cell biology. The experimental methodology of Hubel and Wiesel also appealed to me; even though I was a psychology student with little training in the 'hard' sciences I figured I could learn how to make extracellular electrophysiological recordings from neurons!

What attracted you to invertebrate learning? Toward the end of my graduate career at Stanford I became interested in the role of synaptic plasticity in learning and memory, and decided to enter this field for my postdoc. I figured there were two ways for me to go. The first was to do electrophysiological recordings from slices of the hippocampus, a major center of learning in the mammalian brain. The second was to pursue the study of learning and memory in an invertebrate organism, one that possessed a nervous system amenable to electrophysiological analysis. Landmark studies establishing the role of synaptic plasticity in invertebrate learning and memory were being published at that time. These studies featured two invertebrate models in particular: the crayfish, where Frank Krasne and Bob Zucker showed that habituation of the escape response was mediated by homosynaptic depression; and *Aplysia*, where Eric Kandel and his colleagues performed parallel synaptic investigations of habituation and sensitization of the withdrawal reflex.

Kandel's group was the first to discover a behavioral role for heterosynaptic facilitation, that of mediating sensitization of the *Aplysia* reflex. (This discovery, together with the subsequent elaboration of the cellular and molecular processes that underlie heterosynaptic facilitation, was the basis for Kandel's Nobel Prize in 2000.) The elegance of these studies, and their establishment of direct links between synaptic plasticity and learning — something impossible to do in mammals back then and problematic even today — were tremendously appealing to me, and I resolved to work on invertebrate learning and memory for my postdoc. In fact, I was fortunate to do postdoctoral stints in two of the principal labs in the field, first Krasne's at UCLA, and later Kandel's at Columbia University.

What is the best advice you've been given? That given to me by my undergraduate mentor, David Pisoni, a professor of psychology and linguistics at I.U. He invited me to work in his lab as an undergraduate assistant, strongly encouraged me to go to graduate school, and carefully guided me through the application process. Becoming an academic psychologist seemed distinctly preferable to me as a career to the one proffered by my father: to work with him and my uncles, aluminum siding salesmen in Indianapolis.

What advice would you offer to someone starting a career in neuroscience? Look in the mirror and ask yourself the following questions: Am I willing to work ridiculously long hours for the next several decades? Am I prepared to sacrifice several years of my labor in my twenties and thirties to one or more postdoctoral apprenticeships in order to advance my career? Would I move myself, and possibly my family as well, to wherever in the country or world my postdoctoral lab or tenure-track professor job is located? Could I put in perhaps a decade of hard work and financial sacrifice as a postdoc only to confront the realization that I may never get a tenure-track job? What financial status am I prepared to accept? Is being financially secure sufficient or must I be wealthy? If your answer to any of the first four questions is “No”, or if you would never be satisfied without achieving wealth, you should think seriously about an alternative career. You should perform the above exercise every two years.

Do you have a scientific hero? Yes, the Spanish neuroanatomist, Santiago Ramon y Cajal. Cajal resembled Picasso in his originality and genius. Actually, in some respects Cajal was even more impressive than Picasso, because whereas Spain has always had great painters, it was a scientific backwater when Cajal was starting his career; consequently, he had no real role models. Cajal was a remarkable man, someone who possessed almost superhuman will power. For example, although Cajal adored chess and was apparently an excellent player, he gave it up because he felt that it had become a vice and was interfering with his research. He would spend hours in his laboratory each day staring through a microscope, examining brain tissue he had stained using the method invented by his rival, the Italian neuroanatomist Camillo Golgi; then, in the evenings, seated at his desk at home, Cajal would make exquisitely detailed, stunningly accurate drawings from memory of what he had seen earlier in the microscope. Based on his anatomical investigations he formulated the neuron doctrine, one of the foundational concepts of neuroscience; moreover, he was one of the early proponents of the idea, now almost universally accepted by neuroscientists, that learning and memory involve the growth of new synaptic connections in the brain.

If you knew what you know now earlier on, would you still pursue the same career? Yes, definitely. I love my work. And I feel privileged to be a professor at UCLA, where I have stimulating colleagues and am paid well enough to live comfortably in Los Angeles, a city I love. I just wish I had known how things would turn out when I was younger. There were many times when I doubted that I would succeed in a career in neuroscience. And I know I wasn’t alone in my skepticism!

What do you think are the big questions to be answered in your field? During the previous decades the field has focused on synaptic plasticity, the cellular and molecular processes that underlie the strengthening and weakening of synaptic connections during learning and memory. This enterprise has been enormously successful. But synaptic plasticity is unlikely to be the whole story. In order to fully understand memory we must be able to identify the neural circuits in the brain that mediate specific memories, to establish how these circuits are formed during learning, and to discover how they become reactivated when a memory is recalled.

A major hurdle is that, whereas we possess excellent techniques for investigating molecular, cellular, and synaptic processes, we lack good experimental tools for studying neural circuits in the brain. The challenge of the next several decades will be to develop such tools. One promising new technique, optogenetics, permits one to optically activate a discrete population of neurons in the living brain. Advances such as this give one hope that neuroscientists will one day be able to identify functional neural circuits in the brain, to monitor the activity of neurons in these circuits over long periods of time, and to selectively activate or disable them. The information from such studies will, I predict, radically alter our understanding of behavior, cognition, and memory.

What do you see as the biggest threat to the field? A major change that has taken place in neuroscience over the course of my professional life is the decline of ‘middle class’ labs. By that I refer to medium-sized labs, funded (in the US) by one or two NIH individual investigator (R01) awards. This decline is primarily the result of shortsighted budgetary decisions made by our government. NIH’s overall budget now represents less than 0.3% of the gross domestic product (GDP) of the US; by comparison, the governments of China, India, South Korea, Taiwan, and Singapore spend 2–5% of their countries’ GDPs on biomedical research. But other factors have also contributed to the decline of the middle class in neuroscience. Increasingly, precious research funds are being set aside by NIH for ‘big science’-type projects, large, multidisciplinary efforts headed by multiple principle investigators, or program projects targeted at specific topics or diseases. Such projects drain away money from R01 grants, recognized traditionally as the major source of creative new ideas in biomedical science.

In this regard I confess to strong doubts about NIH’s current emphasis on so-called ‘translational’ research. It’s difficult to imagine that the money being directed toward translational research is not coming, at least to some extent, at the expense of funding for basic research. Although the stated rationale for the present translational enthusiasm is certainly admirable — to speed the development of cures for diseases — there is no empirical evidence that the translational approach accomplishes this any better than the traditional one. Claims to the contrary at this point are mere propaganda. Particularly when it comes to disorders of the brain most neuroscientists would, I believe, agree that the major limitation on the discovery of new treatments is our present ignorance regarding basic mechanisms of brain function.

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