Pigging Out in France

Elizabeth Adkins-Regan

Abstract

I spent a year in France with the help of a Fulbright Award. As a life scientist and animal researcher, my primary aim was to carry out a collaborative experiment with my host on a topic of mutual interest, sexual development in animals, specifically pigs. That aim was fulfilled, leading to a long-term shift in my research. The value of the experience went well beyond that, with an enduring impact both professionally and personally.

Keywords: France • behavioral neuroendocrinology • sexual partner preference • pigs

When I applied for a Fulbright Award in 1986, I was an associate professor at Cornell University, where I had been on the faculty since 1975. My field was behavioral and evolutionary neuroscience, also known as behavioral neurobiology. This branch of science seeks to discover and understand the neural and hormonal systems and processes responsible for naturally-occurring adaptive behavior that has been shaped by selection in the course of evolution. My own research investigated hormonal effects on the brain responsible for reproductive behavior in animals, the subfield known as behavioral neuroendocrinology. I was particularly interested in the role of hormones like estrogens and androgens in the development of sex differences in behavior. Most of my work had focused on birds and on behavior like singing, courtship displays, and mating.

What drew me to France scientifically was the possibility of extending my research to sexual partner preference and to mammals. In this context "sexual partner preference" refers to the pronounced and widespread sex difference across animals in preferred sex of mating partners, with females usually but not always preferring male partners and males tending to prefer female partners. (The analog in humans is often referred to as sexual or gender orientation.) Here the interesting sex difference is defined not by the behavior itself (the motor acts), but by the social preference for the sex of partner for engaging in the behavior, a potentially more complex phenomenon. Remarkably little was known about how this sex difference comes about during development, and it was not at all obvious that hormones would necessarily be involved.

As I combed through the literature on the subject, I discovered some exciting recent work with pigs as the subjects that strongly pointed to a major role for hormones produced by the testes of males during the first months after birth in the development of their adult attraction to females and interest

in mating with females. The work was coming from both France and the US. An opportunity to collaborate with a French researcher better matched my strong wish to spend some time living in another country, to learn how that country worked, and to see the US from another perspective.

With the French researcher on board to be my host and collaborator, I was thrilled when my Fulbright application succeeded. Like many scientists of my generation, I did not already know a spoken non-English language. I had taken Latin in high school and German (reading and translation only) as a college freshman. To prepare for my Fulbright year, I took a year of French at my university along with the freshmen. The summer before going, I hired a tutor to further work on conversation. I did not want to be a visiting scientist who made no effort to communicate in anything other than English. I also suspected, correctly as it turned out, that to do the research, I would need to be understanding the French of the non-professional staff who raised and cared for the animals. Furthermore, I was determined to get to know France and French life through the French language. Scientific culture is international and rather similar everywhere, and so is academic culture to some extent. I wanted to be able to interact with non-academic and non-professional people as well as scientists.

Off to France

I arrived in France just as summer was transitioning to fall. Right away I was invited to a gathering for Fulbright scholars at the American Embassy in Paris. It was quite eye opening to see the show of force surrounding the embassy building, with dozens of heavily armed police due to recent terrorist activity in the city. Also eye opening was that I could write checks on my Fulbright stipend local checking account from anywhere in France without showing any identification. I later learned from French friends that what kept the system honest was that penalties for bouncing a check were much more severe than in the US.

My research took place at the branch of the Institut National de la Recherche Agronomique (INRA, National Institute of Agricultural Research) in Nouzilly, just outside of Tours. France has long been a European agricultural powerhouse, and the Nouzilly INRA was an impressive facility. There were multiple research groups studying behavior and endocrinology in a variety of domestic farm animals, including most of the French researchers whose work had long been familiar to me from reading the literature. My scientific host and collaborator, Prof. Jean-Pierre Signoret, was one of the founders of the study of hormones and behavior in farm animals and a renowned expert on the behavior and endocrinology of the domestic pig. I was free to originate and plan an experiment to achieve my goal of better understanding the development of sexual partner preference in pigs. Signoret provided all the necessary advice and resources and assisted with surgery and behavioral testing. He

was also unfailingly gracious and had a wonderful sense of humor of the kind that is essential when working with animals as lively, intelligent and large as pigs. I learned a great deal from him about the domestic pig, the different breeds, and the wild boar, the ancestral form that is also farmed in France.

The behavioral testing took place in a giant T-shaped maze that allowed each subject to choose to spend time with either an adult male or an adult female. Together we found that males develop to be attracted to females because they are exposed to high levels of estrogens produced by their testes during the first months after birth. Males in the group where testes were removed shortly after birth (that were castrated, a standard practice in pig farming), grew up to be attracted to males instead of females. On the other hand, if males were in a group given implants of estradiol, an estrogen, as replacement for the missing testes, they showed the normal (for pigs) preference for females. At this point perhaps you are scratching your head and thinking, wait a minute—aren't estrogens female hormones? In the world of popular science, they are, but nature has little regard for such categories. In every vertebrate animal that has been studied, both sexes produce both estrogens and androgens, any sex differences lie in relative amounts, and in some species, like pigs and horses, males' testes produce as much of the estrogens as female ovaries do. In the pigs, the testes are major estrogen producers during the period after birth.

Pigs develop more slowly than lab animals like rats or mice, so it was a challenge to fit the experiment into the allotted 10 months. It was completed just in time and fortunately it was a success. To a scientist, that means there was a clear answer to the question and clear support for the hypothesis. In this case, the hypothesis was that in pigs, testicular estrogens in early life are responsible for the sexual partner preference of adult males.

My time at INRA and in France was not without its challenges. As a somewhat shy science geek who began learning French at the age of 40, there were some stressful moments, especially at the beginning. In addition, it was one of the coldest French winters for some years, and the pig barns were unheated. My first purchase was a warm sweater to wear under my work uniform. Even then, I was cold much of the time.

Impact on my scientific career

My Fulbright-supported research experience had a lasting influence on my subsequent scientific career and research directions along with those of a number of my graduate students and post-doctoral collaborators. After I returned, I had the knowledge to co-supervise a dissertation that determined which sense of smell was responsible for female pigs' attraction to the odor of male pigs, a phenomenon I had witnessed first-hand while at INRA. With my interest in sexual partner preference reinforced by the experiment with the pigs, I initiated a program of research on the sexual partner preference of

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a bird, the zebra finch, that forms long-term pair bonds, an arrangement typical of a large percentage of bird species. Animals that form pair bonds have a close and continuous social relationship with another individual that goes beyond simply mating, and often raise the young together (co-parent). Nothing was known about whether hormones have anything to do with this kind of sexual partner preference—with why male birds (usually) pair with females and females pair with males. I was determined to find out. Later on, the research evolved to focus on the pair relationship itself (the bonding process), and whether hormones were involved in the strong motivation to form a pair relationship. Because of these new research directions, I eagerly agreed to participate in a multi-college, multi-disciplinary three-year project (2004-2007) involving both social scientists (human researchers) and biologists (animal researchers) titled "The Biology of Families: From Ecology to Endocrinology" (Evolving Family Project, Institute for the Social Sciences, Cornell University).

Impact on my academic career more broadly

The Fulbright year also influenced my academic life beyond my own research interests and connections. I came back to my university with new understanding of the experiences of foreign visitors and students. I came back with a new openness to moving beyond my comfort zone and giving back to institutions and structures from which I had benefitted. When, a few years later, I was asked to become an associate dean for my college, I accepted readily. (It didn't hurt that I was in France on a vacation when the request came.) I ended up serving in that administrative capacity twice, in 1991-1996 and 2009-2012. Both times my role included working on behalf of the foreign language teaching programs, for which I had even greater respect than before because of my own experience learning French and then using it in the workplace.

Impact on my life

During the Fulbright year my French language preparation paid off richly in ways beyond the research setting. My husband and I (he had come with me) quickly became close and lasting friends with the couple who spoke no English from whom we rented a weekly-rate vacation home while searching for more long-term accommodation. They introduced us to all their friends and family and, together with social time with my colleagues at INRA, we came to have a very active social life. Through these friendships and social activities, I learned an enormous amount about the region of France where we were, its history, government, politics, and school system. I learned how the French version of a government-funded health care system worked. We were in one of the most famous regions of France for food, and there were many opportunities, both in restaurants and in people's homes, to learn a

great deal about what makes the cuisine and the restaurants so special and so treasured. I "pigged out" many times and came back a few pounds heavier but very happy to have gained so much insight. There were also opportunities to talk to local farmer-vintners producing artisanal wine and learn about its production. Throughout the year I met and interacted with a broad range of people ranging across the political and social spectrum. Little of this could have happened if I had not had the good sense to learn French before my Fulbright year.

I came back to the US with a more advanced knowledge of the French language than when I set out, and that too has had a lasting impact. Since then I have been able to read books in French, which opened up a whole new world of literature, not only literature from France but also Francophone literature from Canada and the Caribbean.

Conclusion

My Fulbright year allowed me to achieve my goal of collaborative science that had a long-term influence on my research career. It was also an exceptional opportunity to experience another country first-hand for an extended period, to come away with a greater understanding and appreciation of its place in the world and world affairs, and to acquire lasting language skills.

Notes

1. The year in France doing research at INRA was also supported by a US National Science Foundation Senior Award (Scientists Exchange Competition).

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3. Bailey, N.W. and Zuk, M. (2009). Same-sex sexual behavior and evolution. *Trends in Ecology and Evolution*, 24, 439–446.
4. Ford, J. J. (1983). Postnatal differentiation of sexual preference in male pigs. *Hormones and Behavior*, 17, 152–162.
5. Lévy, F., Nowak, R., & Chemineau, P. (2010). Tribute to Jean-Pierre Signoret. *Hormones and Behavior*, 57, 269-270.

The author (in the required work uniform) recording behavior in the pig barn at INRA in Nouzilly, France.

Biography

Elizabeth Adkins-Regan is professor emeritus of psychology and of neurobiology and behavior, Cornell University, Ithaca, New York. She received an American Fulbright Research Scholar Award (1986-1987) to France. She is the recipient of a Daniel Lehrman Lifetime Achievement Award from the Society for Behavioral Neuroendocrinology (SBN), the Donald S. Farner Medal from the International Symposium on Avian Endocrinology, an Exemplar Award from the Indiana University Center for the Integrative Study of Animal Behavior, and a Howard Bern Award from the Society for Integrative and Comparative Biology. Adkins-Regan is a Fellow of AAAS, the Association for Psychological Science, and the Animal Behavior Society, and has served as President of SBN. She can be contacted at er12@cornell.edu