



AN INCUBATOR FOR NEW FIELDS
RANDOLPH M. NESSE

Randolph M. Nesse, M.D., is Professor of Psychiatry, Professor of Psychology, and Research Professor at the Institute for Social Research at the University of Michigan, where he directs the Evolution and Human Adaptation Program. He is a Board Certified psychiatrist and Distinguished Fellow of the American Psychiatric Association who sees patients regularly as well as conducting research and teaching graduate school courses. Nesse collaborated with George Williams on several early works in Darwinian Medicine, including the book *Why We Get Sick: The New Science of Darwinian Medicine* (1995). Dr. Nesse's current research focus is on how selection shapes mechanisms that regulate defenses such as pain, fever, anxiety and low mood. Low mood is useful to disengage effort from unreachable goals, and failure to disengage often leads to depression. Closely related is his work on how runaway social selection can shape human capacities for altruism and empathy. Dr. Nesse has devoted himself to encouraging new applications of evolutionary biology in medicine. – Address: University of Michigan, East Hall Room 3018, 530 Church St., Ann Arbor, MI 48104-1043, USA. www.nesse@umich.edu. E-Mail: nesse@umich.edu

The most distinctive and valuable thing about the Berlin Wissenschaftskolleg seems to me to be not its history, buildings, funding, library, restaurant, or even its truly extraordinary people. What makes Wiko special is its values. I don't know of any other organization, not even other Institutes of Advanced Study, that encourage members to do whatever seems most important. Not what is most profitable or productive, not what is likely to generate public acclaim, but whatever the individual researcher thinks is most important. It is remarkable that Wiko has been able to maintain this commitment to the free pursuit of

knowledge for its own sake. For those in established fields, it is liberating. For those of us developing new fields, it is invaluable.

The field of evolutionary medicine is not just new; it barely exists. This still surprises me. The utility of evolution for medicine seems so obvious that I keep wondering whether the chasm between the fields is only in my imagination. Perhaps I have been looking for bridges while ferries are busily traversing the gap! But our *Schwerpunkt's* discussions soon made it clear that the gap is as wide as the Grand Canyon. We recognized early on that we had a rare opportunity to think carefully about what evolution can offer to medicine AND what medicine can offer to evolutionary biology. Universities offer no niche for scholars addressing such questions. Many of the questions are about history, but they don't interest historians (yet). Some core questions are philosophical, especially those about standards of evidence, but philosophers rarely address them. Pedagogical questions about what doctors need to know about evolution are not on the radar of medical educators. Biologists sometimes study medical problems, but few are concerned with understanding disease in general. And, very few doctors are aware that medicine is making full use of only one half of biology, much less asking why.

The Wissenschaftskolleg made it possible for our *Schwerpunkt* to tackle these questions. Our group included an evolutionary geneticist (Mark Thomas), an evolutionary biologist who edits a major journal (Catriona MacCallum), a pediatrician/physiologist/editor (Robert Perlman), and an expert in the evolution of infectious disease (Carl Bergstrom). As we got going, we found new members who were already associated with Wiko, including a pediatric oncologist (Dietrich Niethammer), a nutrition researcher (Hans Biesalski), an evolutionary biologist who studies insects (Raghavendra Gadagkar), and a leading theoretical biologist (Peter Hammerstein). It proved a rich mix.

How to make the best use of the opportunity? Our work together was on three levels. First, we examined specific research projects to see if we could agree on how to tell the wheat from the chaff. Second, we looked for general principles – foundations for bridges at narrow points across the gap. Finally, we quickly realized that even our most profound conclusions would not have much lasting effect unless communication could be established among the diverse groups applying evolutionary principles to medicine and public health.

Examining specific research was the most pleasurable part of our work. Does malnutrition in the uterus set a fetus off on a lifelong path optimized to a harsh environment? Why can't we find the genes for schizophrenia? Do variations in skin color influence risk of disease via variations in Vitamin D synthesis? We always disagreed, but usually to the right

degree; by the end of each discussion we had made progress. No amount of individual study could substitute for these seminars. I came away with more respect for the difficulty of the task, more confidence that it was only difficult, not impossible, and a conviction that collaborations among people with many different kinds of expertise will be essential for success.

General conclusions were harder to come by. Some were obvious. For instance, we made several lists of what doctors need to know about evolution, and why. Those lists will provide a good foundation for curriculum planning. Other tasks were harder. Figuring out how to test evolutionary hypotheses about why a disease exists at all is the hardest and most important of all. We increasingly realized, as our work went on, that such questions are new in fundamental ways. They require new strategies. Experimental methods are insufficient. This is very difficult for many scientists to grasp. Even some distinguished researchers do not grasp the fundamental difference between explanations of how things work and explanations of how they were shaped by natural selection. Standards of evidence for testing evolutionary explanations are still developing. We made progress, but this question will not have a definitive answer anytime soon.

Some carefully laid plans dissolved in the face of new opportunities. Shortly after arriving in Berlin, I got an invitation to write an article about how evolution could be applied to medicine. I have thought about this for years, but thanks to time to think, and our *Schwerpunkt's* conversations, the framework became clearer. The big division is between applications of established methods (such as population genetics), and asking and answering new questions about why the body isn't better "designed". In collaboration with Steve Stearns, and thanks to being able to work on the article all day every day for weeks on end, we were able to lay out the landscape for the field more clearly than before. The article was published before the halfway point of the year. It is amazing how fast things can happen now. Shortly thereafter, Oxford asked if I would write a chapter with Richard Dawkins – the first on evolution for a major medical textbook. This was not part of the plan, but being at Wiko made it possible to get it done, despite a very short deadline.

The third challenge, how to establish communication among people from diverse disciplines, is as difficult as it is important. This is not a scientific question, but answering it is essential for the science to grow and progress. The field of evolutionary medicine is needed precisely because a huge gap keeps evolutionary knowledge from making its full contribution to medicine and public health. To make a difference, we had to understand why the gap existed in order to propose practical solutions. We felt as if we had discovered that

engineers were not learning physics, that they did not know what they were missing, and that the physicists were not interested in teaching them. It is obvious that physics is essential for engineering, but much work remains to explain why evolutionary biology is essential for medicine. Strategies for creating closer links with evolutionary biology will advance medicine more than any specific research project. Figuring out the best strategies is an ambitious enterprise, the exact kind of interdisciplinary project that Wiko specializes in.

The traditional first step is to organize a workshop. With wonderfully effective help from Wiko meeting planners, we did just that. We followed the same general approach we used for our *Schwerpunkt* meetings – a mix of specific scientific questions interleaved with brainstorming about how to advance the field most quickly. The Workshop was more exciting even than most of us had hoped, in part because members of the previous year's *Schwerpunkt* on evolution and immunology joined us, and in part because Peter Hammerstein and the Institute of Theoretical Biology provided additional funding that allowed us to bring several additional scientists. Every hour brought a new revelation. The evolution of cancer cells, new approaches to genetic epidemiology, new evidence of the body's ability to monitor and respond to scarcity in early life, and how evolutionary theory might allow us to develop "evolution-proof" antibiotics and insecticides. A report of the meeting is available, and Catriona MacCallum created a nearly verbatim record that historians may well eventually examine.

The Workshop group also offered good advice about how to foster communication. There was a consensus that more workshops are essential and that they should be on specific topics. Thanks to strong support from several at the Volkswagen Stiftung, it seems likely these will be possible. We came up with a remarkable list of topics, several of which we anticipate will provide foci for Workshops in conjunction with the 300th anniversary celebration of the Charité in 2009, titled "The Evolution of Medicine". Does the field need a Society? Opinions were mixed, but scarce resources would be sapped by the required organizational work and inevitable politics. Should we create a paper journal? The best papers will have more impact in established journals where they will be seen by those who don't already know about the field. Besides, paper journals are becoming obsolete. An open-access, web-based journal, in contrast, could be established quickly and inexpensively. Instead of publishing new research, it could bring together information and ideas from scientists, clinicians, and scholars across the diverse reaches of evolutionary medicine.

Shortly after the Workshop, we went to work to make *The Evolution and Medicine Review* a reality. Catriona took on the role of Editor, I became the Executive Editor, and we

began recruiting Senior Correspondents – the world’s best scientists working in areas related to evolution and medicine, starting with members of our *Schwerpunkt*. We also began customizing the software, purchasing server space, designing web pages, setting policies, and carrying out other technical tasks needed to establish a web journal. Sometimes we wished we had had expert help, but telling someone else what we wanted would have been almost as difficult as doing it ourselves.

The journal was launched on July 1, 2008, exactly 150 years after papers by Darwin and Wallace presented the idea of natural selection for the first time. *The Evolution and Medicine Review* is at <http://evmedreview.com>. It is free and open-access without advertising. It offers a new model of how groups can establish efficient friendly communication. We somewhat jokingly call the publishing genre a “WeView”. Members of a group collaborate to review new work and share their views about the important issues in their field. We anticipate that *The Evolution and Medicine Review* will establish formal affiliations with PLoS or other open-access publishers so we can turn the technical work over to others and focus on the scientific content. Already it has had a huge influence. The field now has a home. Instead of a one-off product like a book, we have created something living. With continued nurture, it will grow and adapt to changing environments.

All of us in the *Schwerpunkt* worked also on our individual projects. My main personal project was to figure out why natural selection created a capacity for mood and how this can help us understand depression. I have worked on this for years, but day after day of writing and thinking and talking with other Fellows helped me to finally get my ideas clear. My main conclusion is that the capacity for low mood is useful to stop organisms from putting continuing effort into projects that will not succeed. Compared to other organisms, we humans have grand long-term projects. Particularly in modern societies, we pursue huge goals that require years of effort whose success is uncertain at best. All too often it eventually becomes clear that a job, a marriage, or some other crucial personal effort is failing, but giving up is not an option because there are no real alternatives. This is the perfect depressogenic situation.

Do such situations help to account for very high rates of depression? I want to find out. The theoretical underpinnings are now clear. The next step is to go out and gather data. You would think this had been done long ago. But it has not, for the good reason that different people have different goals, different ways to reach them, and different ways of coping when a goal is unreachable. A mindless questionnaire won’t work, you have to talk with people, at length and in private. But I now know it will be worth it, despite the dif-

faculties. Half of the chapters of my book on the topic are finished. I need to get back to the clinic and talk with dozens of patients before I can finish the rest with confidence. A long paper offers a summary for anyone interested.

Quiet time to think also allowed me to write several pieces about evolution and the emotions. They came to surprising conclusions that I could not quite see before. For instance, psychologists have argued for centuries about basic emotions – how many, how separate, how to define them. But a rigorous evolutionary approach recognizes that emotional states are clusters of coordinated changes in many aspects of an organism that allow it to cope with the challenges in a certain situation that has recurred thousands of times over evolutionary history. Each emotion is derived from similar states in earlier organisms. Thus, they are neither completely separate from each other, nor can they be described as dimensions. They are, instead, partially differentiated states with overlapping characteristics and regulation mechanisms. This conclusion is more than disconcerting to those who have spent decades trying to find some simple clear way to map out the different emotions. Their Holy Grail does not exist. The frustration and low mood arising from its pursuit are appropriate emotions. Phoebe Ellsworth and I summarized this argument in an *American Psychologist* article due out early in 2009.

Finally, the Wissenschaftskolleg was a wonderful place to pursue my long-standing pre-occupation with the evolutionary origins of distinctive human social capacities for altruism and the moral passions. Their origins are the focus of intense and sometimes contentious scientific efforts. Just before arriving at Wiko, I published a paper on how runaway social selection could shape extravagant human traits such as generalized altruism and displays of resources. The explanation is the same as the explanation for the dramatic and expensive tail of a peacock, except the benefits come from being chosen as a friend instead of as a mate. This process shapes the extraordinary concern we humans have about what others think of us, how to please them, and how to avoid offending them. In short, this explains how humans can sometimes be so wonderful in apparent defiance of selfish genes and competing groups. Augmented by the culture of the Wissenschaftskolleg and its commitment to supporting individuals in pursuing whatever is most important, these human capacities allow humans to help each other to accomplish great things.