

# Bart Kempenaers



*He has every reason to be optimistic: 37-year-old behavioral ecologist **BART KEMPENAERS** has succeeded in making the leap from head of an independent Junior Research Group to Max Planck Director. Under Kempenaers' aegis, a new **MAX PLANCK INSTITUTE FOR ORNITHOLOGY** will be created at Seewiesen in Upper Bavaria.*

A visit to Seewiesen does nothing to give the visitor the impression that this could be a research facility. The six Institute buildings are embedded in the hilly landscape between two neighboring lakes, Starnberger See and Ammersee, idyllically remote from any hint of big-city noise. The Max Planck Society purchased this property in the mid-1950s and brought in behavioral scientist and future Nobel Laureate Konrad Lorenz to be the Director at the Max Planck Institute there. A stone's throw away from the research buildings, a smaller lake, Essee, formed the backdrop for the filming of Lorenz and his gray geese. These films were an integral part of the biology curriculum at every German secondary school until well into the 1990s.

Although behavioral ecologist Bart Kempenaers does not work with gray geese, he, too, is quite fond of birds. The young Belgian – just appointed Director at the Max Planck Institute for Ornithology – studies blue tits. He is particularly interested in their mating behavior. Oscine bird parents, which usually raise their young together, were long considered the ideal “married couple.” However, since the molecular paternity test became available as a routine method, biologists have learned that, especially in the case of socially monogamous songbirds, the partners frequently “cheat” – or in technical terms: engage in extra-pair copulations. The researchers are thus trying to discover the selection mechanisms that shape such behavior over the course of evolution.

For male birds, the evolutionary advantage of being unfaithful is obvious: the size of his partner's clutch limits the number of his possible offspring. Only by copulating with other females can the male sire addi-

tional progeny. The importance of promiscuity for females, on the other hand, is not immediately evident. If evolution were based solely on the number of young, then females would have no incentive to prefer certain males as the (genetic) fathers of their brood. However, evolutionary biologists have shown many times that the quality of the genes have a major impact on the survival and reproductive success of the fledglings. Accordingly, it is not just the number of progeny, but also their “genetic fitness” that determines how successfully an individual disseminates its genes.

## IN SEARCH OF THE PERFECT MATE

Thus, in the search for a suitable partner, females should be on the lookout primarily for those features that express particularly “good genes” – for example a strong physique, high aggressiveness (meaning better competitiveness) or lustrous plumage, which signals superior health. These genes are passed on by the respective partner to the female's offspring, where they encode similar successful traits. However, since many females are seeking a partner at the same time, and there are often not as many males or territories available, sometimes the chosen nest box does not necessarily belong to their genetic “dream man.” The only option females have to improve their offspring's gene pool is to be unfaithful.

To verify such ideas in evolutionary biology, pure observational behavioral research, such as Konrad Lorenz conducted in his day, is no longer sufficient. The repertoire of modern behavioral research is thus supplemented today with numerous molecular, neurobiological, endocrinological and immunological

methods. Behavioral ecology can no longer do without genetic analyses – and so, not even Bart Kempenaers, an outdoor biologist by conviction, can entirely avoid the laboratory. Lucky for him, he can always find someone from his team to relieve him of the painstaking and time-consuming lab work. And his success shows that his division of labor is right.

The roots of Bart Kempenaers' scientific career extend back to the ecology movement of the 1980s. At that time, the 14-year-old joined the “Nature 2000” club in Antwerp to get involved in nature observation and conservation. He owes his enthusiasm for ornithology to a book penned by the famous ethologist Niko Tinbergen, Konrad Lorenz's research partner, who was likewise awarded the Nobel Prize for Medicine in 1973. *Curious Naturalists*, as the book was called, provided the young ornithologist his first lessons in bird watching – initially in the garden at his parents' home, and later in a nearby heath. “Even today, I can show anyone the tree on which I hung my first nest box to watch blue tits,” says Kempenaers. “But making a career out of my hobby seemed too risky at the time. After all, I had a book entitled *Regardez vivre les oiseaux* (Observe the Life of Birds) which, in the chapter “Devenir Professionnel” closed with the advice: “Devenir ornithologue de métier est extrêmement difficile, pour ne pas dire impossible” – in short: “Forget it!”

So Kempenaers decided to study biology with the aim of becoming an instructor. In the second year of his studies, ecologist André A. Dhondt gave a talk at the University of Limburg. This gave Kempenaers' later academic career the decisive turn: the biology student followed Dhondt



PHOTO: MPI FOR ORNITHOLOGY

These blue tit siblings were all hatched in the same nest, but they have different fathers.

to the University of Antwerp and here began to devote himself to his true favorite subject, bird research. Dhondt supervised not only his master's thesis, but also his Ph.D. thesis, and he introduced the young junior researcher to the international scientific community very early on. So it was that Kempenaers gave his first English presentation on his master's thesis at the Edward Grey Institute for Field Ornithology at the annual "Student Conference." Just a few years later, he was awarded the "Student Prize" for the best presentation when he presented the findings of his doctoral research.

Presenting and publishing his scientific findings early on – André A. Dhondt had played a major role in encouraging his student to do this, and thus sharpened his sense for the international nature of science (today, Dhondt teaches at Cornell University in Ithaca). It was thus practically inevitable that Kempenaers, after just half a year as a postdoctoral student in the Netherlands, received an NSERC Fellowship and went to Queen's University in Canada for twelve months. Then, in 1996, he took his first full-time position as a researcher at the Konrad Lorenz Institute for Comparative Ethology

(KLIVV) in Vienna. In the preceding years, he established a population of blue tits there whose social mating system and breeding ecology he and his colleagues examined in great depth.

#### BLUE TITS HAVE A SURVIVAL ADVANTAGE

In doing so, the researchers discovered that one out of every two blue tit females "cheated" on its partner and that the nestlings were merely half-brothers and -sisters. Microsatellite analysis can aid in determining the individual genetic diversity (heterozygosity) of the hatchlings. The chicks that were conceived through extra-pair copulations were, indeed, more heterozygous, that is, they possessed more variants of a gene (different alleles) than did their half siblings who were sired by the social father. Since distant breeding males are less likely to be related to a female than her social partner and nearest neighbors, female blue tits can be assured that extra-pair copulation with strange males will produce offspring with greater genetic diversity than the young of her true social partner.

But why should this individual genetic diversity be particularly use-

ful? Because it does, in fact, provide a survival advantage: in an average brood of ten or eleven blue tits, usually just one or two chicks live to see the following spring – predominantly those whose parents are least genetically similar to one another. The individual genetic diversity thus largely determines the fitness of a blue tit – even in adulthood. The researchers discovered that more heterozygous females produced larger clutches and lived longer, while heterozygous males were more successful at breeding and sired more surviving offspring. Kempenaers and his colleagues thus identified two mechanisms that, independently from one another, can cause the evolution of female promiscuity in a socially monogamous system: "good genes" and individual genetic diversity.

Unfaithfulness is much less common in some other species of birds than it is among blue tits. For example, only one out of every ten females of the Alaskan semipalmated sandpiper engages in extra-pair copulations. This is an interesting finding, and one for which Kempenaers would like to find the cause. The local working conditions are ideal for field biologists: these birds can be closely approached for behavioral observations and, in light of the short summer, have an extremely high brood density, thus affording the scientists suitably large samples. But what is more, the arctic and its wildlife is one of Bart Kempenaers' very personal passions. When he reports on it, he vaguely reminds one of zoologist Bernd Heinrich who, in his 1989 book *Ravens in Winter*, gave a fascinating account of sociobiological research in the Maine woods of North America:

"I now saw the birds [ravens], which had always seemed to me solitary animals, doing something solitary animals are not 'supposed' to do: They were sharing valuable food [...]"

This time my mind failed to provide a clearly selfish, evolutionary cause for the apparent sharing, and that failure gave me an instant adrenaline rush. I felt that I might not only learn about ravens, but also something of larger theoretical value."

Books have left their mark on Bart Kempenaers' life: be it Niko Tinbergen's book about the excitement of discoveries in the field, Edward O. Wilson's *Sociobiology*, Malte Andersson's *Sexual Selection*, or *The Beak of the Finch* about Peter Grant and the Galápagos finches. Books excite him because they go beyond pure fact, because they give shape to developing ideas, disclose backgrounds, reveal associations. Books change perspectives – it was not without reason that Charles Darwin waited more than 20 years before publishing his book *The Origin of Species*. "The relentless pressure to publish is not good for science. Scientific journals now publish many poor articles. A book can bring order into this jungle and compile those insights that are truly mature," says Kempenaers. Does he plan to write a book? He says the idea does appeal to him, but he is hardly likely to find the time to do so in the next few years since, for the time being, he plans to dedicate himself to establishing his new department.



PHOTO: FELIX BRANDL

Access to the subject of research is relatively easy, since blue tits like to breed in nest boxes.

#### BIRDS – A POPULAR HOBBY, NOT JUST FOR RESEARCHERS

Bart Kempenaers' appointment also means a new future for Seewiesen. The Max Planck Institute for Behavioral Physiology that was previously located there closed on November 1, 1999. Only the ornithology section, together with Eberhard Gwinner's department in Andechs and the ornithological station in Radolfzell, directed by Peter Berthold, was continued as the Max Planck Research Center for Ornithology. Both Directors will be awarded emeritus status within the next three years. The Max Planck

Society decided to continue funding avian research beyond that date because it is expecting to see landmark contributions to biology. And so it will have to install a new institute sign with the inscription "Max Planck Institute for Ornithology" at the entrance to the research premises in Seewiesen.

The name of the Institute was chosen carefully: in behavioral and evolutionary ecology, birds are the model organism – no other species has been the subject of so many scientific articles. Birds explore their environment and communicate with the same or similar visual and acoustic senses as humans. Their behavior and their social organization are just as complex as that of mammals; however, unlike the latter, they are usually easier to observe in their natural environment. Furthermore, hardly any other species of animal enjoys so much amateur interest. Hobby ornithologists around the world have made an indispensable contribution to the corpus of data on life spans, breeding biology, population sizes and migration behavior. "This is a major advantage for ornithologists in terms of their dialog with the general public," says Bart Kempenaers.

CHRISTINA BECK

Sandpipers in Alaska are more faithful. Researchers would like to find out why.



PHOTO: MPI FOR ORNITHOLOGY