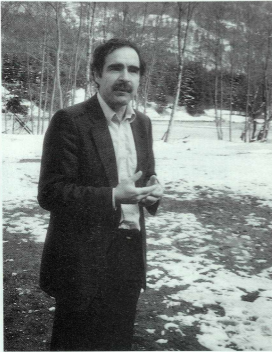


Ethology

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Goals

In general we have tried to perpetrate an integrated approach to behavioral biology, that is a combination of behavioral, ecological and physiological approaches. We combine field and experimental data to isolate causes and effects in the control of behavior. Integration means also employing the help of other competencies to develop projects and to compare methods. This has produced a situation where department members are concerned with such diverse organisms as teleosts, geese, squirrels, Barbet apes or even humans. In effect, we have had to collaborate with a number of medical researchers, botanists, ecologists, entomologists and other physiologists to organize projects. In the long run we hope to add to the knowledge of how physiological conditions affect behavior and visa versa. On top of this we seek information of how envi-

ronmental stimuli are perceived to produce physiological and behavioral changes. In this sense we have a few preferred study objects (reed warblers, geese, some teleost fish species, ground squirrels, guinea pigs, macaques, humans); and a few subjects (aggressive and courtship behaviors including their interactions with reproduction - pair bonds mechanisms and functions, sleep regulation and function in humans and hibernating ground squirrels and sensory physiology in fish). In order to increase the spectrum of the results, a number of different physiological parameters are being investigated including: chemosensitive cells in fish, hibernation and sleep EEG's, metabolic costs of diverse activities via doubly labeled water studies, food spectrum/use/ and growth/reproduction (both experimentally and in the field), biological rhythms under constant conditions and lastly a number of endocrine factors (various steroids, thyroid hormones, oxytocin, gonadotrophins and melatonin) which may have very differing effects of the control of behavior.

Some Results and Present Directions

In a study of four reed warbler species ecological and physiological aspects of mating systems were studied. Initially rather classic correlations were found between various parameters of prey density and the parental effort of males which in turn was related to their mating strategy (from monogamy to facultative polygyny). Physiologically the level of androgen decrease during incubation and feeding was initially thought to cause this variation. Androgen manipulation in the first brood produced a sex specific decrease in feeding activity and an increase in spontaneous and reactive song. This result has, however, been complicated by further studies later in the season. Male investment in late broods increases spontaneously along with the circulating levels of androgen. The "antifeeding" effect of manipulation decreases, spontaneous song

after manipulation decreases but reactive song increases. These results underline the complexity of environment-physiology-behavior interactions in these birds and open the door for more detailed neurological studies examining receptor concentrations and binding in some key hypothalamic areas involved in sexual and aggressive behavior and song control.

In studies on European Ground Squirrels the first results showed sexual dimorphism in emergence patterns and reproductive decisions. Adult males vary emergence times according to environmental conditions whereas yearling males and all females have a precisely timed emergence. This degree of preprogramming and flexibility was also evident from studies under constant conditions. Males also differ from females in that their reproductive strategies are an "all or nothing" decision in second year males. They develop their reproductive organs depending on their mass before and after hibernation. In females mass and age interact by delaying gestation with decreasing mass, decreasing litter size with date and increasing the sex ratio in offspring towards females. In total these and related studies are putting together a comprehensive picture of these squirrels' life history which is of vital importance for this sometimes protected but often persecuted species.

At the Konrad-Lorenz-Forschungstelle in Grünau a wide variety of results have been produced on Teleost fish sensory processing and Greylag Goose behavior. With fish, novel solitary chemosensory cells have been isolated in the skin, their morphology examined in some detail and analyses of their function carried out. With the Lorenzian geese of Grünau the department has tried to take a more modern look at how the sociality in these well-studied objects functions. Analyses of individual behavioral change, depending on resource constraints (like food) and individual social status have shed new light on goose behavior. Future work will examine endocrine factors during ontogeny on one hand and endocrine-behavioral interactions in adults on the other.

One promising future direction is the examination of neuropeptid changes during behavioral interactions and the effects of these peptide releases on subsequent behavior. We are presently developing methods to investigate the enkephalins and oxytocin. The combination of studies where immediate and subsequent behavior is examined with steroid and neuropeptide responses will provide new insights to the physiological control of and response to behavior.

Teaching

We teach an integrative approach to behavioral biology including lectures, seminars and practicals in behavioral physiology, biological rhythms, behavioral ecology and endocrinology. In addition we offer special integrative courses for mammology and ornithology.

International Cooperations

Univ. Groningen, (NDL, Prof. Daan) FFWF Project on Soudalaks; - Max-Planck-Institut, Seewiesen (Germany, Prof. Gwinner, Dr. Hofer) annual reproductive cycles in tropical bird and endocrine correlates of behavior and growth in Spotted Hyenas; - Univ. Bielefeld (Germany, Prof. Trillmich) Starling mating systems, their ecology and physiology; - Universität Marburg (Germany, Prof. Arnold) Reproduction and and reproductive inhibition in Marmots

Selected References

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