THE WIKO – FIT FOR THE FUTURE?
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I studied Biology and Chemistry at the Technical University in Darmstadt and finished my Ph.D. in Zoology at the University of Erlangen, Germany, working on acoustic communication in grasshoppers. Postdoctoral training, diverse scholarships and fascinating research projects saw me working in several places afterwards, including the University of Alberta in Edmonton, Canada, the University of Konstanz, Germany, the California Institute of Technology in Pasadena, USA, and the University of Zurich in Switzerland. Since 1997 I am full Professor for Neurobiology at the University of Ulm, Germany. I studied the control of limb movement in insects and other invertebrates and navigation in desert ants, among several other topics. My interests span all of neurobiology, from the cellular to network and behavioural levels, including systems analysis and cybernetics. A common theme is the quest for general control principles. My project at the Wiko was concerned with constraints in the evolution of sensorimotor networks. Networks for motor control need to be flexible and provide adequate control on the one hand, but they should not waste expensive neural tissue on the other. – Address: Institut für Neurobiologie, Universität Ulm, Albert-Einstein-Allee 11, 89081 Ulm.
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I hate the term “fit for the future”. It implies restlessness, produced by the constant demand to scrutinise and adjust to changes in the working environment. And restlessness is exactly what the “Wiko” strives to avoid, the Institute for Advanced Study in Berlin, or “Wissenschaftskolleg”. It rather fosters concentrated work on projects and co-operations, combined with interdisciplinary interactions and international stimulation at one’s own

pace and liberty. And that is exactly what is needed for productive and creative work, scientific or otherwise. It is also the reason why the Wiko is perhaps more necessary today than at any previous time of its existence. Today's preoccupation with competition, financial tightness, speed and fast success has often all but eliminated basic research and sustainability. The Wiko is an essential antidote here that may serve as a growing point for future changes towards more sustainable modes of scientific endeavour. This does not mean that a healthy dose of competition and a need to get things done are not essentials for successful work – rather, the correct dose and appropriate balance is the point here.

Sustainability in a Changing Environment

Nonetheless, the Wiko is not independent of the developments in its surroundings. These impinge on it directly through questions of accountability, financial, scientific or otherwise, and through the expectations of Fellows who come from and are used to the changing requirements of scientific work all over the world. And several arrangements at the Wiko are certainly exposed to scrutiny by modern attitudes. Wiko needs to address these matters to maintain its positive function and achieve a stable existence, even in times of financial tightness and political change. I therefore take this opportunity to make a few suggestions how, in my view, lasting stability could be achieved by implementing timely ideas and organizational principles without sacrificing the essential ideas outlined above. As a Fellow, my perspective on the Wiko is necessarily limited and somewhat biased. The Fellow perspective may also be highly significant, however, since it provides the most direct view of the Institute's tangible results and achievements. I shall collate into this report not just my personal impressions, therefore, but also an overview of discussions among this year's Fellows and a few former Fellows.

Still, many points will be addressed from a natural scientist's perspective that values scientific cooperation across all generations. A more monadic approach to science is probably closer to the original concept of the Wiko, but both modes of scientific work easily coexist. And the monadic scientist – more often a humanist, I believe – will certainly enjoy the opportunity for discussion at her or his liberty. And my suggestions are explicitly intended as positive and constructive input towards sustainable future development of the Wiko. In this way, I hope it is more productive than the expressions of gratefulness and thanks that constitute much of the yearly report volumes, producing a certain redundancy – however justified and appropriate these praises are, including my vivid personal

agreement. After all, my own stay at the Wiko was most productive and enjoyable, owing to the excellent working conditions and atmosphere. Here are my suggestions, loosely arranged from Fellow-oriented to more general matters.

Fellow Presentations

It is good practice at the Wiko not to interfere with Fellow presentations, in particular during the Tuesday colloquia. Nonetheless, a small but significant number of Fellows, and not just the younger and less experienced ones, are simply unable to provide concise and intelligible presentations. And while the other Fellows certainly provide scientific feedback during the discussion period, the mode of presentation is rarely questioned. Rather, participants in the discussions may seize the opportunity to make small co-presentations, instead of asking concise questions. In view of this unsatisfactory situation, it would appear useful to spend the first Tuesday colloquium not with a normal presentation but rather with a discussion centred on the question of how this year's Fellows want to deal with each other in the seminars. Is their primary objective to present themselves as distinguished scientists? The Fellows' mere presence at the Wiko would appear to be acceptable proof of scientific achievement and international recognition, though, would it not? Or is it the Fellow's preference to attend presentations that address them as interested non-specialists in each other's respective realm, enjoying an entertaining introduction to their respective fields and lively and unprejudiced discussions? Since the new year's Fellows will usually be innocent regarding these topics, it may be supportive for such discussion to invite a former Fellow who has been dedicated in this topic during her or his own tenure.

Some junior, and maybe even not-so-junior, Fellows might even enjoy an organized opportunity for training and practice in oral presentation. This opportunity needs to be purely optional, of course, considering that the Fellows are all grown and experienced scientists. Presentation seminars may be organized along the lines of the well-accepted German language courses. Examples of successful offers in this area are nowadays common in many universities, in Germany and abroad.

Age Structure

There are two major aspects with regard to age structure. First, the composition of Fellows is perhaps just about right with an average age of about 55, and the extremes ranging from the early thirties to the early seventies. Intense exchange among different age groups appears highly desirable for Wiko Fellows, not least because such opportunities are rare elsewhere in academia and usually not actively supported. And I consider the transfer of the modes of scientific approach across disciplines, and of methods and attitudes across the generations, a major task of the scientific community. With the concentrated and often quite isolated work modes in modern science, this task may be all but forgotten. This lends particular importance to institutions such as the Wiko. It thus appears important that a class of Wiko Fellows not be composed of Fellows mostly within their last decade before retirement. Although such individuals are normally highly experienced and productive, the tendency to be reclusive is also more pronounced in such an age group, and, as noted above, exchange with young scientists is stimulating and serves the continuity of scientific endeavour across generations.

A second aspect regarding age structure is actually problematical. It concerns the audience of public lectures at the Wiko. The audience is sometimes dominated by persons who are not within a decade *before* but within a decade *past* their retirement, or beyond. And while I have not the slightest caveat against that age group *per se*, there are two aspects that make this situation indeed regrettable. First, the above-mentioned exchange with younger scientists and perhaps students might have an excellent forum in such public lectures and presentations. This chance is lost with today's average audience, whatever the reasons for the age structure may be in detail. This is all the more unfortunate in view of the restricted public outreach of the Wiko, see below.

Second, while interesting and fruitful discussions may indeed occur after public lectures, there is equally often a notable insistence, stubbornness and sometimes even a lack of realism in participants in public discussions. This is a situation I have never encountered before, and which I am inclined to attribute to the complacency of a small but insistent minority among participants, clinging to perceived entitlements in dominating discussions. From this perspective, it would be highly desirable to make a serious attempt at rejuvenating the audience of public lectures at the Wiko. More directly and easily, a friendly but determined chairperson would be able to supervise and steer discussions into productive realms.

Fellow Selection

Among the Fellows at large, as well as among persons outside the Wiko who are familiar with the institution, the criteria for and processes of Fellow selection are unknown to obscure. Naturally, this may give rise to questions and doubts in cases where individual Fellows are perceived as being below average in their performance, their publication record or whatever aspects may have incited a particular scrutiny. Instances of scrutiny may appear among the Fellows of a year's class and from previous Fellows, but they are more common among colleagues outside the Wiko. What is clearly needed to avoid such ominous scrutiny, be it based on envy or fact, is more transparency of the Wiko proceedings in Fellow selection. While a lack of transparency and the resulting questions regarding the quality of Fellow selection jeopardise the reputation of the Institute for Advanced Study, transparency based on a clear set of rules, proceedings and criteria that guarantee quality will certainly strengthen international standing. A comprehensible mode of input control based on quality and transparency is essential for an institution where output control is virtually impossible, or may actually be counterproductive (see initial notes on restlessness). Quite apart from the fact that output control is pervasive nowadays and has more often than not proved rather unsuccessful.

I have no doubt that the procedures employed by the Wiko for Fellow selection are based on quality and are basically objective. What is needed is primarily an effort to make procedures and responsibilities explicit. And nobody would reasonably expect 100 % success in selecting excellence anyway. It is well established in other organizations dealing with excellence, in Germany particularly the "Studienstiftung des Deutschen Volkes", the "Alexander von Humboldt-Stiftung" or the "Junge Akademie", that an error margin of close to 20 % is almost impossible to undercut. Of course, this is true only for organizations that have a veritable interest in promoting excellence, in contrast to the inflationary and pervasive use of the term in present-day education and research policy, which in reality refers to larger clusters of upper mediocrity. In fact, the occasional failure may, and should, be taken to evaluate, to learn and to keep selection procedures flexible. Failures cannot be avoided, and realizing this fact allows the leeway and freedom necessary for creativity, an asset that outweighs any minor mistakes. From this perspective, the above-mentioned transparency does not imply that, within a given set of procedures, there is no allowance for criteria that are inevitably subjective. Many important personality traits that are essential for successful tenure at the Wiko fall into this category.

Interdisciplinary Projects

While the international and interdisciplinary composition of the Fellow classes is an important requirement of the Wiko, actually integrating different disciplines and building interdisciplinary work groups is not easy. When putting together 40 Fellows from different disciplines for a year, interdisciplinarity will not normally emerge spontaneously. The Fellows will certainly enjoy social interaction; and within disciplines and particularly within focus groups, there is normally good to intense exchange and cooperation. True intellectual and interdisciplinary scientific interaction is more difficult to achieve, though. The interactions within disciplines and focus groups may be considered to suffice in this situation, particularly when supplemented by the fortuitous contact between disciplines, as is brought about by the occasional personality fit and overlap in interests outside the scientific speciality.

A more organised support of interdisciplinary exchange and cooperation may appear desirable, however. A possible means of achieving such a goal may be the advance advertisement and solicitation of possible interdisciplinary discussion groups or even projects. While the eventual outcome of such ideas will have to remain open until the class commences, the very presence of advance alerts should put the frame of mind of the future Fellows in desirable directions. More concentrated support for *ad hoc* initiatives by the Fellows is an avenue that may be fruitful during the academic year, dependent of course on the emergence of such initiatives. The "human uniqueness" group initiated by Steven Lukes in 2009/10 is a good example of such an initiative, including philosophers, linguists, biologists and physicists, to name just the regular participants. This initiative may have thrived even better with "online" support from the Wiko. Another option is in Fellow selection, where individuals may be preferred who possess proven interest in interdisciplinary work.

Focus Groups Across Several Years

In my view, it was a major advance in Wiko policy to establish focus groups that allow several scientists to work together on a common theme. This not only strengthens interdisciplinary research, depending on the composition of a given focus group, but also allows intensive interactions on an everyday basis that is not possible in other settings. This should significantly increase productivity, too, as it has done in the past, since the Fellows

of a focus group feel bound by their membership to that group and tend to invest a steady and reliable contribution over the academic year. I propose to use these advantages of the focus group setting by extending the tenure of a given topic across several years.

This does not mean that the individual Fellow should stay longer than the 10 months of normal Wiko tenure. Such extension of individual time slots is probably neither productive nor possible to arrange with the home institution of the respective Fellow. Rather, I envisage the topic of the focus group continuing and the Fellows of subsequent years interacting before and after their respective tenures at the Wiko. Such extension of focus group topics may be particularly useful in the case of current "hot spots" in the natural sciences, and in lucky cases it may allow the early identification of important emerging research fields. Such topics would be suitable to raise Wiko's reputation in the realm of natural sciences, the extended time schedule would allow continued and significant progress that is noticed in the scientific community, and more visible foci would increase the incentive for prospective Fellows to participate. The latter aspect is particularly important in the natural sciences, since here Fellows are notoriously difficult to recruit. Younger scientists in their earlier career stages in particular have "more important" things to do than join the Wiko for an academic year. To do this, they would have to abandon their labs, their work groups and the scientific connections they have worked hard to establish and possibly their families. Enhancing Wiko's reputation in the natural sciences and taking measures to increase visible progress would thus appear to be important parameters that may facilitate the recruitment of promising young scientists. The selection of "hot spots" would also make it easy to abandon the particular topic after three to five years. After such a time period, former "hot spots" are usually firmly established elsewhere or have gone cold.

Thus, while the Fellows should stay no longer than their normal academic year, exchange with the Fellows of the same focus group from the other years' classes needs to be fostered, not just by e-mail contact but also by the occasional seminar or talk invitation.

What is further needed to achieve continuity of extended focus group topics is supervision regarding organization and perhaps content by a mentor Fellow. Such a mentor would be the person who organizes the focus group, contacts potential Fellows and keeps track of developments over the years. The mentor would thus need some administrative support from the Wiko and additional benefits that would make her or his efforts worthwhile. Possible remuneration, which would also help the extended focus group idea *per se*, would be the status of permanent (mentor) Fellow during the tenure of the focus group

topic. This would allow the mentor Fellow to join the Wiko for one academic year completely and otherwise provide contributions through regular visits. These latter visits may even be used to provide further functions and responsibilities at the Wiko.

I could imagine such extended focus groups concentrating on junior scientists, which may indeed be essential if foci are on current topics or even emerging "hot spots" of research. To make the Wiko setting attractive for these people, additional efforts are necessary, for instance, timely computer hardware and software, and the software tools necessary for the respective research focus. Further, common computer rooms and work rooms may be highly desirable to enable discussion and joined work on computer models. After all, one has to realize that natural scientists in particular have to leave their labs to join the Wiko, unless the focus is on theoretically oriented topics and computer modelling.

What must not be forgotten in all these focussing efforts, though, is that focus group Fellows need to be normal participants of the Wiko community. And there may be a problem because the Fellow group should not increase beyond 40 people, otherwise the productive social and scientific atmosphere is in jeopardy.

Funding of Fellow Activities

There appears to be too little funding for activities of the Fellows in any given year. Whatever the reason for the perceived financial tightness, there will always be limits to the funds that may be invested in the organization of workshops and seminars and the invitation of speakers from Germany and abroad. In this situation, activities should be limited in number and size to an extent that each individual activity can be supported appropriately. There is nothing more awkward for the Wiko or for the Fellows working at the Wiko in a particular year than the organization of seminars and similar activities where invited speakers, perhaps even keynote speakers, have to pay their own travel expenses, their meals in the course of final farewell gatherings or the like. Any stinginess at this point may harm Wiko's reputation in Germany and abroad. And after taking all the effort of selecting, inviting and accommodating the Fellows, some additional funds would appear well invested to further their work through the invitation of external contacts. Of course, healthy competition for funds is necessary (not least since there is always some limitation). But the conditions for fund applications, the criteria for fund distribution and the possible amount of support that may be provided need to be clear right from the beginning. Only in this way are the appropriate planning and execution of events possible

that will satisfy both participants and Wiko Fellows. For any given event, grants should be large enough to cover all essentials and a few not so essential expenses, rather than spreading insufficient grant money across too many events.

External Contacts and Outreach

Contact between the Wiko and other Berlin institutions, ranging from the three universities to the Max Planck Institutes and other organizations, is somewhat unsatisfactory. Developing and perhaps slightly formalizing interactions with these institutions might increase the attractiveness of the Wiko for natural scientists, as well as for topical humanities researchers. Fellows newly arriving at the Wiko are often quite innocent about the research areas and specialities present at other Berlin institutions. Had they known in advance which possibilities exist, they might well have established fruitful and lasting contacts. Thus, an individualized listing of potential contacts, including researchers' names and institutions, might be provided for new Fellows well before their arrival, enabling advance contacts. Of course, Fellows differ in their attitudes, and many may prefer not to be bothered with such things and rather concentrate on their isolated projects. But this effort is certainly worthwhile for Fellows who are interactive and relish co-operations but just do not have the time to gather the necessary information beforehand.

Contacts with Berlin institutions may further be fostered by establishing a schedule of external talks and seminars by Wiko Fellows, at the particular Fellow's discretion, of course. I would expect that such activities will be welcomed by many Berlin institutions, provided they are well-organized, well-advertised and touch on a nerve of current research interests. I would consider such activities particularly worthwhile where younger scientists and students become involved. After all, this age group contains the people who will in the future participate in scientific and political decisions concerning the Wiko, from its scientific activities to its financial endowment. Such external presentations need not put undue extra stress on the Fellows (and as with other activities and distractions, they need to be optional, although early planning will be essential). Just one presentation per Fellow would already provide a weekly presence of the Wiko at Berlin institutions. And some of the topics that have no major audience at Wiko events may be relocated to places where more people will attend.

Sustainable Use of Wiko Assets

The Wiko has many assets, a number of which appear not to be used fully and some not at all. These assets include the literature and other works provided by former Fellows and stored in the library and the main building. These resources are accessible by the former Fellows' names and years of residence. To my knowledge, though, there is no catalogue that would allow access by subject area or key words for use in scientific context, except the monographs in the Fellow library.

More important assets are the expertises and personalities represented by the body of former Fellows. Except for the "Fellow Club", I am not aware of any Fellow or alumni network that might utilize these resources. And these are important resources indeed. For instance, counselling may be welcome with regard to possible future directions of Wiko activities or even in the selection of future Fellows. The Wiko might further, and perhaps more importantly, provide a database for other purposes, ranging from requests from political entities for counselling and expert judgement to the review of initiatives in science policy. After all, the former Fellow database will contain internationally recognised specialists in most areas of science and the humanities. A tightly knit alumni network and the data base for its maintenance would make such resources available to past and present Fellows and to the scientific and political community at large. It could further outreach to Berlin science and younger scientists. A brilliant example in this context is the Former Fellow Network of the Humboldt Foundation, which may well serve as a template for future activities of the Wiko in that direction. The Humboldt Foundation is able to keep its former Fellows in truly productive contact, certainly for a particular research area and its surroundings, but in many cases actually in an interdisciplinary, international context.

Evaluation and Accountability

Evaluation procedures are a common and inevitable element of contemporary science, research and education. And while such evaluation efforts often proved counterproductive as far as scientific creativity and student education are concerned, for example, by misuse for the implementation of fiscal policies and economisation efforts, they are inevitable elements of academia. It is thus surprising that many of the parameters used for current evaluation procedures and benchmarking are unavailable for the Wiko. First, this

situation cannot last anyway. Second, and despite the above reservations, some of these data may actually be quite useful for an analysis of the current situation by the Wiko and its Fellows, as well as by future Fellows and external science organizations. It would appear desirable, thus, that some key parameters are publicly and easily available, for instance, funds spent per year and per capita, and publications per year and per capita emerging from the Wiko over the years. Even more important are organizational structure, decision levels and responsibilities at the Wiko and, more significantly, of Berlin and federal German science policy levels concerned with funding and steering the Wiko (although the latter are at least formally known, of course). Lack of such information is all the more surprising, as it appears certain that the Wiko would fare well indeed, based on the information available. For example, the number of publications produced by a Fellow from the natural sciences during her or his tenure at the Wiko, including the publications that appear during the following years if they were instigated during the Wiko stay, will certainly exceed the average number of publications of scientists in related fields at universities or even at Max Planck and comparable institutes. I imagine, therefore, that publication of at least the standard evaluation parameters would indeed increase Wiko reputation and its national and international visibility.

Management Issues

One of the primary assets of the Wiko is the staff members, who are competent and extremely supportive; and they all feeling responsible if approached with a query, even if it is not within her or his field of work. This atmosphere is certainly one of the main factors for productivity at the Wiko, next to the opportunity for unrestrained work. No improvement is desirable here, or possible. This very positive overall impression notwithstanding, some Fellows and staff feel the need for adjustments to present-day standards where organization and infrastructure are concerned.

Just a few examples: With the advent of computers and digital databases, the use of scientific literature has changed considerably. Historians often, though by no means exclusively, still depend on the availability of historic or even ancient books and handwritings, which need to be accessed through library services. Modern natural sciences, by contrast, will soon depend entirely on electronic resources that are available through the Internet, usually again via library services. Accordingly, work in libraries, and in offices in general, has changed dramatically over the past years. While the classical librarian is still

necessary, as are transport services, book scanning and cataloguing resources, even though on a reduced level, new challenges have arisen. For example, the modern electronic resources in natural sciences require personnel who are not just familiar with electronic book catalogues, but also possess software and programming skills to extract relevant and possibly personalised information from the internet and assorted library services. What would appear highly desirable for Wiko Fellows, for example, is a regular, and preferentially automatically updated, table of contents (TOC) of those scientific journals that are of interest to that particular Fellow. Such a service has recently been implemented at the Wiko, very much to my personal satisfaction. Its continued maintenance and adaptation to future developments remains open, as far as I know, partly due to the lack of appropriately trained personnel.

A similar situation exists with regard to computer services. While the computer service staff are extremely dedicated and helpful, the available software and hardware are often dated. Naturally, this is of marginal importance for scientists whose work involves mainly word processing, but it may be pressing for natural scientists who work with computer modelling.

Of course, managing changing resources and requirements with a given number of staff who have been trained in the past is a common problem for many organizations. This also means that there are common and tested solutions, some of which may be applicable to the Wiko, such as training schemes and external consulting. This is particularly true when considering the benign, supportive and interactive atmosphere among the Wiko staff. Nonetheless, the administrative heads of the Wiko have to initiate, instigate and accompany necessary changes.

In summary, the above observations and ideas are intended as suggestions for organisational updates and other potential improvements. Further improvement may be difficult in some instances, though, considering that the starting point is already excellent. Above all, the suggestions are made from a deep affection for the Institute for Advanced Study in Berlin and a genuine interest in its continued prosperity.

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Just for the record, and having commented on accountability above, here is a list of how I spent my time at the Wiko in terms of science productions.

– completed, prepared, or initiated at the Wissenschaftskolleg zu Berlin

Eberhard, M. J. B., D. Lang, G. Metscher, G. Pass, M. D. Picker, and H. Wolf (2010). "Structure and sensory physiology of the leg scoplopidial organs in Mantophasmatodea, and their role in vibrational communication." *Arthropod Structure & Development* 39: 230–241; doi 10.1016/j.asd.2010.02.002

Wittlinger, M. and H. Wolf (2010). "Distance estimation in desert ants, *Cataglyphis fortis* – the optic flow factor." Abstracts of the 9th International Congress of Neuroethology, International Society for Neuroethology, Salamanca, Spain, P140.

Wolf, H. and N. Schmid (2010). "(Re-)Adjustment of foraging site approach by desert ants, *Cataglyphis fortis*." Abstracts of the 9th International Congress of Neuroethology, International Society for Neuroethology, Salamanca, Spain, P139.

Wolf, H. "The Wiko – fit for the future?" In *Wissenschaftskolleg zu Berlin – Institute for Advanced Study Berlin. Jahrbuch 2009/2010.* Eigenverlag. ISBN 978-3-934045-12-5.

Bußhardt, P., S. Gorb, and H. Wolf (submitted). "Using muscle while hanging around: How stick insects employ their claws for adherence." *J Exp Biol*.

Bußhardt, P., H. Wolf, and S. Gorb (submitted). "Adhesive and frictional properties of tarsal attachment pads in two species of stick insects (Phasmatodea): Comparison of smooth and nubby euplantulae. " *Zoology*.

Wolf, H. (submitted). "Odometry and insect navigation." *J Exp Biol.*

Wolf, H. and S. Harzsch (manuscript finished). "Serotonin-immunoreactive neurons in the scorpions' pectine neuropils: similarities to insect and crustacean olfactory centers?" *Zoology*.

Dürr, V., B. Hochner, F. Pasemann, A. von Twickel, H. Wolf, and S. Yakovenko (in preparation). Working title: "Neuromuscular organisation, control hierarchy and mapping strategies in animals and animats."

Wolf, H., M. Wittlinger (in preparation). "Orientation and navigation experiments in (desert) ants – a field manual."

Research projects

– initiated during the time at the Wissenschaftskolleg zu Berlin

In cooperation with Dr. Frieder Mayer, Museum für Naturkunde Berlin: "The hexokinase enzyme – temperature sensitivity in sibling grasshopper species; a possible metabolic drive for speciation?" (working title).

In cooperation with Prof. Dr. Frank Pasemann, University Osnabrück: "Modelling the locust flight oscillator – evolution of segmental versus monolithic network structures" (working title).

In cooperation with Prof. Dr. Frank Pasemann, University Osnabrück: "Modelling the locust flight oscillator – disagreement with physiological experiments, interruption of connective and commissural pathways, as a source of network information" (working title).

Grant proposal "The use of environmental cues in biological and perceptual synchronisation" with the HFSP (human science frontier program) LIP000512/2011 (declined in July 2010; alternate funding opportunities shall be considered).

Oral presentations

– at German Universities and the Wissenschaftskolleg zu Berlin

"Insect science, movement control, and navigation." Fellow presentation, Wissenschaftskolleg zu Berlin, Institute for Advanced Study Berlin.

"Motor control in insects – the example of locust flight." Humboldt-University Berlin, Institute of Biology.

"How do desert ants navigate? Strategies to find a goal without external orientation marks by combining idiothetic, anemotactic and olfactory clues." Christian-Albrechts-University Kiel, Department of Zoology: Functional Morphology and Biomechanics.

"The scorpion pectine neuropils – centres for olfactory processing with intriguing similarities to insect and crustacean olfactory lobes." University Greifswald, Institute of Zoology and Museum.

"Animal Migration: physiology, evolution, performance – a brief overview." Fellow presentation, Wissenschaftskolleg zu Berlin, Institute for Advanced Study Berlin