

## **Fundamental consideration of Research: with reference to the AO Research Institute and the AO Foundation**

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It is challenging and important alike to consider the aims, tasks and management of research. The first priority is to clarify what the aims and purposes of research in a given environment are. What sort of research work comes under consideration, how important are the working methods to a Foundation, which special requirements must be taken into account and which problems are to be reckoned with?

*Purpose:* The purpose of the AO Research Institute might be to distinguish the Foundation as a scientifically competent institution. Scientific reputation is important, but it cannot be the main or even the only research purpose of the AO Foundation. In contrast to academic research, AO Research has the clear duty to open up new approaches and to make the basic research carried out by the Foundation and Universities accessible in order to optimize the treatment of traumatized patients. Research should enable the Foundation to lead the field of trauma care of the locomotor system. The following specific tasks and work methods may be distinguished:

**Scientific service:** Researchers reply - on the basis of their expertise and resources - to practical questions arising in clinic and industry e.g. information on specific biomechanical issues.

**Scientific projects:** This work is highly structured in its purpose, method and schedule and culminates in scientific publications. It usually leads to incremental progress and indicates ways to optimize patient treatment e.g. experimental clarification of local infection resistance. Scientific projects at the fundamental research level take place in close collaboration with a network of internationally active institutions usually associated with university research. This work also facilitates academic promotion: many temporary collaborators of the AO Research Institute are today Professors and Doctors.

**Scientific creativity.** Creative, unconventional research and lateral thinking are the basis of scientific and clinical leadership that open the doors to unusual treatment methods for locomotor injury e.g. insight into the nature of temporary bone loss and its avoidance by application of the internal fixateur.

Classification into these three categories is not intended to reflect any form of rating but rather to

show that different approaches require different environments, management strategies and communication. All three forms of research are essential.

The different levels of relevance of the aforementioned working methods for the AO Foundation are obvious:

**Service:** Service does not exist specifically to provide influence for the Foundation, and its contribution to the leadership requirements of the Foundation is limited, but yet service is indispensable. Scientific service is based on clear communication of the clinical problem and solution. Service management is conducted in accordance with standard procedures.

**Projects:** These consolidate the scientific reputation of the Foundation through subsequent teaching and publications. The nature of their purpose and the resultant knowledge help to solve problems and to compare different methods. Project work generally indicates a better way rather than a fundamentally new approach.

**Creativity:** Real and lasting leadership presupposes the ability to create, explore, validate and disseminate consequences of important new insights even if they are unusual and unexpected. Improving technology of teaching and public relations does not, by itself, result in lasting leadership if it is not supported by ongoing creative research in the lab and in the hospital. Long-term, high-risk research projects lead and avoid the trampled paths behind the herd. They cannot be directed administratively in the usual sense and are incompatible with the concept of early and frequent publication and extensive administrative activity.

*Specific Requirements :* Although project work is tightly structured in terms of aim, time and funding, it is imperative that part of the activity can respond as required to a change in circumstances or demands. It is essential in this kind of research to have a certain amount of freedom and flexibility with regard to the ultimate aims.

The opportunities, possibilities and frameworks for creative research are difficult for an outsider to understand, and cannot be considered and evaluated in terms of quantitative parameters. Due to the creative component, contributions from creative research are long-term and can and must not be considered as such in the regular, short-term

evaluations of the scientific performance of an institution. This type of research is very demanding in terms of directorship, goes beyond the normal scope of investigative endeavor and demands understanding and risk-taking from management. A prerequisite of creative research is a certain amount of freedom for the researcher and the research methodology. The risk that some projects will fail must be considered and accepted.

Evaluation of the quality of research deserves special attention. If the research cannot be adequately assessed within the institution, evaluation by the editorial board of scientific journals is a solution frequently chosen. Unfortunately, this procedure often only determines whether the methodologies fulfill prescribed technical requirements and the outcomes do not collide with the reviewers' existing knowledge. This level of review is hardly conducive to genuine progress in the sense of new insights. Evaluation of the value of creative scientific activity to the Foundation cannot really be delegated to authorities that are either unaware of the specific requirements of the Foundation or do not take them into account. Proper evaluation assumes a sound knowledge of the aims, function, requirements and expertise of the Foundation, and so the judicial selection of such experts as "auditors" is vital.

One aspect to be taken into consideration arises from the requirement that the researcher is able to experience clinical problems continuously at close hand so that he/she is well informed and motivated, i.e. the researcher has to be a member of the Foundations institutions that deals with problems in the clinic. The value of frequent direct contact and reciprocal visits involving clinicians is often underestimated.

In the thirty years of AO research, it was the challenging of generally accepted assumptions and the embracing of new insights that justified the leading role of the AO. In every area of research in Davos it was creative work that led to the development of new procedures, work which would have been given little opportunity in the context of service delivery or structured projects.

Unconventional thinking led to the strain theory of induction and repair tolerance and to the development of flexible osteosynthesis and the internal fixateur, opening up new territory and having a direct and important effect on clinical practice. Scrutiny of the histologically attractive mechanisms of primary bone healing and the mechanisms of necrosis also led to genuine clinical progress by stimulating and underpinning the concept of biological osteosynthesis. Concern for spontaneous tissue reactions as well as for the

function of the injured limb and patient replaces or complements the rigidity of compression or thinking.

It is important that an integrated system of research and management of clinical outcomes develops that includes smooth transfer to an education program that ensures dissemination and sustainability.

Since a relatively large number of doctors active in trauma surgery worldwide do not perform internal fixation every day, an important demand on osteosynthesis technology is that it should not require the skills of the lonely expert. The techniques must not be rigid and demanding but "forgiving". The surgeon is confronted during the operation with particular, distinct biological issues and, in the face of limited exposure; the simplest technique is the safest. Demanding or, incompatible technologies in the hand of the non expert may jeopardize safety.

Assessing the value of unusual ideas is very demanding. It requires in depth discussions and it cannot be achieved by simple surveys. The introduction of the locking nail and the locking head screws of the internal fixateurs only long after their conceptualization and completion of their development are examples of an inherent stubbornness with regard to assuming that yesterday's procedures correspond to the "best proven technologies".

Focus has become a buzz word. In recent years, focusing on defined priorities such as osteoporosis has helped the AO Foundation to concentrate on central issues. Energy applied resolutely, flexibly and in moderation has been of genuine value in supporting the aims of the AO Foundation.

Research at the AO Institute offered unique opportunities to question and explore clinical fundamentals. Theories that make sense to us because they apply our reality (intelligence and logic) to structures and organs can be misleading. It is often overlooked that biological structures and organs possess neither intelligence nor logic. Does the bone know what we know? Does the bone want something? Can implants be intelligent?

Thus, the main emphasis and top priority of research at the AO Institute was the resolution of clinical problems and the improvement of fracture treatment. The aims and, almost logically, geographical location of the AO Research Institute were unique compared to those associated with university research, which acts, not a role model, but a necessary basis for and complement to AO activity. Buoyed by the acceptance and enthusiasm of AO members, AO research in Davos was able to develop to a large extent free from the academic pressure of "publish or perish". Rather than

publications, the criterion of success was the help offered to the patient and the doctor by innovative procedures. Success was measured by procedures that addressed burning clinical problems and that could be executed by the surgeon at large – fulfilling a philosophy that the simpler the solutions the safer they are.

It is vitally important (but not always easy!) to resist the enticement and temptation of fashionable ideas, concepts and trends (e.g. electro stimulation). Attractive new terms such as mechano-biology, biotechnology, stimulation of bone healing, tissue engineering etc. must be consistently evaluated in terms of their contribution to the AO Foundation and thus to the patient. AO research has a highly interesting, fascinating and rewarding role to play creatively challenging precepts and fundamental views.

Genuine progress cannot be called up, it originates from within.

*Outlook:* If we ask ourselves what the role of the AO Research Institute might be in the future, the following aspects stand out: The research laboratory in Davos is ideally suited to function as the central think tank for the AO Foundation. It should continue to support the foundations leadership through creative research whilst being ideally a pool of human and technical resources available on request according to the capabilities of the Foundation in all its diversity. In addition, the lab in Davos can continue to foster reciprocal communication and research coordination. Such coordinating and unifying functions are essential to provide focus in a world that tends towards diffusion and drifting apart.

How should these roles take form? Neither centrifugally, without fragmentation, nor centripetally, without patronizing. If every institution contributes best practice, if every contribution receives the appropriate recognition, then the collaboration will be genuine, spontaneous and, consequently, corresponding ideally with the ideas of the Foundation. In such a setting, the institution “Davos” can act as center of competence as *primus inter pares* without arrogance but as a natural and neutral point of reference. “Davos” is a worldwide renowned brand within the community trauma surgery.

The past thirty years were filled with fascinating activity and unusual research. I am convinced the AO Foundation’s coming decades will continue with productive engagements for the best care for the trauma patient. Everybody involved with the AO Foundation’s research institute in Davos could feel the creative buzz coming out of this worldwide

unique place. I am deeply grateful for the circumstances and opportunities that brought me to the AO Research Institute and even more to all the people who participated in this endeavor creating the perfect research climate.