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Occupational Medicine—Its Contribution to Protection and Promotion of Health at Work

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This article deals with the special demands on occupational medicine due to the changes of work and of tasks at workplaces. Conclusions for research in occupational medicine are drawn from these processes. They are discussed on the basis on an analysis of literature from the years 1980–1998. Focus of future research in the field of occupational medicine is developed by taking international tendencies, the interdisciplinary setting of occupational medicine, and the close relations between science and practice into consideration.

occupational medicine health work future

1. SPECIAL REQUIREMENTS FOR OCCUPATIONAL MEDICINE DUE TO WORK AND LABOR CHANGES FOR OCCUPATIONAL SAFETY

Occupational medicine examines and influences the interrelations between demands and conditions of work on the one hand and health, illness, and employability on the other. Its aim is to improve, preserve, and cure health and the occupational capacity of working individuals, and secure the working ability of disabled and differently skilled human beings.

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Occupational medicine developed as an independent medical field within a short historical time period—a scientific field that was partly politically demanded, but also developed organically. This creates problems within external as well as internal understanding. Due to the change of labor and the demands on occupational safety in Germany, the scientific discipline of occupational medicine has had to reshape its theory, its applied research, as well as its practical performance in order to adapt (Scheuch et al., 2000).

The fact is that working conditions have improved immensely. The modern structure of work leads to a diminishing number of jobs with high occupational risks as well as a drop in employed individuals. Thus the actual extent of occupational medicine is affected more by legal regulations than by vocational risks. In addition, the change of work causes other health risks, which have not been the focus of occupational medicine so far. With the change of labor, new strategies, not previously considered part of this field, are becoming possible. Vicarious are the catchwords mentioning "human-related design of work" and "health promotion." We suddenly find ourselves in the well defined and highly regulated field of occupational medicine, facing the question "What actually is the content of occupational medicine?" What are our competences for and how far do others (mainly the legislator and financiers) trust us?

1.1. Structural Changes

Already 60% of jobs in Germany can be counted in the enlarged branch of services. In comparison, the number of industrially oriented work places with their classic strains—the traditional field of activity of occupational health—is decreasing.

One main task of future occupational medicine research is the search for answers to the arising health and capacity problem as a consequence of the structural changes. Teaching, science, and communicational type of jobs will grow in quantity, in addition to information processing professions. Lifelong learning and flexibility towards work time, labor, and locality belong to the new requirements. Additionally there will be demographic changes, characterized not only by the permanent rise of the average working age, but also by the constantly growing number of female employees in industry.

Professionals in occupational medicine have to promote the fact, more than ever before, that aside from the human-machine interface there is also

the interface between individuals. Psychological-social factors gain importance. A new dimension of the integration of preventive medical knowledge and action in the work processes is then created and can be paraphrased with the slogan "mental occupational medicine" (Scheuch et al., 2000).

Concepts and methods on how occupational medical care can contribute not only to early recognition of health impairments but also to health promotion and development of capacity need to be developed. Professional groups are affected by these changes for whom no consolidated concept of occupational medicine exists.

1.2. Change of Work Organization

The rapid changing process of structures in the workplace and companies will cause an on-going disintegration of the organizational structures of work. The consequence will be an inadequate supervision and consultation of the employees. Examples of this are the occupational medical care of employees in domestic home-work, the problem of the so-called Scheinselbständigkeit (a term expressing pseudo self-employment) or the general medical care of the self-employed. The protection of their privacy is, according to German law, more important than their work safety. To approach these future demands occupational medicine has to develop solutions for a highly qualitative care, which will be mainly attended by a mind changing process. The benefit of occupational medical activity has to be demonstrated and thereby feeding the need.

The changed organization of work queries health-related issues concerning the arrangement of work time and length, the combination of work and leisure time, social effects, and possible health consequences. Jobs that lose regional and national borders or work in different time zones will become an ever-growing quantitative problem. Continuous vocational biographies will become exceptions to the rule, thus complicating the recording of strain development and causality. Times of qualification or unemployment disrupt continuous job performance creating health-related effects.

1.3. Change of Health Relevant Problems at Work

Content and organization of labor increasingly determine the health relevant impacts of work. As a result the effects of work on individuals in a modern

economy are in a positive as well as in a negative manner contingent upon mental processes, psychosocial strains, and personal behavioral styles.

Meanwhile employees' perception of work hazards has seriously changed. Hazards through accidents have been diminished and long-term hazards due to chemical or physical strains are often minimized. The belief in occupational safety has increased. Mental strains and demands are coming to the forefront. Figure 1 illustrates this with data from surveys of the European Foundation for the Improvement of Living and Working Conditions (1993, 1997).

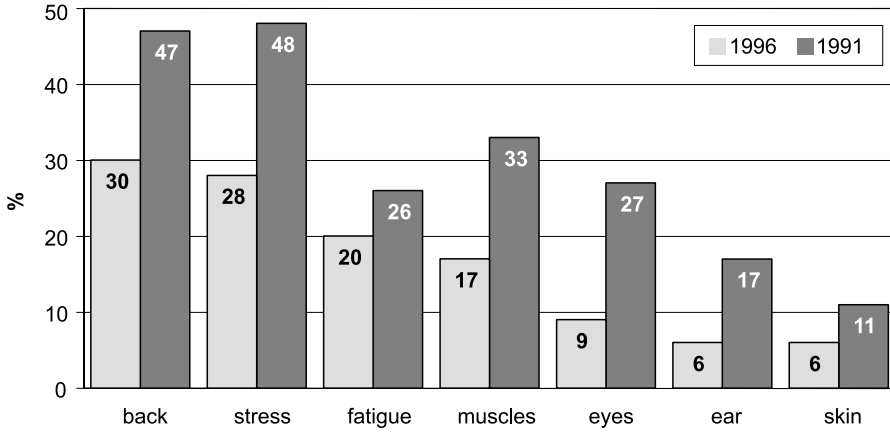

Figure 1. Vocationally caused hazards to health 1991 and 1996 in percentage (selection, survey by the European Foundation for the Improvement of Living and Working Conditions, 1993, 1997).

The topic of health and safety hazards is the critical problem of occupational medicine. This deliberately chosen comparison of two surveys of vocational health and safety hazards also shows our problem with the methodical recording and interpretation of the results: The improvements shown can not be the result of preventive efforts.

In the last 20 years there was great progress in the field of conditional prevention, whereas the success of behavioral prevention was minor. Therefore, special programs, which focus on behavioral prevention, ought to be developed, and ultimately realized. The company physician has a crucial importance concerning the transformation of scientific outcomes as only he or she holds the sufficient competence to wholly judge the effects of work on the employees' health. Also research results, resources, and concepts from the discipline of occupational medicine are rarely used to improve the

population's general health. Several contacts between an employee and an occupational physician are required by law. It would be effective and advantageous to use these for health promotion and to promote behavioral change. This calls for a rethinking of organization and finance.

1.4. Change of Structure and Importance of Occupational Medicine Suppliers

Commercialization grows and the layout of the services of occupational medicine differs increasingly. Due to outsourcing company assigned occupational physicians will be few and occupational medicine services will be incorporated into more complex services. Established doctors of general health care will realize considerably the tasks of occupational medicine. Hence, various problems follow, mainly concerning postgraduate education, quality management, and the practical application of scientific investigations. This can cause principle problems of acceptance of occupational medicine in the practice and science in the interdisciplinary field of medical research (Lehnert & Valentin, 2000).

The importance of occupational medicine and especially its research activities are threatened, likewise in virtue of the immense pressure evolving out of increasing unemployment. On this account future occupational medicine is forced to prove its legitimacy, utility, and efficiency. Research and the realization of quality management gain a central importance. Additionally the need to think about future structures of activities of occupational prevention and health promotion as well as to combat proliferation arises. That can only succeed with long-ranged development concepts, the supply of grounded methods, and continual quality management of the realized tasks. This means that research of occupational medicine is considerably challenged.

1.5. Change of Legal Regulations for Industrial and Health Safety

Activities of occupational medicine in Germany are legally ordered and inherit together with the work of the expert for occupational safety a special position for safety at the workplace. According to the German law on occupational safety, Arbeitssicherheitsgesetz (1973, §3), occupational medicine has to contribute to the prevention of vocationally caused diseases. Section 2 of the Arbeitsschutzgesetz exceeds this demand: ''Actions of occupational

safety in the legal interpretation are actions to prevent accidents at work and vocationally caused hazards to health including actions of human-related design of work." Research of occupational medicine must assert a claim in the fields it would like to engage in and prove its competence. In the future, legal regulations and competence determine the action fields of occupational medicine.

As a consequence of the change of labor and the tasks for occupational health in our country the position of occupational medicine within the system of occupational health and safety is put to question. Occupational medicine is at a crossroad: Should the classic fields, based on traditional and approved methods, be used or should its methodical inventory be enlarged with interdisciplinary help and occupy itself with all demands in modern economy that are connected with health and capacity?

2. CONTRIBUTIONS FROM OCCUPATIONAL MEDICAL RESEARCH REGARDING OCCUPATIONAL HEALTH, SAFETY AND HEALTH PROMOTION

2.1. Change of the Scientific Field "Work and Health"

The research of industrial safety with its classic, mainly toxicological strains, profited by the pressure of possible emergence of diseases. Investigations were determined by mono-causal approaches and thereby it was more likely than ever to prove economical evidence. This is inherently more complicated with the new multi-causal mental strains, which are increasingly dominating. Modern labor is characterized by informatory aspects, organizational change, globalization, flexibility, intensification, insecurity, and a continuous change of workplace. All these changes are common in that mental demands rise, psychosocial strains increase, and work-related after-effects, for example, (modern) illnesses, occupational dissatisfaction, and well-being are determined by emotional effects.

Comparing the international scientific literature regarding work and health since 1980 (cf. Brueggmann, Roetting, & Luczak, 2001, in this volume; Luczak, Brueggmann, Rösler, & Rötting, 2000) we can observe that in comparison to English-speaking countries, Germany lacks occupational medicine capacities. German research regarding work and health is extraordinarily oriented on technique and sociology (Figure 2).

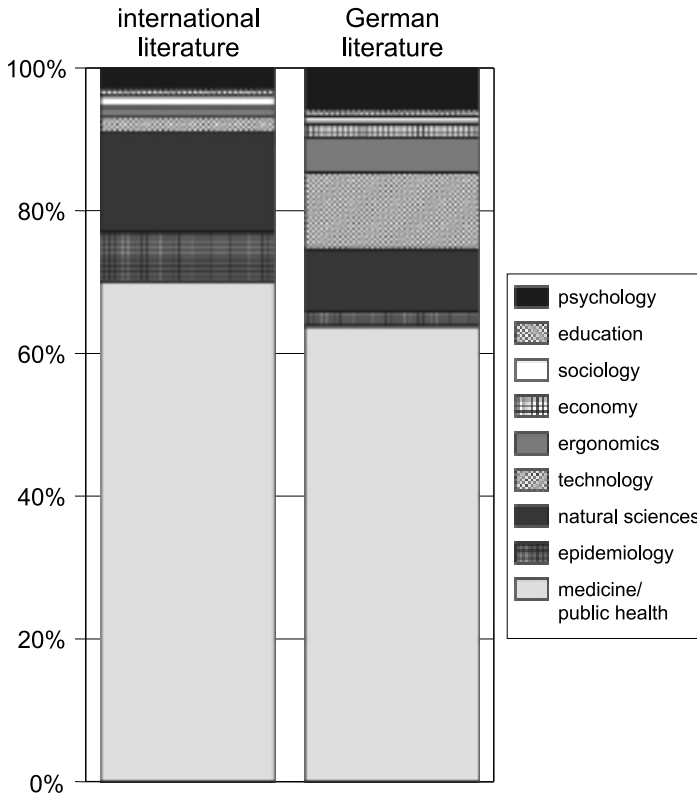

Figure 2. Disciplines of the scientific institutes, which published in the international literature between 1980 and 1999 (searched by the key words ''work'' and ''health''): *n* = 5,428 (German publications), *n* = 13,831 (English publications).

Besides this, an increasing discrepancy between research and practice in occupational medicine is noticeable, which is not only unhealthy for the researchers but also for the practice of occupational medicine. This discipline, as all others, exists upon the meaning of scientific investigations *and* practical realization. A separation of both aspects leads to depreciation on both sides, to the point of the closing of university sections of occupational medicine and the degradation of the occupational medicine in general as abstruse services in the practice.

Reasons for the disadvantaged development of the externally funded research in occupational medicine are various: the change of vocational risks in a modern economy, the establishment of scientific capacities outside of universities and the field of occupational medicine, and the shortage of lobbying at possible finance organizations. Essential reasons are situated in

occupational medicine itself. Part of them is the denial of actual vocational problems affecting health. Considering the increasing importance of mental strains and demands within work, research of occupational medicine ought to give them a scientific importance, too. Observing the use of psychological parameters and theories of work-related effects on organic functions in the German and Anglo-American scientific literature, we can state that in the English reports these kinds of investigations are more widely spread than in the German ones (Figure 3).

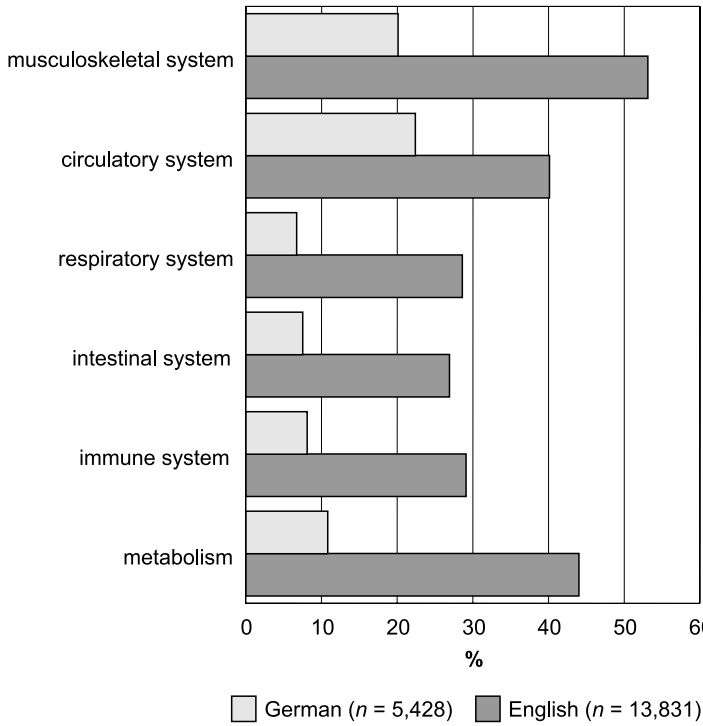

Figure 3. Use of psychological parameters and theories in work-related effects on organic functions in German and English literature 1980–1998 (%).

2.2. Increasing Importance of Science in the Field of Occupational Health

There is no doubt that through changes of human work, material conditions for labor processes, social and organizational context of work, structures and demands on human work have severely changed. Also the emphasis and the

forms of the scientific dealing with the described changes shifted with them. Unique within the scientific history we can state an exchange of paradigms in the research field of work and health (Scheuch et al., 2000).

Modern labor does not diminish the importance of research in occupational medicine. On the contrary, it leads to growing demands, because

- the role of human beings increases in a modern economical philosophy: Endurance, adaptation, recovery, and boundaries of capacity of employees will be a central issue;
- differential design of work and differentiated employability will no longer be an utopia but rather a necessity;
- the investigation of individual predisposing factors in order to prevent functional disorders and diseases will be necessarily apart from the average oriented assessment of occupational demands and strain;
- the borders between working and nonworking time mingle due to a flexible design of work time, work organization, and workplace, which causes new demands on the physiological regulation of strains incorporating free time and sleep;
- the continuously changing working conditions demand a higher level of initial period and adaptation to new or changed work;
- of the development of the employment structure regarding changes and shifts within jobs, mainly relating to age and gender, which presents new challenges for investigating strains and demands;
- modern economy offers new chances for the chronically ill and disabled and the amount of those chronically ill patients with vocational handicaps who have not reached the pension age will increase; in this respect the reintegration of temporarily disabled or challenged employees is also important;
- the extended occupational safety order on human-related design of work and reduction of work demands a supplementation of the purely risk-orientated methodological approach towards a resource oriented one;
- new technologies once more question the relevance of health at work-related strains. As technologies change rapidly, the quantity of such demands on occupational medicine increases.

The past occupational medicine research regarding interdependent relations of work and health proved that special chemical and physical influences, vocational technologies, structures, and organizations affect the anonymous, statistically standardized human being. The central question for occupational medicine—‘‘Why under the same working conditions do some human

beings stay healthy and capable and others do not?''—moved into the background.

In the future the topic of research, especially for occupational medicine, should be increasingly directed at the individual. The individual substantially participates in modern fragmentized, individualized, organizational structures and bears the health, capacity, and personality-related effects of work. So far no convincing contributions have been made to identify any mechanisms of regulation of different strain-coping relationships and the factors that determine the type of relation.

Modulators of stability and adaptability of cognitive and emotional processes of modern labor and their importance for health have to be investigated. This means that the interaction between individual resources and situation demands in a psychological and physiological manner ought to be the topic of scientific analysis. The dominant mechanisms of modern labor, which do not follow the classic cause-effect principles of chemical and physical factors of work, can only be explained through an individual view of the processes. Until now the scientific outcomes of occupational medicine have not been sufficiently used for drawing practical consequences for an individualized prevention and use of resources. Doing so could allow the development of the examining occupational medicine to become a differential occupational medicine under consideration of mental and psychosocial factors. Models of explanation and methods shall serve as prerequisite for actions of occupational medicine. With this, the efficiency and effectiveness of the preventive system can be enhanced in the future world of labor.

The molecular biological and genetic orientation of medicine and biological science will increasingly affect research with relevance to occupational medicine. The extensive decoding of the human genome brings about new chances and risks for activities of occupational medicine. Occupational activities and vulnerability in the professional world are extremely sensitive. Therefore, basic research will in the future gain more importance for occupational medicine, although it should not lose its connection to the practice. Gentoxical issues will also increase their importance, and not only in the mentioned respect (Greim, 1999).

Ninety percent of all companies in all European states are small enterprises. They employ about two thirds of all employees. These enterprises accomplish a grand contribution to the political economy and to the respective upkeep of jobs. In opposition to this is the fact that in Germany only 20% of all small enterprises are served by experts of safety technology and occupational medicine. In order to reach the justified goal of a qualitative

and quantitative care such as used for large enterprises, medium and small enterprises not only need to be cared for by occupational medicine but rather require an interdisciplinary approach (Scheuch, 2000).

The growing quantity of complex processing, vocational condensation, multiple jobs, increase of working time, increase of night shifts, growing variability and flexibility of time and place of work gives rise to question of possibilities, methods, and structures of occupational medicine in order to realize the tasks of occupational medicine now and in the future.

Apart from already developed methods, the main focus should be set on the recording of long-term effects of disadvantageous interaction of work and human beings. The whole interrelationship between human beings, work, and environment has to be in the foreground, not only at the work site. In this respect a development of the analytical level from its momentary state of well-developed taxonomy of paid labor, to a 24-hour-daily cycle of work and recreation is necessary. The model by McEwen (1998) offers a fruitful conception of this.

In the process of orientation on future subjects of research, one should not neglect that traditional tasks will also be important and that classic questions of occupational hygiene will be steadily asked due to new hazardous materials and strains (Beth-Huebner, 1998; European Agency for Safety and Health at Work, 2000). While discussing the change of work and the following consequences for science, one should not forget that a great number of pathogen influences affect working conditions. Demand mechanisms and possibilities of prevention are not finally investigated. Most of these problems are not of direct interest to a company, as their effects become apparent outside the occupational area.

Considering the organ-related issues in national and international literature from the perspective of work and health, we can see that apart from a few exceptions no shift has happened over the past 20 years (Figure 4). The exceptions are the increase of articles on the musculoskeletal system, blood, and the blood circulation system and the decrease of articles concerning illnesses of the senses and the heart/circulation system with occupational relevance. We do not expect a substantial change over the next few years. We assume that the immune system and the vegetative nervous system will rise in their scientific importance, as will the investigations regarding the combined effects of various strains on different organ systems and, most importantly, the research of unspecific effects of occupational strains.

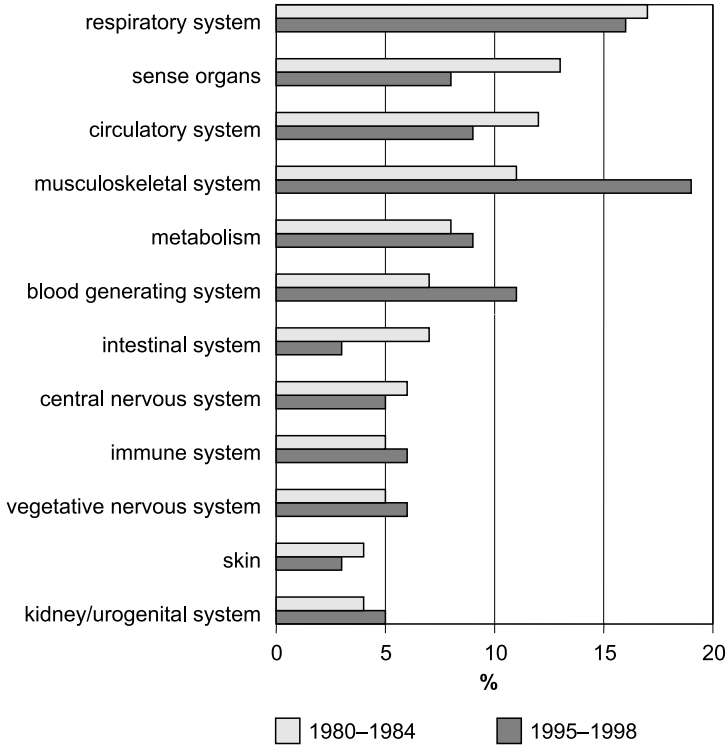

Figure 4. Publications to work and health regarding examined organ systems in the entire national and international literature (*n* = 36,097).

Future research and practice of occupational medicine will be confronted with various problems, because

- the combination of low and relatively high concentrations of chemical, physical, and other health-related factors at work will determine the profile of strains and hereby complicate the access of its effects;
- unspecific and complex descriptions of health disorders influence the discussion of the relation between work and health, especially in the media (burnout, chronic fatigue syndrome, multiple chemical sensitivity, sick building syndrome, repetitive strain injury);
- the so-called health market has developed into a playground for nonscientific and hardly provable activities, which also affect work structures.

In the past years scientific tasks with priority for interdisciplinary occupational medicine were repeatedly stated in national and international literature (Harrington & Calvert, 1996; Rantanen, 1996). Numerous scientists

in the USA elaborated over a long period of time on focal points for the future research in the field of work and health (Table 1).

TABLE 1. National Occupational Research Agenda (NORA): Priority Research Areas for 21st Century (U.S. Department of Health and Human Services, 1996)

Category	Priority Research Areas
Disease and Injury	Allergic and Irritant Dermatitis
	Asthma and Chronic Obstructive Pulmonary Disease
	Fertility and Pregnancy Abnormalities
	Hearing Loss
	Infectious Disease
	Low Back Disorders
	Musculoskeletal Disorders of the Upper Extremities
	Traumatic Injuries
Work Environment and Workforce	Emerging Technologies
	Indoor Environment
	Mixed Exposures
	Organization of Work
	Special Populations at Risk
Research Tools and Approaches	Cancer Research Methods
	Control Technology and Personal Protective Equipment
	Exposure Assessment Methods
	Health Services Research
	Intervention Effectiveness Research
	Risk Assessment Methods
	Social and Economic Consequences of Workplace Illness and Injury
	Surveillance Research Methods

From our point of view the statement has to be supplemented in the following specific questions and tasks:

- Occupational medicine has to fundamentally contribute to the development of integrative concepts in order to clarify and influence the relationships between human beings and work, as they are the basis of action. In the future it will need to take—more than now—an integrative role between the disciplines.
- Cognitive and emotional demands and endurance will gain central importance for occupational medicine. Methods for analyzing hazards and resources, for investigating and influencing chronicle states of strain, and for a prognostic assignment of the differently abled have to be developed.

The prerequisites for a differentiated view on human beings and work need to be set.

- The current inventory of methods for assessment of work strain in practice has to be critically analyzed. The utility is determined by the validity, reliability, and time-related economy and not by the quantity of measure parameters.
- Criteria such as troublesomeness and well-being disorders have to be utilized as strain parameters of occupational medicine.
- Classic occupational factors, which have so far been viewed from the perspective of risk, play an increasing role considering their cognitive-emotional functions and hereby their influence of employability. That is the point exemplified by illumination, noise, and vibration. Subjective criteria, besides physical criteria for action, gain increasing relevance for the design of working conditions.
- The compression of labor and working time increases steadily. A huge part of human and financial detriments can be tracked down to negative effects due to fatigue and exhaustion. Therefore, the issue of diagnosing tiredness, its influence, prognostic assessment, and the consequent design of labor gains more and more importance.

Contemplating our discipline realistically and without the need of representing it, we can state that we are a marginal clinical discipline in medicine, but the most important and extensively institutionalized preventive one that deals directly with the human being. Surely we need the evidence of the occupational causality of cancer but this is not clinical medicine; we need the relevance of an illness to work, but that is not the entirety of occupational medicine. We ought to define ourselves out of the content. The emphasis of one or the other side leads to a separation of the discipline and to a steadily increasing distance between science and practice. Our power is the integration, we should focus our energy on protecting this.

Science and the practice of occupational medicine and their partners are about to be greatly challenged. This affords a closeness in working together. Competence and not pretensions will decide the future scientific role of occupational medicine in practices and in science.

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