Health research 2000 : the program of the German Federal Government.

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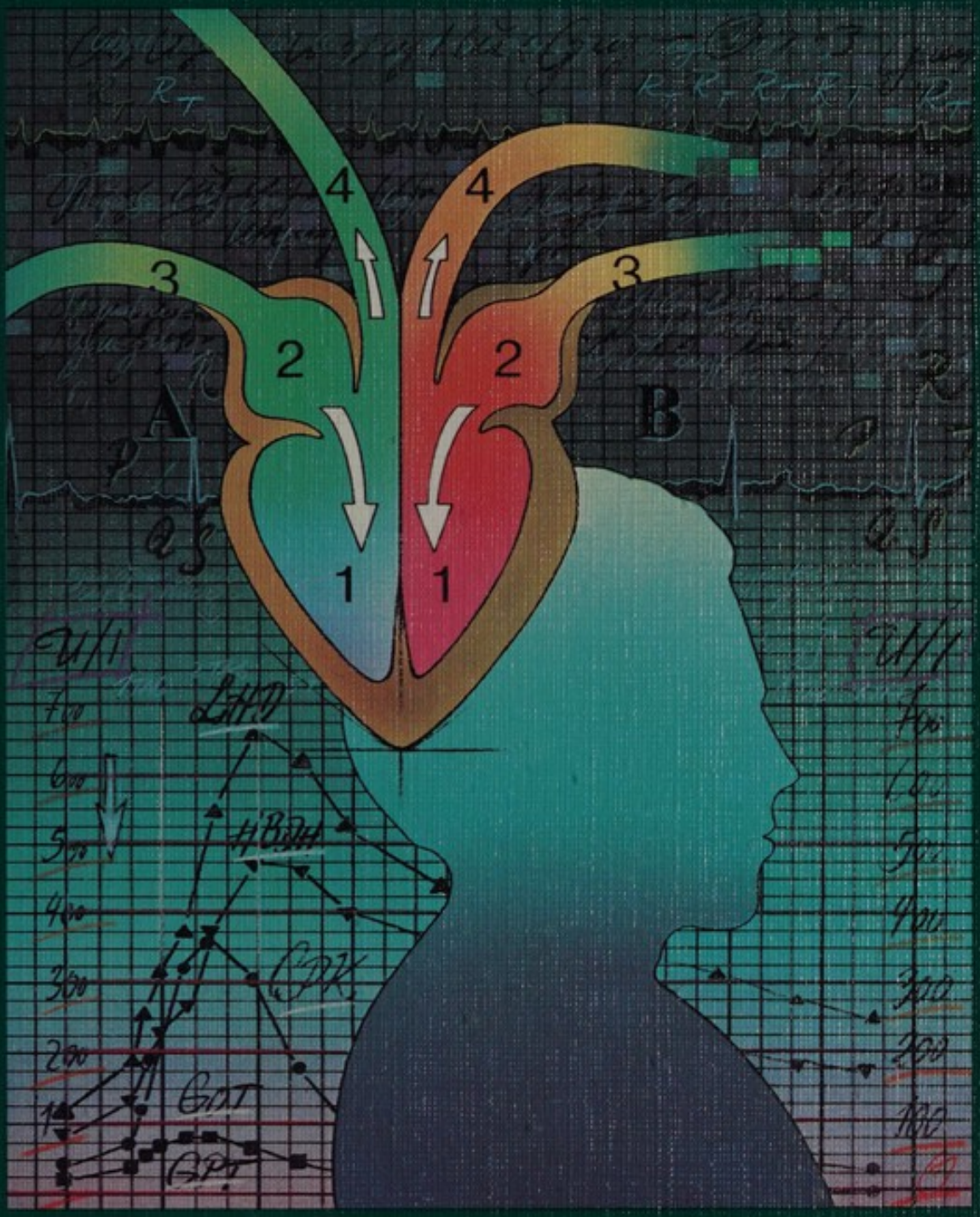

German Federal Ministry for Research and Technology (BMFT)

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German Federal Ministry for Research and Technology (BMFT)

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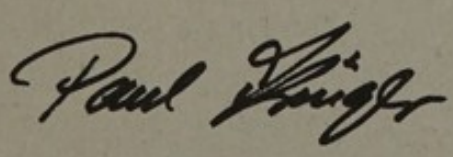
Preface

Health is one of the most valuable possessions in human life and thus an important priority of public preventive care. Though the state cannot relieve its citizens of responsibility for the way they conduct their lives, it does have to see to it that a healthy environment and appropriate care in case of illness are available. Promoting research is part of this task.

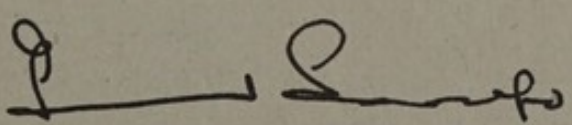
If health research is to be rationally funded, various requirements have to be met. First of all, it has to be clarified how health can be best maintained and promoted, how illnesses arise, and how they be treated more effectively. At the same time, health research funding should make preventive measures and health care as effective and economical as possible.

Health-related research represents a steady and transformative process of advances in knowledge that at the same time requires enough continuity as to allow scientific competence to prosper and young researchers to develop. This is in keeping with the strategy of the German federal government, which combines long-term commitment to nonuniversity research facilities with the flexible use of project funding. Health Research 2000 shows for the first time the combined efforts of these two funding mechanisms on health research.

Not all topics can be given priority and taken up at the same time. The objective instead is, in a division of labor and responsibility incorporating the Länder and the scientific community, to focus on those issues in health research where scientific quality and medical relevance coincide. The limiting structural conditions of health research are particularly important in this strategy. They decisively affect the success of health research and need to be actively molded. Only in this way can the urgently necessary interdisciplinarity between related sciences and the transfer of cognitive advances from basic fields of research into practice be effected. And only in this way can the ultimate goal be reached: to make research beneficial to man's health.



Dr.-Ing. Paul Krüger



Horst Seehofer

Summary

1. Optimizing an individual's chances of enjoying a healthier, longer, and more active life, while at the same time keeping health services economically feasible: this is the challenge facing health policy. In this effort, research can be instrumental. Under the sponsorship of the BMFT and BMG[1)], the federal health research program[2)] has the task of coordinating research policy in this field and directing federal funding to the major problem areas of health policy.

2. Germany is endowed with a wide array of university and nonuniversity resources in health research. Against this background, federal funding for health research serves to fulfil a constitutionally established spectrum of federal obligations in the areas of health and research policy. Accordingly, funding is not organized to cover territorial needs nor is it centralized; instead, it adheres to the principle of subsidiarity.

3. An analysis of the current situation of health research in Germany and reflection on both past instances of success and general experiences within the framework of the preceding program yield the following fields of investigation:

   – Research on prevention and preventive care
   – Research on disease control
   – Health Services Research

   In these fields, the Federal Program primarily focuses on the centers and fields of priority in clinical research and public health (i.e., those sciences related to the health problems, health-related behavior, and health-care requirements of entire population groups, including health-system research).

4. By pursuing this conception of health research, the Federal Program takes aim at the strategically important structural weaknesses in German health research, as previously pinpointed in analyses by the Wissenschaftsrat (German Science Council) and others. According to these studies, research can only successfully contribute to the improvement of the health of the population, if the structures of research are themselves further developed and improved.

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1 BMFT, Bundesministerium für Forschung und Technologie, Federal Ministry of Research and Technology; BMG, Bundesministerium für Gesundheit, Federal Ministry of Health.

2 Hereafter referred to generally as the Federal Program, or, using the name of the specific program continuation presented here (for 1993-1998) as Health Research 2000.

The case of clinical research and public-health research shows that – at least for research funding – in the major problem areas of health policy its substantive tasks and structural aims should not be separated from one another. Both must play a part in defining funding-policy objectives.

5. In terms of the aforementioned objectives, the following criteria in particular hold for the selection of research proposals of high scientific quality:

   – Priorities on important research fields in health policy
   – Interlinkage of basic and applied/clinical research
   – Quality guarantee by external peer review
   – Longer-term establishment of the funding-initiated research structures

6. The Federal Program seeks to achieve its objectives by funding projects with time limits and with the help of basic-facility (non-project-restricted) federal funding for research institutions.[3)] The clear intention is to make lasting improvements to the basic conditions and structures of health research in Germany.

   The reconstruction funding in the new German Länder (former East Germany) should be continued within the framework of the Federal Program. In keeping with the recommendations of the Wissenschaftsrat, it should aim to foster the structural development of the university domain and the nonuniversity research institutions in the new states.

7. Of project-earmarked funds, about one third are spent on public health projects and two thirds on projects in clinical research. This is supplemented by the contribution made by health research at nonuniversity institutions, which use their capacities primarily to strengthen the biomedical part of Federal Program activities, and, in cooperation with university facilities, serve clinical research by helping integrate biomedicine into clinical practice.

8. If federal project funding is to be successful, the processes it has initiated – of thematic orientation and structural improvement – have to find sponsoring structures willing and able to adopt and further develop the objectives pursued in the federal promotion of health research.

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3) A basic distinction is made in Germany, especially by public funding agencies, between project funding (Projektförderung; usually short term and specific) and *institutionelle Förderung* (basic funding of research institutions). The latter is long term, usually not tied to any specific conditions, and is provided to institutions for their basic material and operational costs, i.e. for their basic facilities and needs, without directing this money to specific budgetary items or projects. For the sake of conciseness, this will be rendered in English hereafter as basic funding. (For a more comprehensive discussion of this distinction, see the writings of Dietmar Braun.)—translator's note.

9. Modern biomedical and health research is dependent upon international cooperation and can only be adequately assessed in international comparison. Thus, international collaboration, especially within the framework of the EC, is becoming increasingly important in its own right.

   National health research funding activities and those of the EC mutually influence one another. The overriding objectives of the Federal Program also govern the German attitude toward the formation of the EC program on health research.

   In terms of non-European cooperation, working together with Israel, Japan, and the United States continues to receive top priority.

10. The Federal Program, whose goals are set by health policy, develops, in research policy terms, from the dialogue with the relevant branch of science. In the Gesundheitsforschungsrat (GFR, Health Research Council), the BMFT has brought together representatives of science, and of its research and funding organizations. In this way they can play the moderator in this dialogue, critically attending to the shaping and implementing of the health research program and evaluating its performance.

Chapter I. Goals and Tasks of the Program

Since 1978, the German federal government has promoted health research in the framework of its program "Research and Development in the Service of Health" (Forschung und Entwicklung im Dienste der Gesundheit). The program "Health Research 2000" (Gesundheitsforschung 2000) continues to pursue the objectives of the preceding funding periods of this program, while at the same time focusing policy along new lines for the period from 1993 until 1998. It is the program's task to coordinate research policy within this field and to direct federal funding to important problem areas in health policy.

Health research falls under both research and health policy. For this reason, the federal administration's program has been given an interdepartmental structure. It is jointly administered by the Federal Ministeries of Research and Technology (BMFT) and of Health (BMG). The program is structured in conscious recognition of the great range of health research already covered by the universities and thus by the Länder.[4)] Accordingly, its funding is not organized to cover territorial needs nor is it centralized; instead, it adheres to the principle of subsidiarity.

The program takes its point of departure from those health-policy tasks that research can help realize and whose purpose is

* to improve prevention and preventive care
* to discover the causes and effective means of treating diseases, and
* to continue to develop an efficient and fundable system of health services

Thanks to science, modern medicine has enjoyed great achievements. Nonetheless, the future will also demand great efforts from all responsible parties in health services (including individual responsibility for one's own health) if the health tasks facing Germany are to be solved. The state certainly cannot relieve its citizens of their personal responsibility for leading healthy lives and taking measures to prevent illness. However, it is the task of health policy to see to it that healthy living conditions are found in the natural and social environment, to strengthen individual initiative and responsibility, and to ensure effective and economical health care in the case of illness.

4 In Germany, universities generally fall under the jurisdiction of the individual state in which they are located – translator's note.

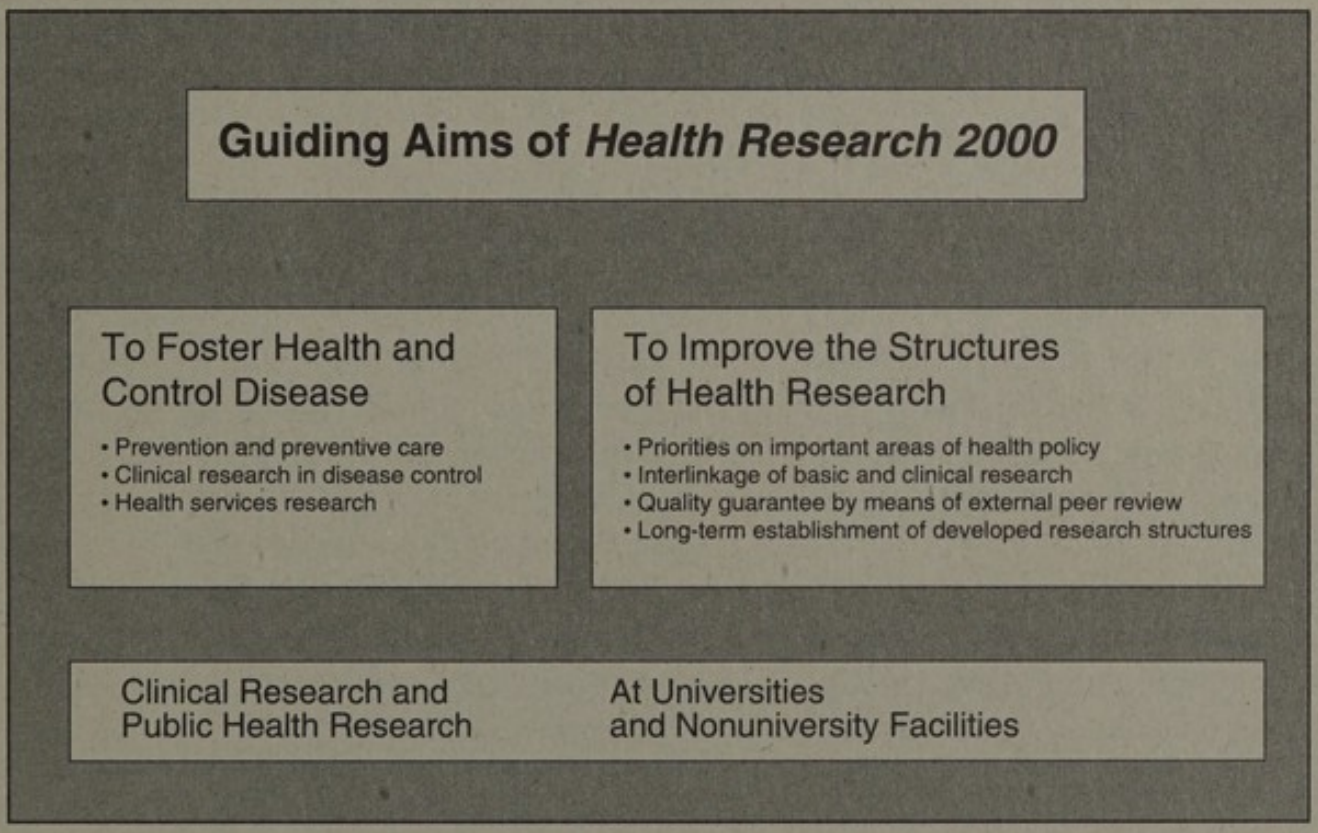
The Federal Program fosters these goals, above all by funding the structures in science and health services within which advances are made in knowledge of health and disease. Additionally, it provides incentives for taking up certain specific topics of inquiry.

The federal administration has promoted health research in years past as a high priority and with growing financial resources. It represents, along with environmental research, a central part of the public preventive-care tasks of research policy.

1. Guiding Aims and Tasks of Health Research

Federal Program activities are governed by two overarching aims, shaped in equal measure by health-policy requirements and research-policy considerations. These two guiding aims "To Foster Health and Control Disease" and "To Improve the Structures of Health Research" define both the choice of topical areas of inquiry (described in detail in chapter II) and the measures implemented by the program (see chapter III).

In terms of these goals, the program's thrust has basically two directions: priorities in public health research (in the sense of health sciences related to health



problems and the health-care needs of the population, including health services research) and priorities and centers in clinical research, with special attention given to cooperative efforts with basic research.

Health Research in Germany

Health research basically occurs within the universities in Germany, which in conjunction with the university hospitals have great responsibilities in the areas of research, teaching, and patient care. Their endowment should enable them to conduct the independent research required by their tasks. These institutions are joined by related departments in natural sciences and, to a lesser extent, in the humanities and the economic, social, and legal sciences, which in their totality make significant contributions to health research.

University-based health research is supplemented by nonuniversity health research at Großforschungseinrichtungen (GFE, National Research Centers), institutes of the Max Planck Society (MPI), Blaue Liste Institute (BLI, "Blue List" institutes), and federal and state institutes. Medically relevant issues are also handled at some of the institutes of the Fraunhofer Gesellschaft (FhG, Fraunhofer Society).

Finally, the pharmaceutical and medical-technology industries represent an autonomous field of health-related research.

This diversity in the realm of research reflects both the historically evolved division of tasks between university and nonuniversity facilities and the basic federalistic character of Germany with its conception of subsidiarity.

The federal and state governments see their primary tasks in nonuniversity health-related research in the provision of complementary funding in those areas not taken up by the universities, in the realization of nationwide and explicitly federal tasks, in the implementation of long-term research tasks entailing high infrastructural costs, and government-department and industrially related, application-oriented research and commissioned research. Close interaction between university and nonuniversity research funding activities is required in order to complete these tasks.[5)] The nonuniversity research institutions, especially the GFE, are supposed to represent – in conjunction with the universities – the centerpoints of networks. This interaction becomes even more important in terms of the effort to integrate the realm of research in Germany and in all of Europe.

Complementing the efforts of other sponsors, the Federal Program sets itself both substantive and structural targets, with the quality of research as the decisive funding criterion. Permanent funding of specific areas should be avoided. The aim, instead, is to use financial incentives and initiatory funding to help incorporate those topics recognized as priorities into the existing institutions of health research. Fragmentation into an array of individual initiatives has to be avoided, even though one or another topic certainly might have its own legitimacy.

1.1 To Foster Health and Control Disease

The goal of government health policy is to promote and maintain the health of its citizens, or, in the case of illness, to restore it. The improvement of material living conditions, such as nutrition, housing, and working conditions, in conjunction with modern medicine and our system of health care have contributed toward this aim. A clear indication of this is the enormous improvement in average life expectancy from the turn of the century until today[6)]: for women, from around 48 to almost 79 years of age and for men, from around 45 to over 72 years of age.

The standard of living reached today, however, has also – in combination with increasing industrialization and general prosperity – created or underscored new problems and risks: malnutrition, lack of physical movement, and the abuse of sumptuary goods (tobacco, alcohol, etc.) and drugs jeopardize and have considerable negative effects on the health of the population. In the highly technologized work and leisure world of industrial society, this is joined by mental and physical stress created by noise, contaminants, and other environmental influences. Their impact on health, especially in terms of their complex interactions, is still largely uninvestigated.

In the course of this development, the spectrum of disease has also been transformed considerably. Whereas at the beginning of the century, infectious and parasitic diseases represented the greatest dangers to health, other diseases now top morbidity statistics. These include above all cardiovascular illnesses, malig-

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5 On this, see *Die Empfehlungen des Wissenschaftsrats zur Zusammenarbeit von Großforschungseinrichtungen und Hochschulen* (The Recommendations of the Council on Science on Cooperation Between National Research Centers and Universities) (Cologne, 1991).

6 These figures refer to the Länder of former West Germany.

nant tumors, metabolic diseases, depressive diseases and dementia, as well as accident-related injuries and alcohol- and tobacco-induced disease. Which is not to imply that the dangers of infectious disease have been permanently banned, as AIDS has demonstrated all too well. At the same time, given today's life expectancy, there is also an increased risk of geriatric ailments. These health risks and diseases also demand effective prevention, causal treatment, and rehabilitation.

Not all tasks can be tackled at the same time and with the same intensity. The priorities of health policy[7] are placed on those diseases, which due to their frequency, duration, or severity involve or threaten to involve large numbers of citizens, where disease control precipitates high costs, and preventive measures are promising. It is not as if these criteria could simply be mechanically applied, and a scala of disease could be calculated by means of statistics and registered data. Instead they serve in conjunction with other less-easily measurable criteria as means of orientation in the effort to establish priorities in keeping with the guiding aim of this part of the Federal Program. These other criteria include the quality of life, multimorbidity, the avoidability and treatability of certain diseases as well as the prospective risk potential of new diseases and the existence of research capacities (infrastructures and personnel) to deal with specific diseases.

By taking these aspects into account and reflecting on the successes and experiences of past programs, the following topical areas move to the forefront for the future of the Federal Program:

- Research on prevention and preventive care
- Research on disease control
- Research on health services

Research and research funding in this field necessarily have to be organized in an interdisciplinary manner, in the sense of the public health sciences. Accepting this criterion, the program should also contribute to the target set by the World Health Organization (WHO), which urges member states to work toward a type of health research that supports a development toward "health for all"[8].

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7) See also Dringliche Gesundheitsprobleme der Bevölkerung in der Bundesrepublik Deutschland (Urgent Health Problems of the Population of the Federal Republic of Germany). Ed. Projektgruppe Prioritäre Gesundheitsziele beim Zentralinstitut für die kassenärztliche Versorgung as commissioned by the Federal Minister of Youth, Family, Women, and Health (BMJFFG). (Nomos Verlagsgesellschaft, 1990).

8) Ziele zur "Gesundheit für alle": Die Gesundheitspolitik für Europa (Goals Toward "Health for All": Health Policy for Europe). WHO Regional Bureau for Europe. Up-dated summary, September, 1991.

1.2 To Improve the Structures of Health Research

Lasting advances in health research can only be achieved by successfully improving the basic conditions under which it is conducted. For this reason, it is a high priority of research policy to advance the development of research structures and to mould the latter in such a way that they provide conditions accomodating to research. In this way, problems that beset science could be solved quickly, efficiently, and competently. Analyses made by the German Wissenschaftsrat and by other authors have demonstrated structural weaknesses in German health research[9]. They are mostly clearly visible in the fields of public health research and clinical research.

Public Health

Whereas schools of public health or similar institutions can look back on a long tradition in Anglo-Saxon countries, the health sciences were not able to establish themselves to the same extent in Germany. Its traditional disciplines, such as epidemiology, behavioral and social medicine, and the economics of health have tended to be underrepresented in German university research and education.

According to the definition upon which this program is based, public health research encompasses both the fields of "Prevention and Preventive Care" and "Health Services Research." Its goal is to help better recognize the limiting conditions and possibilities of health funding and to demonstrate ways to improve them. It can help in the analysis of risk factors and conditions promoting health and in the identification of high-risk population groups who require priority treatment.

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9) Deutsche Forschungsgemeinschaft (DFG; German Research Association), *Zur Lage und Verbesserung der klinischen Forschung in der Bundesrepublik Deutschland* (On the State of Clinical Research and its Improvement in the Federal Republic of Germany) (1979). Wissenschaftsrat (German Science Council), *Empfehlungen zur klinischen Forschung in den Hochschulen* (Recommendations on University-Based Clinical Research) (Cologne 1986); Wissenschaftsrat, *Empfehlungen zur Förderung klinischer Forschergruppen in den Hochschulen* (Recommendations on the Funding of University-Based Clinical Research Teams) (Cologne 1987). Dietmar Braun, *Die Einflußmöglichkeiten der Forschungsförderung auf Strukturprobleme der Gesundheitsforschung in Deutschland* (Addressing the Structural Problems of Health Research in the Federal Republic of Germany: The Potential and Limits of Research Funding). Vol. 15 of *Materialien zur Gesundheitsforschung, Schriftenreihe zum Programm der Bundesregierung "Forschung und Entwicklung im Dienste der Gesundheit"* (Materials on Health Research. Monograph Series on the Federal Government's Program "Research and Development in the Service of Health") (Bonn: Wirtschaftsverlag NW, 1991); now published in English as part of a study by Dietmar Braun with the title *Structure and Dynamics of Health Research and Public Funding*, Kluwer Academic Publishers, Dordrecht, 1994.

In recent years, the establishment of research study programs at several universities marks movement in the direction of public health. The BMFT has offered structurally oriented funding for the establishment of research priority programs and the Federal Ministry for Education and Science (BMBW; Bundesministerium für Bildung und Wissenschaft) has provided funding for development of courses of study with the explicit purpose of taking up these university initiatives. In the course of the next few years, funding for crystallization points of research and efficient interdisciplinary research structures is supposed to be used to establish high-quality, university-based public health research. Special value is placed on expanding epidemiological research, especially in clinical epidemiology.

Clinical Research

The task of clinical research is to produce cognitive advances in basic research, but also to discover practical applications for the latter. It also seeks to bring the observations and problems of medical practice into scientific research. This means that close cooperation between the hospital and theoretical research has to be established and then cultivated: in this way, the topics investigated by basic research remain as problem oriented as possible, and the findings made can be quickly incorporated into clinical practice.

> Clinical research can be defined to include all scientific activities that help explain pathological phenomena. In the most extended sense of the concept, clinical research encompasses all research on the causes, genesis, and courses of disease and all scientific activity related to its detection and treatment that has its origin in medical care of the sick. Clinical research makes use of both natural-scientific methods for analyzing pathological phenomena and statistical methods for assessing forms of medical treatment and the clinical significance of risk factors.

Problems in meeting these high demands arise from two factors: First of all, they arise from the traditionally rigid division made in Germany between clinical subjects and basic research, and the fragmentation that has taken place within individual disciplines. Secondly, the tasks of caring for the sick put strains on the commitment to science. In this conflict, clinical research is frequently given less priority than the duties entailed by patient care. In order to surmount this structural problem of clinical research, it is necessary to

- Create suitable latitude for clinical research in relation to the tasks of patient care
- Intensify collaboration between basic research, and clinical research and other related disciplines, and
- Place priority, in the allocation of resources among the tasks of research, patient care, and teaching, on high-quality clinical research

Goals of Structural Funding

In order to achieve the structural improvements necessary from the perspective of research policy, the future selection of research proposals will be expected to

- Place priority on clinical and public health research
- Develop organizational forms in which basic research, clinical research, and applied research are connected in an interdisciplinary manner
- Guarantee high scientific quality by means of external evaluation procedures (peer review)
- Guarantee long-term financial support for established structures in collaboration with the Länder
- Strengthen the interlinkage between university and nonuniversity research

In the future, the Federal Program will pay greater attention to these goals. Funding should make new cognitive advances possible and, at the same time, establish structures that the institutions receiving funding will then continue to finance on their own.

Considerable financial investments are connected to health research. In large part, they are implemented by the individual German states, in keeping with their constitutionally based powers to promote science. Most problems relevant to health policy cannot be resolved on short notice simply by means of directed funding activities (project funding) of restricted duration. If this project funding is to be successful, the processes it has initiated – of thematic orientation and structural improvement – have to find sponsoring structures willing and able to adopt and further develop the objectives pursued in the federal promotion of health research. Federal resources should be used to complement state-government funds in sensible ways; they should be used above all in those instances where universities and the Länder set and develop priorities in health research of nationwide importance. Funding procedures follow this line both in basic funding and in project funding by setting targets and providing incentives for efficient organization, especially in clinical research.

Medical Schools and Academies at Universities of the Federal Republic of Germany

Institutes jointly funded by the Federal Government and the Länder releved to health research.

- National Research Center
- „Blue List" Institute
- Max Planck Institute
- Fraunhofer Institute
- Superior Federal Authority / Federal Institute

● ■ ▲ ▼ ◆ - Only Health Research

○ □ △ ▽ ◇ - Partly Health Research

1.3 Special Tasks in Health Research

Special structural requirements are raised by the situation in the new German Länder (formerly the German Democratic Republic; GDR) and in what used to be East Berlin.

The Integration of Health Research into the New States and the Eastern Section of Berlin

The universities in the new states and in the eastern part of Berlin have been in a state of upheaval since German unification. The Academy of Sciences (Akademie der Wissenschaften) of the former German Democratic Republic (GDR) and its affiliated institutes were disbanded, and greater efforts were made to reincorporate research into the universities. A series of institutes were newly established, for example as BLI or as GFE[10]. The current state of the infrastructural and technical prerequisites for research of university hospitals and institutes in the new German Länder, especially in terms of their buildings, but also in terms of their technical (instrumental) endowment will necessitate special appropriations for a long period of time.

The same was also true for the GFE and BLI that were established in Eastern Germany upon recommendation of the Wissenschaftsrat. The productiveness of nonuniversity institutions is especially dependent upon having the up-to-date instrumentation and international literature in the relevant field. Grave deficits existed precisely in these terms. Most of the buildings of the nonuniversity facilities are also in poor repair. Quick support was necessary here in order to make high-quality and internationally competitive research possible.

Even though the German research domain has been unified since 3 October 1990, the special conditions in the new German Länder will still require special funding efforts over a period of time in order to develop compatible structures in East and West[11].

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10) A listing of the newly established research institutions is found in Appendix II (2.4-2.6)

11) "Allgemeiner Teil" (General Section) in Wissenschaftsrat (German Science Council), *Stellungnahme zu den außeruniversitären Forschungseinrichtungen in den neuen Länder und in Berlin* (Position [Paper] on Nonuniversity Research Institutions in the New States and in Berlin) (Düsseldorf, 1991). Wissenschaftsrat, *Stellungnahme zu den außeruniversitäre Forschungseinrichtungen in der ehemaligen DDR im Bereich "Biowissenschaften und Medizin"* (Position [Paper] on Nonuniversity Research Institutions in the Former GDR in the Field of "Life Sciences and Medicine") (Düsseldorf, 1991)

Funding for Reconstruction in the New Länder and in the Eastern Section of Berlin

In the framework of the Federal Program, at the beginning of 1991, a specific and one-time funding measure was initiated for the medical academies and universities as well as for several nonuniversity research institutions in the new states. The objectives of this measure for universities and medical academies consisted in

* Promoting those research priorities that accelerated a structural reorganization of medical schools and in which existing scientific potential was concentrated
* Creating the ability to compete within the normal channels of research funding
* Promoting structures that are suitable for clinical research in the long term, and
* Speeding along the formation of a differentiated spectrum of research in which promising directions in research are emphasized in accordance with the traditions and strengths of the individual medical schools

To this effect, the program provided all medical academies and medical schools with the opportunity to develop one or two priority programs (in the case of the Medical School of the Humboldt University in Berlin even three such programs). The objective behind the funding of nonuniversity research institutions was also, on the one hand, to create the ability to compete within the normal channels of research funding. In addition, the aim was to give these facilities an initial push to make it easier for them to redefine and newly define themselves as recommended by the Wissenschaftsrat (WR, German Science Council).

It will remain the goal of program initiatives in coming years to make the research facilities in the new states competitive and at the same time, in keeping with the recommendations of the Wissenschaftsrat, to help shape the structures of the university domain and of nonuniversity research institutions in the new states.

European Integration in Health Research and International Cooperation

In spite of differences in national systems of health care, health problems do display international similarities. Given similar demographic developments, a

comparable spectrum of diseases, new developments in medical and information technology, and the problem of health-related costs, the governments involved are faced with comparable choices. This is especially true for the member states of the European Communities (EC), whose development toward European Union and the completion of the internal market will mean new forms of responsibility and organization in health research for Germany. Health research can help give substance to the newly regulated powers over health (including health research) provided for in the Treaty on European Union (EU-Treaty, Art. 129, 130ff.). It can also help in determining and analyzing the effects that arise and the conclusions to be drawn from the completion of the internal market. This holds for both the national and the EC level, whereby attention is also to be paid to the principle of subsidiarity on the latter level.

The EC provide funding programs and concerted actionse[12], which, in conjunction with nationally provided funding, allows German researchers and research institutions to fulfil their upcoming responsibilities in a European network of research. Information centers have been specifically established to help scientists surmount the particular problems involved in applying for EC funding[13].

The fourth framework program of community activities in the field of research and technological development, which will establish priorities for European research policy for 1994 onwards, is currently in preparation. A general aim of the program is to provide life sciences with a greater role. This goal is to be translated into the contents of specific programs.

The Health Research 2000 program provides funding mechanisms that can also accomodate international cooperative projects within its priority programs. Specific initiatives should aim to encourage greater participation on the part of German scientists in conceiving of and implementing the specific programs of the EC.

There will also be increased cooperation with Central and Eastern European countries in the coming years. Accordingly, collaboration with scientifically

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12) The programs of primary relevance for health research are the "Biomedical and Health Research Programme" (BIOMED 1), the program "Life Sciences and Technologies for Developing Countries" (STD 3), and the program "Advanced Informatics in Medicine" (AIM).

13) * Koordinierungsstelle EG der Wissenschaftsorganizsationen (KOWI; EC Coordinating Office for Scientific Organizations) for EG programs.
* Beratungs- und Koordinierungsstelle für die Beteiligung deutscher Wissenschaftler an EG-Programmen (Advisory and Coordinating Office for the Participation of German Scientists in EG Programs) at the Projektträger Forschung im Dienste der Gesundheit der DLR (Project Management Organization "Research in Service of Health" of the DLR; for address, see Addresses in appendix III).

qualified research teams from these countries will play a greater role in the future. In addition to bringing together the leading groups of various countries, East-West cooperation should also include elements of support for scientific reconstruction programs, for example, in the form of scholarships.

In addition, it is essential that the cases of well-established international cooperation, especially with the United States, Japan, and Israel (as well as with other countries) be continued.

2. Ethical Principles: A Guide for Research and Practice

The expectation that scientific research would ultimately conquer all disease will also remain unsatisfied in the future. Research always grapples with current health hazards and, with the aid of the medical art of healing, works to come to terms with them. Even in the future, new diseases will continue to arise. For this reason, medicine is premised on further advances in research; similarly, basic science cannot do without the observing physician, who provides essential empirical knowledge on the place of new findings within medical practice.

Ethical guidelines provide the basis for both medical practice and health research. They are not restricted simply to the objectives of a scientific project, but also address questions of quality and risk controls in scientific and medical procedures. The Helsinki Accords are part of the standard of internationally recognized ethical guidelines for medical research; in a revised and addended version from 1987, it makes up part of the professional statutes of German physicians. A host of further regulations on clinical research are found in such legislation as the Arzneimittelgesetz (law governing the manufacture and prescription of drugs), the Strahlenschutzverordnung (law governing radiation safety), the Embryonenschutzgesetz (law governing the use of embryos), the Tierschutzgesetz (law governing the protection of animals), the Datenschutzgesetz (law governing data protection), and the Gentechnikgesetz (law governing gene technology; currently undergoing revision). The ethical guidelines for epidemiological research, only expanded in recent years have been collected in the so-called CIOMS Guidelines[14]; it has been used as a basic review instrument for all proposals funded within the Health Research 2000 program.

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14) CIOMS (Council for the International Organization of Medical Sciences), International Guidelines for Ethical Review in Epidemiological Research (Geneva, 1991).

Political and ethical responsibility imposes limits, where not everything that appears scientifically and technically feasible can be and is allowed to be investigated and tested. However, ethical limits are not only imposed by means of legislative measures; they also result from conventions generally accepted by scientists and in the society at large, which take medically responsible action as their model. It is also one of the tasks of Health Research 2000 to take up questions of biomedical ethics in conjunction with, and in anticipation of scientific activities.

3. Health Research 2000: Future Perspectives

It follows from the preceding sections that public health (in the sense of health sciences related to health problems and the health-care needs of the population, including health-system research) and clinical research together represent the general direction that the Federal Program continues to take. It is one of the main goals of the program to help eliminate structural weak points in Germany health

research, especially in these two fields. This objective is to be realized by using substantive priority programs for the purpose of establishing new model structures, on the one hand, in public health research priorities and on, the other, in clinical research centers and priorities.

Previous measures serve as starting points in this endeavor. Government program resources have already been flowing into clinical research since 1988, in the form of DFG support of clinical research teams. The funding of interdisciplinary research priorities in 1992 marked the beginning of support for public health research. Complementary efforts are now above all directed toward further improving the basic institutional conditions for the "basic model units" that have already arisen at university hospitals. This would allow the latter to develop further and (if research is of high scientific quality) to establish themselves on a longer-term basis.

Part 3 below, "The Program of Action in Health Research," provides a depiction of the funding initiatives and mechanisms that seek primarily to help establish viable structures for clinical and public health research. The focus is no longer on individual projects; instead, it is increasingly on interdisciplinary research fields that ensure the evermore necessary cooperation of various scientific disciplines and the development of longer-term competitive priority programs.

Especially the interdisciplinary centers for clinical research established at university hospitals represent new models of funding. The aim of such centers is to work out strategies for optimizing the organization of research at university hospitals and then establish structures that prove advantageous for the organization of clinical research. The program will first provide start initiatory financing for a limited number of six to eight such centers; the aim is to have the respective universities and states assume responsibility for these centers in the longer term. The centers will take up scientific topics related to priorities in health research. One criterion for such start financing is the extent to which any given university is ready to permanently invest its state-government allocations for research and teaching in such a center.

Activities of federally basic funded nonuniversity research institutions will be depicted, according to the specific goals they pursue, in the relevant section of the program. In this way, the research activities of these facilities can be integrated into the presentation of the Health Research 2000 program made here.

Chapter II. Priority Areas in Health Research: Experiences and Perspectives

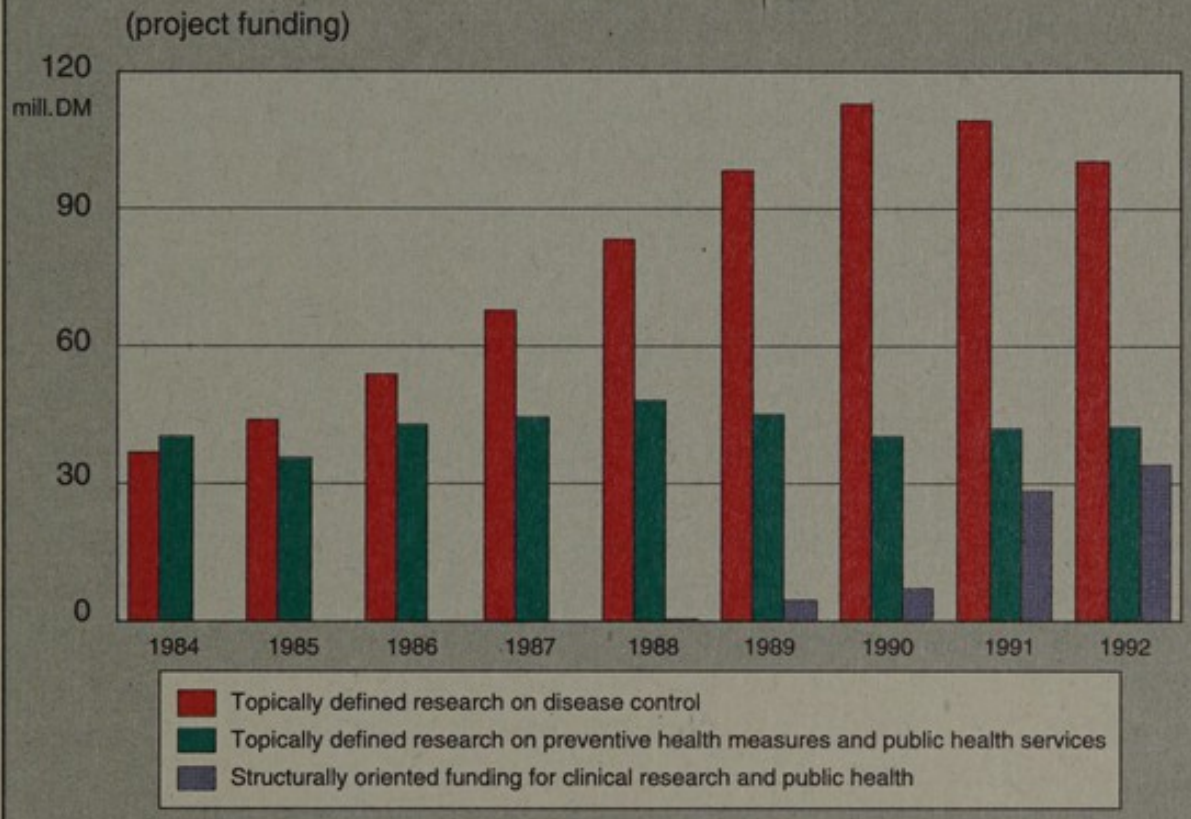
Considerable resources from the Federal Program have been expended by the BMFT on directed funding activities (project funding) in health research at universities, GFE, and other nonuniversity facilities in the last 15 years. This is joined by the allocations made within basic funding. This dual funding has allowed a series of long-term priority programs to be initiated and successfully completed. This is also the context in which departmental research, especially of the Federal Ministry of Health should be seen (on this, see esp. the Appendixes).

The topics for new priority fields are agreed upon in a dialogue involving science, health policy, and, if applicable, health services funding authorities. Here, existing institutional capacities, as the potential basis of any initiative, are always taken into consideration. In these consultations, health policy arguments are evaluated as carefully as are the scientific capacity (that is to serve as the foundation of the projects) and the results of earlier funding programs. In keeping with the principle of subsidiarity, the question is also examined to what extent other funding agencies, including health services funding authorities, could be called upon for funds or be incorporated into any funding plans.

When a funding priority is established, special heed is taken that its topical field is defined in such a way as to include those aspects of its application important for health policy. The first guiding aim of the program, to foster health and control disease, defines the orientation of priorities. In keeping with its second guiding aim, to improve the structures of health research, attention is always paid to the structural limiting conditions of scientific research. There is undoubtedly a certain amount of competition between different topical fields here, and this favors priority fields that are also promising in structural terms.

The topical fields cited in the following provide examples of previous project funding, while at the same time representing the basis for future work. In this context, the activities of nonuniversity research institutions along the lines of Health Research 2000 are also presented. An overview of the priority fields initiated in the past and now completed will be published in the program reports

Fig. 1: Growth of the different priority fields of the *Health Research 2000* program



Source: Health Research 2000

of the BMFT[15]. Each future funding priority will be worked out separately (in relation to the way problems are defined here) and then made public. Their contents will be largely defined by the two primary directions of the program "Research on Preventive Care and Health Services" and "Clinical Research on the Control of Disease." Figure 1 shows how the project funding of the Federal Program has already developed in this direction in years past.

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15) *Gesundheitsforschung – Programmreport: ein Bericht über die Förderschwerpunkte des Programms "Forschung und Entwicklung im Dienste der Gesundheit"* (Health Research – Program Report: A Report on the Funding Priorities of the Program "Research and Development in the Service of Health) (Bonn, 1990).

1. Topics of Funding

The spectrum of topics that the Federal Program – previously under the title of "Research and Development in the Service of Health" – has taken up has continuously changed since the program's inception 15 years ago. Whereas at its outset, the focus of the Federal Program was on priorities in medical technology, in the course of its development, attention has increasingly turned to clinical research and public health sciences. The same tendency is also to be noted in the development of nonuniversity research institutions.

1.1 Research on Preventive Care and Health Services

Individual health is always involved in an interaction with its surroundings and is influenced by living conditions in the family, housing, and the world of work, as well as, in the most extended sense of the term, in society and nature. The individual is involved in diverse forms of exchange with these different realms of life, on physical, mental, and emotional levels. Here, he or she develops behavioral patterns both favorable and adverse to health, shaped by education and other societal forces. This framework sets the boundaries within which health can be fostered and illnesses prevented. These latter activities necessitate a system of health services that provides help in case of disease, but also promotes individual responsibility for health.

1.1.1 Life-Style, Nutrition, and Environment

The most effective ways to improve the quality of life and to lower morbidity and mortality rates always involve anticipatory measures and preventive care. In analyzing those factors relevant in fostering health, a disease-oriented approach has to be supplemented. Attention must be directed to general aspects of individual conduct (avoidance of potentially health-jeopardizing life-styles) and of living conditions (the cultural, social, and technological environment). Research funding should above all facilitate interdisciplinary cooperation between the different fields of specialization that deal with these areas, especially between the biomedical and behavioral/social-scientific disciplines (including questions of health education and teaching methods). The success of prevention and preventive care is largely dependent upon the extent to which knowledge about healthy modes of living can be translated into corresponding individual and societal habits and life-styles, and these ways of life can be given permanency.

Bild 1

Bild 2

Bild 3

Bild 4

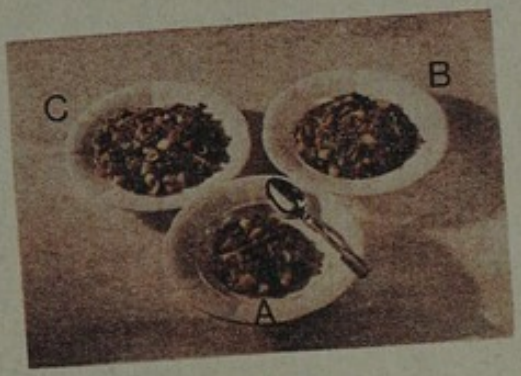

Bild 5

Bild 6

Andere Gerichte

Lebensmittel	Esse ich nicht	Esse ich	vorgegebene Portionsgröße	meine Portion	Häufigkeiten wie oft ...
				A B C	1 2 3 4 5
Pizza	☐	☐	Bild 1	☐ ☐ ☐	☐ ☐ ☐ ☐ ☐
Salziges Kombinationsgebäck (z.B. Quiche, Speckkuchen, gefüllte Pastete, belegtes u. überbackenes Baguette, ...)	☐	☐	Bild 2	☐ ☐ ☐	☐ ☐ ☐ ☐ ☐
Reibekuchen, Kartoffelpuffer	☐	☐	Bild 3	☐ ☐ ☐	☐ ☐ ☐ ☐ ☐
Pfannkuchen	☐	☐	Bild 4	☐ ☐ ☐	☐ ☐ ☐ ☐ ☐
Eintopf mit Hülsenfrüchten (z.B. Linsen-, Erbsen-, Bohneneintopf, ...)	☐	☐	Bild 5	☐ ☐ ☐	☐ ☐ ☐ ☐ ☐
Gemüse-, Kartoffelsuppe	☐	☐	Bild 6	☐ ☐ ☐	☐ ☐ ☐ ☐ ☐

Using standardized questionnaires epidemiologists analyse lifestyle and dietary habits of certain groups of the population.

Life-Style and Nutrition

Unhealthy life-styles, external risks, and unfavorable social conditions can have a considerable effect on individual health. However, it is still largely unclear how and to what degree these factors play a role. The Federal Program took up such

questions at an early date. The funded research projects concentrate on the central health problems of our industrialized, prosperous, and rapidly changing society.

Nutrition has a special place among those factors that decisively influence health. Impeccable foodstuffs and a diet adjusted to individual needs contribute to the avoidance of health risks. Dangers arise primarily from an improper and inappropriate diet, a lack of hygiene, natural poisons, and – to a much lesser extent – from environmental contaminants and residues that can be contained in food.

These questions are given priority in the health research program. They were taken up in a series of large-scale epidemiological and biomedical studies, which aimed at providing more information on the interconnections between health and diet and between disease and improper diet. These efforts were also to help develop scientifically based procedures for monitoring food[16]. Opportunities to lower risk are given, for example, by data collected on dietary habits, nutritional needs in various phases of life, and on the dangers of contaminants contained in food.

In the future, the German Institute for Nutritional Research (DIfE; Deutsche Institut für Ernährungsforschung) will make an important contribution to the prevention of chronic diseases that are caused in part by improper dietary habits. In addition, basic investigations are also conducted by federal research facilities under the jurisdiction of the Federal Ministry for Nutrition, Agriculture, and Forestry (BML; Bundesministerium für Ernährung, Landwirtschaft, und Forsten). Appendix II provides a detailed depiction.

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16) * *Ernährungsforschung im Dienst der Gesundheit: ein Förderschwerpunkt des Bundesministeriums für Forschung und Technologie* (Nutritional Research in the Service of Health: A Funding Priority of the BMFT) (Bonn, 1991).

* *Ernährungsbericht 1992* (Nutritional Report 1992). Ed. Deutsche Gesellschaft für Ernährung (German Association for Nutrition) as commissioned by BMG and BML (Frankfurt, 1992).

Health and Environment

Environmentally related protection of health is becoming increasingly important, since the daily impact of substances, radiation, noise, and other influences on the private and occupational environment produces strains on health. Frequently, little attention is given to additional risks, aided by individual patterns of behavior; however, if environmental influences are to be assessed, these other risks must not be neglected. Health impairments are dependent upon the length of exposure, the concentration or intensity of harmful factors, and genetic disposition. They can progress through all stages, from a slight functional impairment all the way to manifest illness, and psychosomatic mechanisms also play a role. The combination of several influential factors can have synergistic (intensifying) or antagonistic (neutralizing) effects, something which poses special methodological difficulties for any attempt at explanation.

Epidemiological studies allow one to better estimate the extent of the individual and social strains created by environmental influences as well as the utilization made of the health care system. The results of biomedical research can help in the discovery of means of causal treatment. In this context, GFE – for example, the Forschungszentrum für Umwelt und Gesundheit (GSF; Research Center for Environment and Health) in Munich-Neuherberg – and BLI, but also projects in the framework of different specialized priorities of the Federal Program (such as nutritional research, allergy and pulmonary research, and research on infertility and on bone disease) all make important contributions.

The BMFT program "Environmental Research and Environmental Technology"[17] offers further funding opportunities for clarifying the interconnections of exposure and effects and for producing the foundations for a scientifically based estimation of the risks of environmental factors. Moreover, the government program "Work and Technology"[18] also provides funding resources for the methodological, analytical, and, above all, preventive aspects of the aforementioned problems.

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17) Umweltforschung und Umwelttechnologie: Programm 1989 bis 1994 (Environmental Research and Environmental Technology: The Program from 1989 until 1994). Ed. BMFT (Bonn, 1989).

18) Forschungs- und Entwicklungsprogramm "Arbeit und Technik" (Research and Development Program "Work and Technology"). Ed. BMFT, BMA, and BMBW (Bonn, 1989).

Findings of Research Funding: Prevention and the Preservation of Health

The field of prevention and the preservation of health already encompassed in past program periods numerous research projects on the interconnection of health, life-style, and environmental influences. This includes above all the funding priorities of the early detection of cancer and cardiovascular disease, the findings of which are now reflected in the standards set for general medical check-ups. The German Cardiovascular Prevention Study, whose main phase was completed at the end of 1991, also contributed in this context. The National Consumption Study (also completed in 1991) and an array of epidemiological projects in the field of nutritional research have produced a comprehensive data base on dietary behavior and resulting health hazards as well as corresponding preventive strategies. Achievements in the field of preventive care also include the early-detection programs for newborn and small children that were worked out in the framework of research projects. They have resulted in considerable improvements in medical care for newborn and the prematurely born and thus contributed to the clear drop in infant mortality witnessed in the past decade. On the basis of the findings of these research projects, the scope and quality of (preventive) medical check-ups for children were markedly improved.

The program has made a special commitment to improving epidemiological research. With its assistance, it was possible to carry out a series of large-scale epidemiological research projects in recent years, especially on allergy and rheumatic disease.

In addition, since 1992, there are three specifically developed priorities in public health research in which, for example, focus is placed on the social and behavioral-psychology dimensions of health research as well as on questions of the economic feasibility of our system of health services.

1.1.2 Preventive Care for Population Groups at Risk

The Federal Program devotes special attention to population groups in which typical health problems arise that are marked by specific social or developmental-physiological, or gender-specific features, but which frequently do not receive sufficient attention in scientific investigations due to the methodological problems they entail. Accordingly, all clinical and epidemiological proposals funded by the program should give adequate attention to all population groups affected by the problem treated. This holds primarily for children and youth, women, the chronically ill, and the elderly and handicapped.

Children and Youth as a Target Group

Infant mortality is considered a gauge of the quality of a country's health care. At the beginning of the eighties, relatively high maternal and infant mortality rates were recorded in the Federal Republic of Germany. Given this situation, special attention was given to obstretics and the health of children and youth in previous periods of program funding, in the task areas of prevention, early detection, therapy, and long-term care. Funding made it possible to develop a research field that stretches from questions of human genetics in the framework of family planning to the continuing development of health education in the school system. Special note is due above all to the multicentric network-organized studies on congenital metabolic disorders (especially phenylketonuria and mucoviscidosis) and long-term observational studies of children with perinatal and early-childhood developmental risks. The results of the metabolic-disorder studies have been translated into a component of the statutory early-detection check-ups for children. It is expected that the long-term studies still in progress will have effects on clinical and post-clinical care for high-risk newborn.

Many questions are still unanswered: the causes and delayed aftereffects of impairments acquired early and of intensive-care procedures are still largely unknown. The same holds for the consequences on the psychosocial development and quality of life of children with chronic illnesses as well as the psychosomatic disorders, problems managing disease, and problems of social integration besetting these children. Focus is placed on sudden infant death syndrome and, due to their frequency and severity in this target group, allergic, rheumatic, and mental illnesses. Research can bring about decisive improvements, though only when it succeeds in taking into account the complex dimensions that play a role here. Scientific success can be expected if the relevant disciplines closely collaborate with each other and pursue common plans.

Women as a Target Group

Aside from large-scale studies on improving preventive care for the pregnant, the program has started initiatives on the rehabilitation of women following breast cancer and the treatment of fertility disorders. This provided research teams just getting established in this field with effective start support.

Health disorders and diseases of grave consequence are often connected to phases of major change in women's lives. The possible treatments available are not yet satisfactory, due the inadequate understanding of causative processes. Examples here include problems in puberty, such as anorexia nervosa, and post-menopausal phenomena, such as osteoporosis or post-menopausal vascular changes. These questions are to receive special attention in the future.

The Elderly as a Target Group

In Germany, the health problems of the elderly have not yet received recognition in keeping with their importance in everyday hospital life and in health policy as an increasingly growing generation. Their problems are marked by multimorbity, their chronic character, and the interaction between processes of disease and aging.

The primary goal in the treatment of the elderly is the maintenance and restoration of the functions necessary for leading an independent life. Beyond the investigation of individual diseases and side effects frequently or typically found accompanying old age, there is a considerable need for knowledge of therapeutic and rehabilitative procedures optimally geared toward old age. The same holds for leading clinical indicators and age-adjusted target values, which are sometimes considerably different from standard values for younger patients. There is also special interest in questions of drug treatment, which has to take into account not only differences in physiology, but also changes in prescription practice and prescription compliance in the treatment of the elderly.

Questions concerning the connection between aging and health were taken up primarily in terms of the priority program of "Mental Health in Old Age," where funding has now been completed. In the future, it is to play a part in all relevant disease-oriented priority fields as well as in the areas of public health. The Federal Ministry for Family and Senior Citizens (BMFuS; Bundesministerium für Familie und Senioren) provides for corresponding funding opportunities for topics of government departmental research that go beyond the medical aspects of this area of research (see Appendixes for references).

Aftercare and rehabilitation are integral parts of modern medical treatment, since they ensure the longer-term success of the latter. Rehabilitation helps the convalescing patient return to "normal life." Rehabilitation is supposed to be especially helpful for those threatened by permanent physical or mental repercussions: either to help prevent permanent disability or to mitigate its effects and help the patient to cope with it. The importance of these tasks grows with the increase in chronic disease.

Whereas the rehabilitation system in Germany can serve as a model in organizational terms, it continues to lack a scientific basis in many fields and thus a standardized quality control. This is especially true for the theoretical and methodological foundations it requires. The projects funded by the Federal Program have been able to fill some of these gaps. Future funding can help advance the establishment of an adequate research infrastructure and the integration of in- and out-patient rehabilitation. However, this goal can only be reached if hospital administrations and health insurances also make similar efforts.

1.1.3 Plans of Action in Medicine: The Clinical Evaluation of Preventive, Diagnostic, and Therapeutic Procedures

Medicine is action oriented. Its strategies are largely based on accumulated empirical experiences. As a rule, the findings from basic research cannot be directly applied. A series of intermediate steps are required. These conversionary processes require not only scientific understanding, but also medical experience and the commitment of physicians to the patient's welfare. However, the economic feasibility of new procedures, especially in light of the increasing costs of health services, represents another important limiting condition of this process.

It is not enough, when new diagnostic and therapeutic procedures are being conceived, to consider whether they are feasible or whether harmful side effects have been eliminated. Conclusions must also be drawn as to whether their positive effects for the patient outweigh their side effects, whether they exhibit advantages over existing methods, and whether the measures are acceptable in health-economic terms. The implementation of medical plans of action is also premised in no small degree on their acceptability among both physicians and patients.

Clinical Examination and Evaluation of the Products and Procedures Developed by Medical Technology

Funding for the development of new apparatus and procedures in the field of medical technology has been part of the Federal Program from its outset. It focused on those areas in which there was special interest for reasons of health policy or in which overly high market risks thwarted the potential for independent and sufficiently rapid commitment on the part of industry to product development. It turned out, for example, that technology for the handicapped, which in the meantime has become crucial for those affected, required certain initiatory incentives.

The evaluation of procedures developed by medical technology according to clinical or health-economic criteria has been an important topic of the Federal Program for years. Examples include validating studies of procedures for early cancer detection, studies of the use of magnetic resonance imaging and other imaging procedures, and studies of implantation safety and the long-term stabi-

The Findings of Research Funding: Medicine and Technology

The now completed funding priority fields of "Endoprosthetics," "Technical Orthopedics," "Aids for the Sensorily Handicapped," "Imaging Techniques," and "Endoscopy" are found in this area. The focus of an "Initiative on Medical Measurement Technology" (also now completed) was on functional reliability, the clear relationship between measurement values and clinical findings, simplicity in use, and the lowest possible risk for patients.

In the field of **biomaterials research**, the primary interest was in the development of organ-supporting biomaterials and products for hospital use, such as heart valves and vascular prostheses, which were also suited for long-term blood and tissue contact. Important results were reached in the large-scale projects on "Bioartificial Pancreas" and "Artificial Mucous-Membranous Tracheas."

In the field of **medical-technology instruments for endoscopy**, the focus was especially on the quality of image reproduction by using opto-electronic and stereoscopic techniques and on the development and testing of specific instruments for arthroscopy of the hip.

The decisive factors in the decision to fund **magnetic resonance imaging (MRI)** was the expected reduction in radiation exposure and the improvement in the low soft-tissue contrasts provided by classical x-ray techniques. In this context, a special role was played by a multicentric evaluative study that provided the basic data on the place of MRI in clinical diagnosis, its economic impact on the health care system, and its structural requirements and costs.[19] This study provides a model in Germany for a far-sighted, comprehensive technology assessment of a major, cost-intensive piece of apparatus developed by medical technology.

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19) *Kernspintomographie: Forschungsbedarf unter gesundheitsökonomischen Aspekten. Materialien zur Gesundheitsforschung* (Magnetic Resonance Imaging: Research Needs in Health-Economic Terms). Materials on Health Research, vol. 2. Commissioned by the BMFT (Bonn, 1987). *Kernspintomographie: Multizentrische Studie zur klinische und ökonomische Evaluierung. Materialien zur Gesundheitsforschung* (Magnetic Resonance Imaging: A Multicentric Study for Clinical and Economic Assessment). Materials for Health Research, vol. 17. Commissioned by the BMFT (Bonn, 1990).

lity of endoprostheses. In this context, it is reasonable to compare, on the level of the health care system, the utility of new diagnostic and therapeutic techniques to the often not inconsiderable commitment of resources and to define those fields where implementation makes sense. The objective of funding is to improve the methods of comparing complex preventive, diagnostic, and therapeutic procedures, to develop strategies for long-term assessment, and to initiate evaluations in terms of health-economic criteria.

In this field, the strategies of various funding programs of the BMFT and the government complement one another. Thus, the scientific and technical development of pioneering techniques and instruments, such as minimally invasive techniques, is funded in the framework of the programs of "Microsystems Technology" and "Laser Research," while these new technologies can be evaluated in terms of their clinical relevance in the framework of Health Research 2000. Their common objective is to make use of the technological advances for the purposes of controlling disease, but to estimate early on the efficiency and impact of its innovations on the equilibrium of the health economy.

The establishment of an informal circle "Innovations in Medical Technology" would contribute to the "innovative offensive" of the BMFT. Its aim, in conjunction with (especially middle-class) private enterprises, physicians, scientists, and health insurance agencies, is to identify promising new technical developments for medicine and help create the prerequisites for their acceptance and transferibility into the health economy. Fields that presently come into consideration include techniques and plans for the operating room and the intensive-care ward of the future, for endoprosthesis, and for minimally invasive surgery.

Evaluation of Therapeutic Measures

The assessment of therapeutic measures presents special methodological demands in the area of clinical research. This applies both to the comparison of different procedures (such as those from the surgical and nonsurgical fields) and to the long-term evaluation of clinical plans. Therapeutic studies are particularly successful when the disease in question follows a regular and thus comparable course in most of the patients afflicted, such as is the case in childhood leukemia. Other syndromes, such as neurological and psychosomatic ailments, run their course in such a variety of ways that it is hardly possible to subject all patients to a general scheme of therapy. Natural remedies also often cannot be scientifically evaluated, at least not using conventional scientific methods, and thus their results cannot be compared with conventional types of therapy. Research can help in comparing therapeutic procedures from different fields.

Naturopathy and Alternative Forms of Medicine

The techniques of naturopathy are accepted by a large part of the population without reservations, but are skeptically viewed on the part of physicians due to the lack of conclusive proof of effectivity. For this reason, funding for the topic "Nonconventional Directions in Medicine" provides specific impulses for improving the situation of research on naturopathy. Focus is placed on the analysis of techniques of nonconventional directions in medicine.

The funding initiative of the program has its origin in a resolution of the German parliament of 20 June 1990 in which the federal government was required to fund the application and investigation of naturopathy, to provide a report on the state of research on naturopathy, and to develop a funding plan. In 1989, the BMFT had already commissioned the University of Witten/Herdecke to provide a comprehensive report on the state of research, and based upon it, to develop funding recommendations for suitable areas of research in alternative forms of medicine.

On the basis of these recommendations, support is to be given in the future to model networks on selected topics of research, which in particular take up

* Naturopathic approaches to the prophylaxis of infection
* The use of acupuncture to control head and back pain
* Clinical research on homeopathic and anthroposophic therapeutic techniques and on phytotherapy.

This funding is aimed at helping create collaborative structures in the medium term that will make possible continuous scientific research activities and help improve the acceptance of effective and widely disseminated therapies.[20)]

20) On this, see also: Unkonventionelle medizinische Richtungen: Bestandsaufnahme zur Forschungssituation. Materialien zur Gesundheitsforschung (Nonconventional Directions in Medicine: A Report on the State of Research). Materials on Health Research, vol. 21. Commissioned by the BMFT. (Bonn, 1992).

Clinical Reference Studies

Clinical reference studies help in evaluating complex therapeutic strategies. They make it possible to identify the technique from among an array of competing ones that provides the greatest advantages in terms of various criteria (effectiveness, side effects, therapeutic range, costs, etc.) and, thus, at least for the time being, represents the optimal treatment strategy. Reference studies go beyond traditional therapy studies, since they refer to more than just individual new techniques. Instead they incorporate the full range of available empirical and experimental strategies and can provide points of reference for diagnostic and therapeutic priorities. In this way, they contribute to the rational basis for plans of action in medicine. Reference studies are premised upon well-defined and established therapeutic procedures that are widely disseminated.

Such evaluative studies often do not succeed due to the structural prerequisites they entail, since they generally go beyond the capacities of any single facility. The program provides funding procedures that are suited for multicentric projects (see section III.1.2).

1.1.4 Key Disciplines for Public Health and Clinical Research

There are disciplines situated between basic research and application that are especially concerned with questions of the effectiveness of techniques of medical therapy and their repercussions on medical practice. The development of these key disciplines, however, have often not kept pace with the growing importance of the questions they address, due both to the present structure of the university and the frequently still inadequate application orientation of the disciplines themselves.

For this reason, the program is especially eager to provide incentives for establishing and expanding these key disciplines, such as clinical epidemiology and clinical pharmacology. Federal funding can be granted as initiatory aid for the formative phase of local priority programs, so that suitable structures can be created and such facilities can become competitive and viable on their own.

This structural aid is predicated upon close cooperation with medical schools and governments of the Länder. Both have to develop their own interests in these specialized disciplines and document these interests by means of an early financial commitment and, above all, by incorporating them into their planning. Such funding measures also reflect the specific aim of advancing the individual dis-

tinctiveness of university hospitals (as recommended by the Wissenschaftsrat) by developing a differentiated spectrum of special disciplines.

Clinical Pharmacology

Clinical pharmacology is an application- and patient-oriented example of clinical research. It focuses on drug-based therapy and its optimization. Clinical pharmacology makes a basic contribution in the testing of drug-based therapy and its provision with scientific foundations that takes into account its effectiveness and safety and the results of clinical examination, monitoring, and consultation. Examples from the sprectrum of tasks of clinical pharmacology include the detection of side effects, combined effects, and intoxicating effects of drugs, as well as special features of pharmacological effects on different age groups. For the individual patient, this means a safer, more effective, and more individual therapy.

Due to the traditional structures of university hospitals, clinical pharmacology does not have the position it deserves in health-policy terms. The WR has urged all health research sponsors to address this issue.[21)]

Epidemiology

Since 1978, the program has committed itself to strengthening epidemiological research and, in this way, the field as a whole. Epidemiological studies take up, for example in the framework of etiological research, the significance of risk factors in the origin of disease. They can help identify unknown influences, help interrelate known factors of influence, and help estimate their respective relevance.

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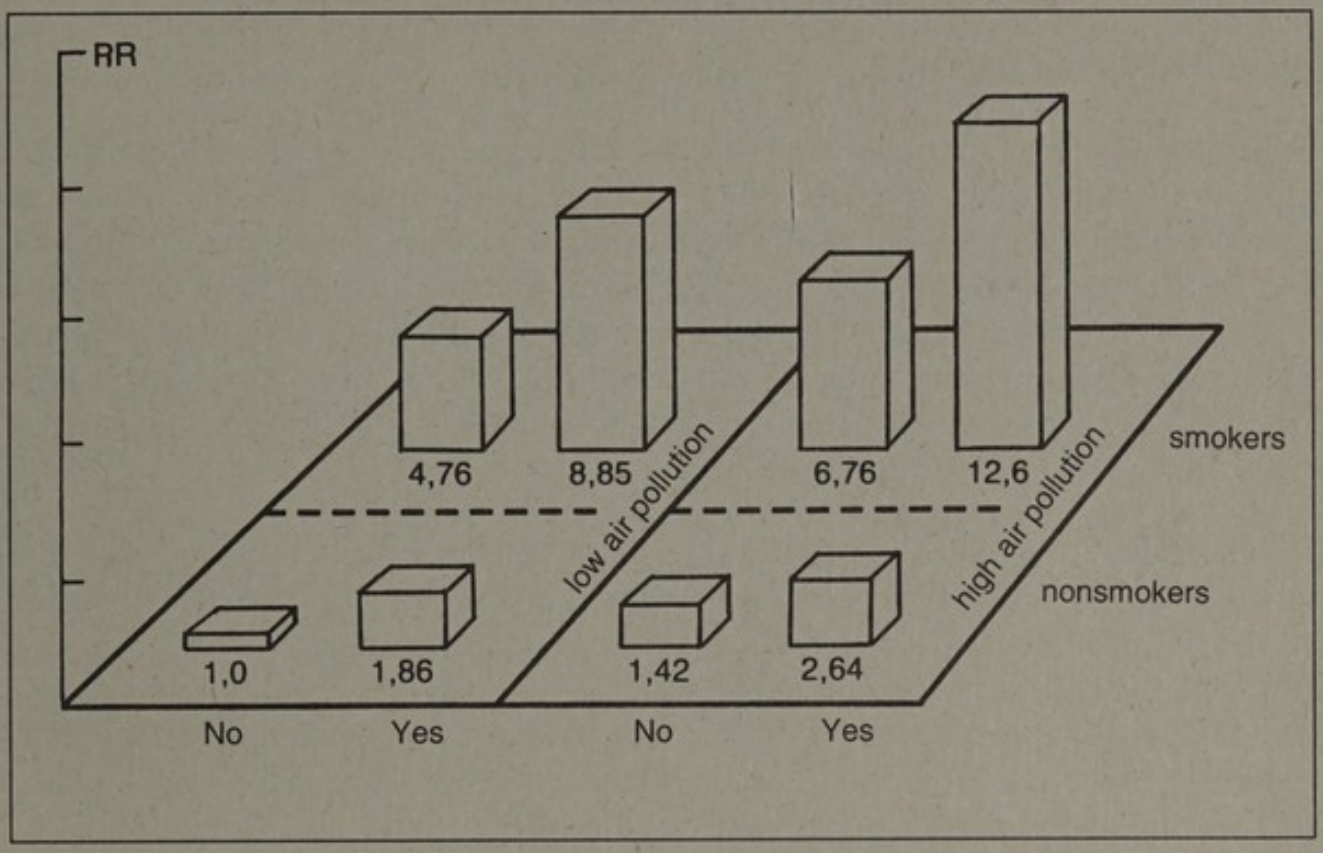
21) Wissenschaftsrat (German Science Council), Empfehlungen zur Förderung der Klinischen Pharmacologie (Recommendations on the Funding of Clinical Pharmacology) (Cologne, 1990).



Which influence on lung cancer have the factors smoking, occupational exposition and air pollution? For a non-smoker without occupational exposition but living in area of high air pollution, the relative risk (RR) is 1,42. The data were gained in a study in Cracow, where 2000 persons were examined.

Epidemiology and experimental basic research based on laboratory experiments possess complementary methods of acquiring knowledge about health and disease. For example, the connection between fat in the blood and heart attacks was first conjectured as the result of epidemiological studies, before it could be proven on the basis of scientific methods. Epidemiological findings also furnished the decisive indications about the causes and ways in which AIDS is transmitted.

In addition, it is also possible with the aid of epidemiological methods to determine the frequency of diseases and to register trends in the development of health risks, such as the occurrence of unexpected side effects of drugs, over a longer period of time. Epidemiological research is also used in this context to evaluate the efficacy of new preventive, diagnostic, and therapeutic measures and to develop comprehensive scenarios for the potential future structure of health services. It is also of special importance in determining future demand for

health care services, for example, against the backdrop of the increasing larger proportion of the elderly in the overall population.

Whereas in North America, Great Britain, and Scandinavia, epidemiology is part of the repertoire of all major medical schools, in Germany, the discipline was only able to gain a foothold in a few university hospitals and several nonuniversity institutions. With the help of the Federal Program, it was possible to conduct a series of large-scale epidemiological research projects in recent years, especially in the fields of cardiovascular disease, allergies, rheumatic illnesses, nutritional research, as well as in other task areas. A scholarship program was also put into effect.

In this context, emphasis should also be placed on the efforts at establishing the discipline per se made within the framework of the funding of priorities of public health research. In the future, funding strategy will continue – in close cooperation with the Länder and research institutions – to concentrate on embedding epidemiology in university and nonuniversity structures. For example, to complement the studies in progress at the German Center for Cancer Research, a new institute of epidemiology was founded at the GSF.

1.1.5 Productivity, Quality, and Economy of Health Services

Health services encompass all persons and institutions that are active in health care. Statutory health insurance plays a crucial role here. Its duty is to guarantee the insured, and thus ca. 90% of the population, comprehensive health coverage in the case of illness or injury. The central question in research on the productivity, quality, and economy of health services is thus: how must health services be constituted and organized, in detail and in general, in order to ensure the best possible state of health of the general population with economic use of funds and at a societally manageable cost?

The State of Health of the General Population and its Defining Dimensions

A basic premise for any evaluation of the productivity, quality, and economy of health services is the ability to differentiate and quantify the tasks they consist of and the completion of these tasks as far as possible. This includes an estimation of the state of health of the population and its development over time specified according to population groups and regions. Such data are especially important

for many questions, such as those connected to the level of demand for health care, the organization of the health system, its financing, and prognoses on its developmental tendencies.

Pilot Project: Reporting on Health Affairs

At the end of 1992, the important task in health policy of developing regular coverage of health affairs was taken up in a five-year research project in the framework of the Federal Program. This project goes far beyond conventional medical statistics by making aggregated data available and interpreting them. The objective of the project is especially ambitious, since coverage of health affairs, which aims to provide the basis for health-policy decisions, has to relate the dimensions of the general state of health to the dimensions of the health-care system and evaluate them in terms of this interlinkage.

Coverage of health affairs also provides the foundation for an analysis of long-term trends in regards to the state of health of the population and the structure of the health care system. Both complexes are influenced by demographic developments, changes in the spectrum of disease, advances in diagnosis and therapy, developments in the economic situation, and an array of other factors, not least of which includes decisions in health policy.

The Productivity and Organization of Health Services

Once the question of the state of health of the population and the situation of its health system is posed, further important questions arise concerning the demands made on, and the services rendered by health services: In which population groups is need especially great for preventive, curative, supportive, and rehabilitative services? Which sectors of the health service system (professional, social, or lay services) can best deliver such services? How can new forms of the cooperation necessary between the different sectors be organized and shaped? How can the need for coordinating structures in the curative area – on the increase due to specialization – be met? How can mutual aid in families and in neighborhoods be fostered? How are costs and services offered developing? And

finally, how can the development of costs be kept within economically viable limits without sacrificing optimal quality?

Without more detailed answers to these and similar questions, it is practically impossible to adequately evaluate medical health care and to adjust its structures in accordance with societal and demographic changes. Research can help develop suitable criteria and monitoring instruments, analyze trends, and thus provide decision-making tools for enacting purposeful health policy.

The Health Economy

In addition, the transparency of costs and services as well as quality control represent some of the most important points for research. Data processing techniques will become increasingly important supportive services in the field of medicine. In this way, medical information science gains in importance in the areas of communication, consultation, and evaluation, and its usefulness needs to be assessed. Health economy, which raises the question of the relation between cost and utility, is one of the important fields of research. This issue pervades all areas of health services, starting from the definition of, and planning for health care demand all the way to quality control.

Further questions are related to the development of expenditures on health services and their repercussions on the general economy, especially on statutory health insurance. They also take up the economic costs of the system and the opportunities available for reducing them.

Quality Control

The commitment to quality standards in medical and dental care was first regulated in a unified federal fashion in the 1988 health reform legislation (Gesundheits-Reformgesetz). The self-governing parties addressed by the new regulations – especially the associations of physicians participating in health-insurance plans, the hospital associations, and the health insurance agencies – received instructions to agree upon and issue framework recommendations, contracts, and guidelines for quality control in the individual service sectors. The goal of these regulations is to ensure a homogeneously high standard of medical care for all in- and out-patients in the health care system. This requires adequate means of comparing and evaluating diagnostic and therapeutic services and the organizational procedures connected to them.

A satisfactory degree of quality controls have been successfully introduced into some areas, not least of all through the help of the Federal Program. Nevertheless, in other areas of health care, it has not yet been possible to determine the quality of medical and nursing services adequately, in part due to methodological problems. Here, science, in the form of task-oriented research, can make important contributions in sustaining and improving the quality of medical care.

1.2 Clinical Research on the Control of Disease

The advances in molecular and cell biology and in biochemistry and immunology in recent decades have permitted new insights into the understanding of the foundations of human health and the causes of disease. Due to the greatly increased selectivity and accuracy of their methods of detection, they have made possible a previously unknown differentiation of the processes taking place in the cells and organs of the human body. Based upon these cognitive advances, it has become increasingly possible in recent years to analyze pathogenic defects in the control and regulative processes of the human body and to design precisely targeted treatment techniques.

The novelty of this development is that its modern methods transcend traditional disciplinary boundaries. The knowledge of these functional principles of cells and organs (and the concomitant disruptive mechanisms) is an important precondition for grasping the complex causes of multifactorial health disorders (and this includes most widespread chronic illnesses).

More than basic research is needed to control disease. Rather, it is the rational interlinking of different disciplines, especially with clinical research and epidemiology, that can be expected to yield important results for medical practice. The usefulness of scientifically gained knowledge for medical practice depends primarily upon whether the structures of the scientific system permit innovative approaches to be consistently followed through within the framework of productive clinical research. The Federal Program can provide important support by using suitable funding mechanisms to facilitate this step in the transfer of knowledge.

The Results of Funding for Research on the Control of Disease

Clinical research on disease control encompasses especially those diseases that frequently occur or are connected with early death, permanent invalidity, or are chronic in development. Funding priorities were placed above all on the fields of cancer, rheumatic ailment, mental illness, and infectious-disease research. A wide spectrum of topics were taken up, ranging from early detection via diagnosis and treatment to rehabilitation.

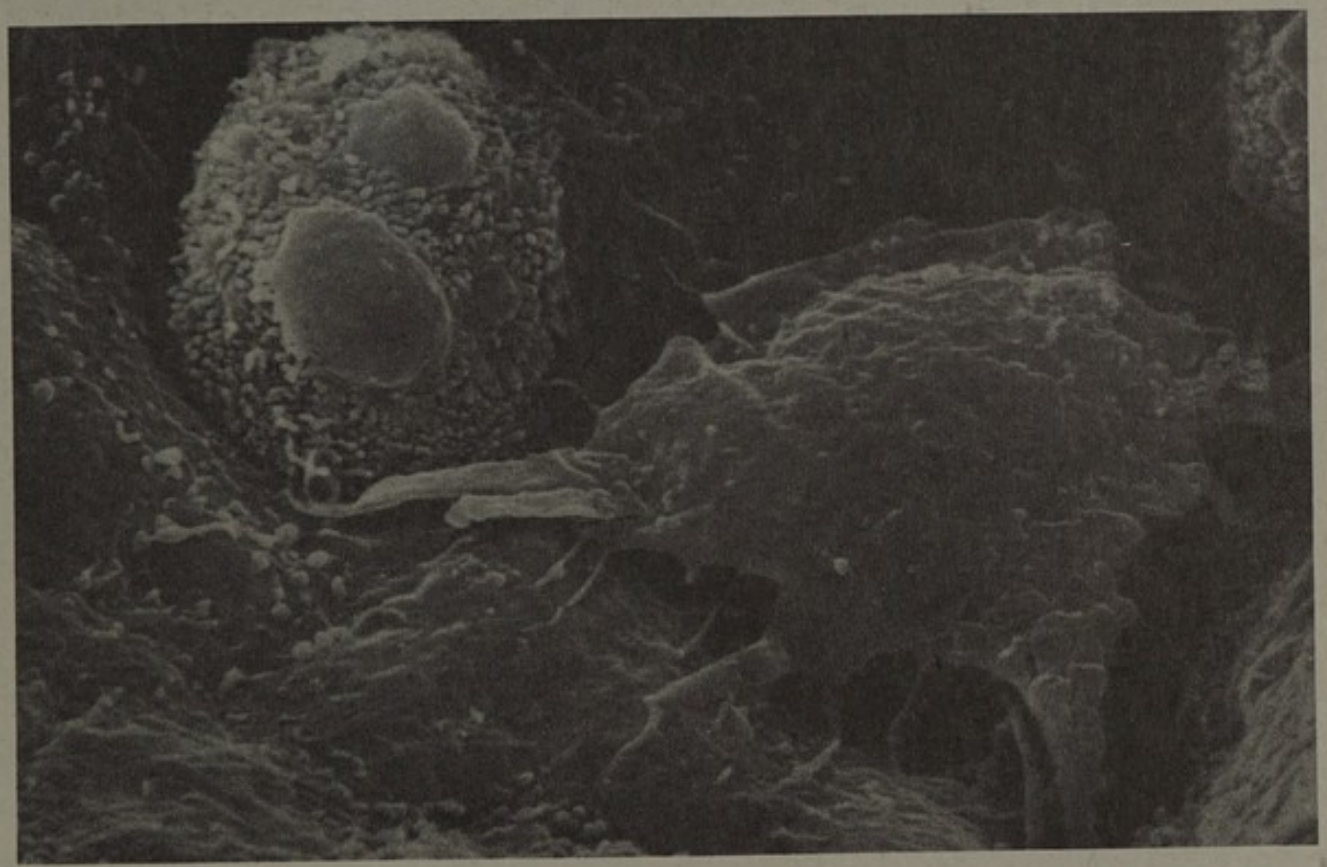
The primary aim of disease-related funding consists in providing incentives for rapidly and flexibly tackling fields of urgency. One goal here is to see to it that, after an appropriate period of time, research established by means of Federal Program funding is further supported with regular funding, coming, for example, from state-government and other funding organizations. The example of the now-completed funding of cancer-therapy studies makes it clear that the philosophy of the Federal Program does not equate the goal of funding with permanent support. Instead, the aim is to establish permanent structures for high-quality research.

The field of infectious-disease research provides another example of disease-oriented funding. In recent years, it has been moved along by AIDS research in particular. With the help of project funds quickly made available, it was possible to assemble an impressive concentration of qualified research teams. Parallel to other immediate federal measures, natural-science and medical research aimed at improving the diagnosis, therapy, and vaccination-based prophylaxis of other infectious diseases was also expanded.

Aside from these topically oriented priorities, the Federal Program's project funding made special commitment to the structural improvement of clinical research at university hospitals. Currently, 18 clinical research groups are already being funded, which deal with problems such as cardiovascular, cancinogenic, rheumatic, and addictive diseases.

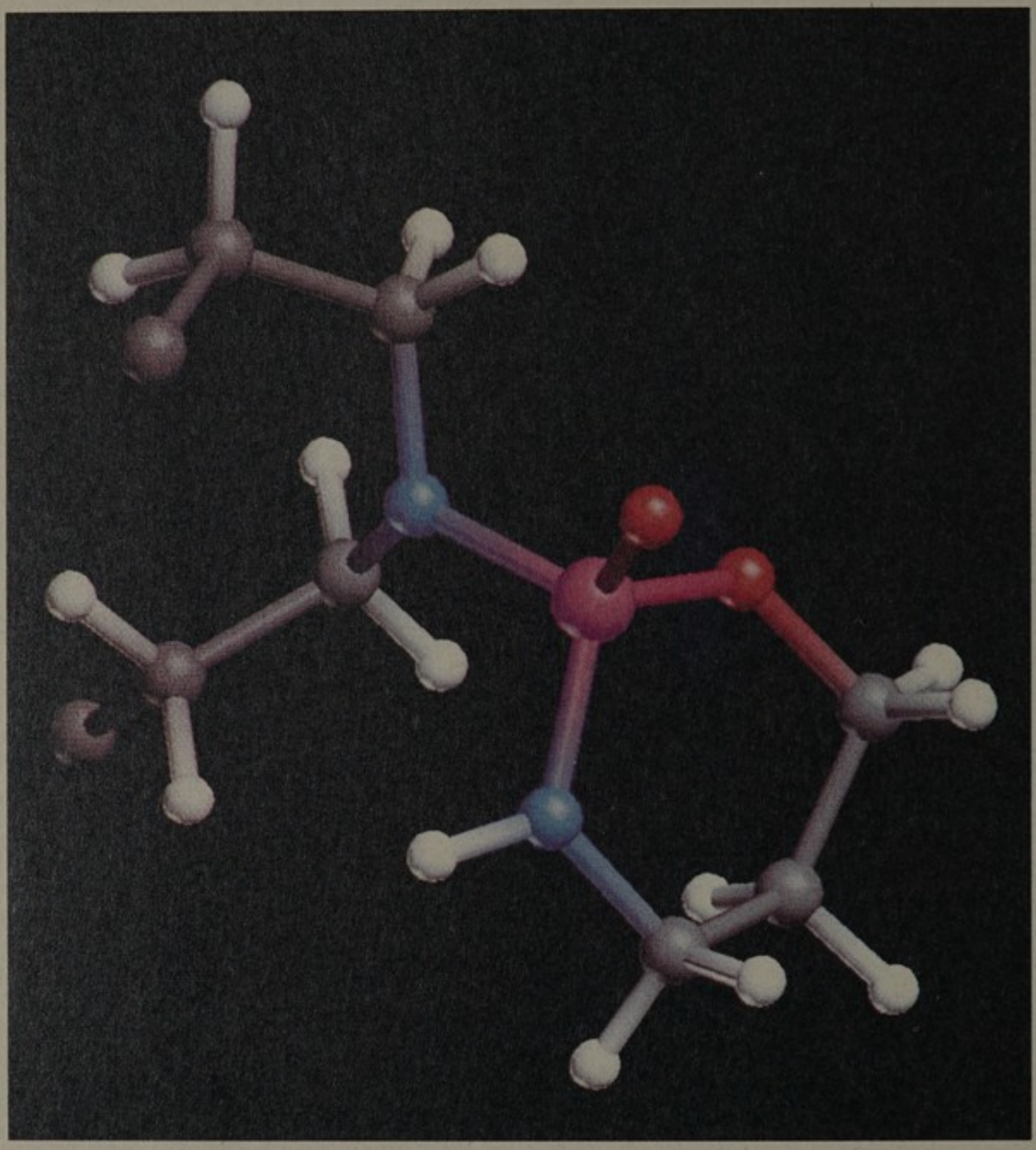
1.2.1 Immunity and Defense

The immune system protects humans from disease-producing microorganisms, contaminants, and dysfunctions of their own organisms. Disorders and malfunctions of the immune system seriously damage health and play a role both in triggering infectious diseases and allergies and in the development of cancer and rheumatic diseases. Immunological research investigates these interactions, which also involve functional interconnections among the components of the immune system. Internationally, there has been an explosion in immunological research, and German scientists have played an important part in it. As currently understood, immunology is practically unique as a field of study, encompassing as it does almost all the disciplines of the life sciences. In Germany, thanks to the intensive support of research funding, it has reached an internationally competitive level of performance. It might be possible to convert the research findings of molecular biology into successful forms of somatic genetic therapy. The first practical experiences in this field have been encouraging. In the coming years, it will be crucial to create stronger links between these disciplines, which are



Lung alveole with macrophage and type II pneumocyte, rat, scanning electron microscope picture, magnification: 18000 x

primarily focused on basic research, and related clinical disciplines and epidemiology.



Computer model of the structure of the anti-cancer drug Cyclophosphamide, which is widely used in cancer therapy

The Control of Cancer

With the increased life expectancy of industrial nations and the decrease in infectious diseases, cancer has moved from seventh to second place among the statistical causes of death. In spite of the enormous financial expenditures of public and private organizations on the fight against the disease, more than 200,000 people died of cancer in the Federal Republic of Germany in 1989, one sixth of whom died as a result of malignant growths in the respiratory tract. Over 70% of all cancer-induced deaths occurred after the age of 65. The annual number of new cases is estimated at about 300,000. Though there are types of cancer that are in decline today (such as stomach cancer, cervical cancer, and bone cancer in women), other kinds are increasing in alarming numbers, such as tracheal and esophageal cancer and skin cancer.

Epidemiological studies suggest that a large proportion of cancer cases are affected by external factors, for example, by certain substances and viruses that might play a role in the carcinogenesis. Inadequacies of life style and nutrition can also increase the risk of cancer. Carcinogenic chemicals also affect humans, either as the result of certain forms of behavior (such as smoking) or as the result of the absorption or ingestion of certain toxic substances from the natural environment or at the place of work. Thus prevention, and here that means avoidance of carcinogenic influences, becomes especially important.

Aside from the improvement of preventive measures, one of the important aims of future cancer research will be the most rapid possible conversion of basic-research findings into clinical models. In this context, advances are also expected from the new possibilities opening up in genetic therapy. Just as important is the psychosocial care and oncological rehabilitation of those afflicted with cancer. It aids the sick to get over the illness, it initiates the transition into a new phase of life, and it works to prevent delayed aftereffects of illness.

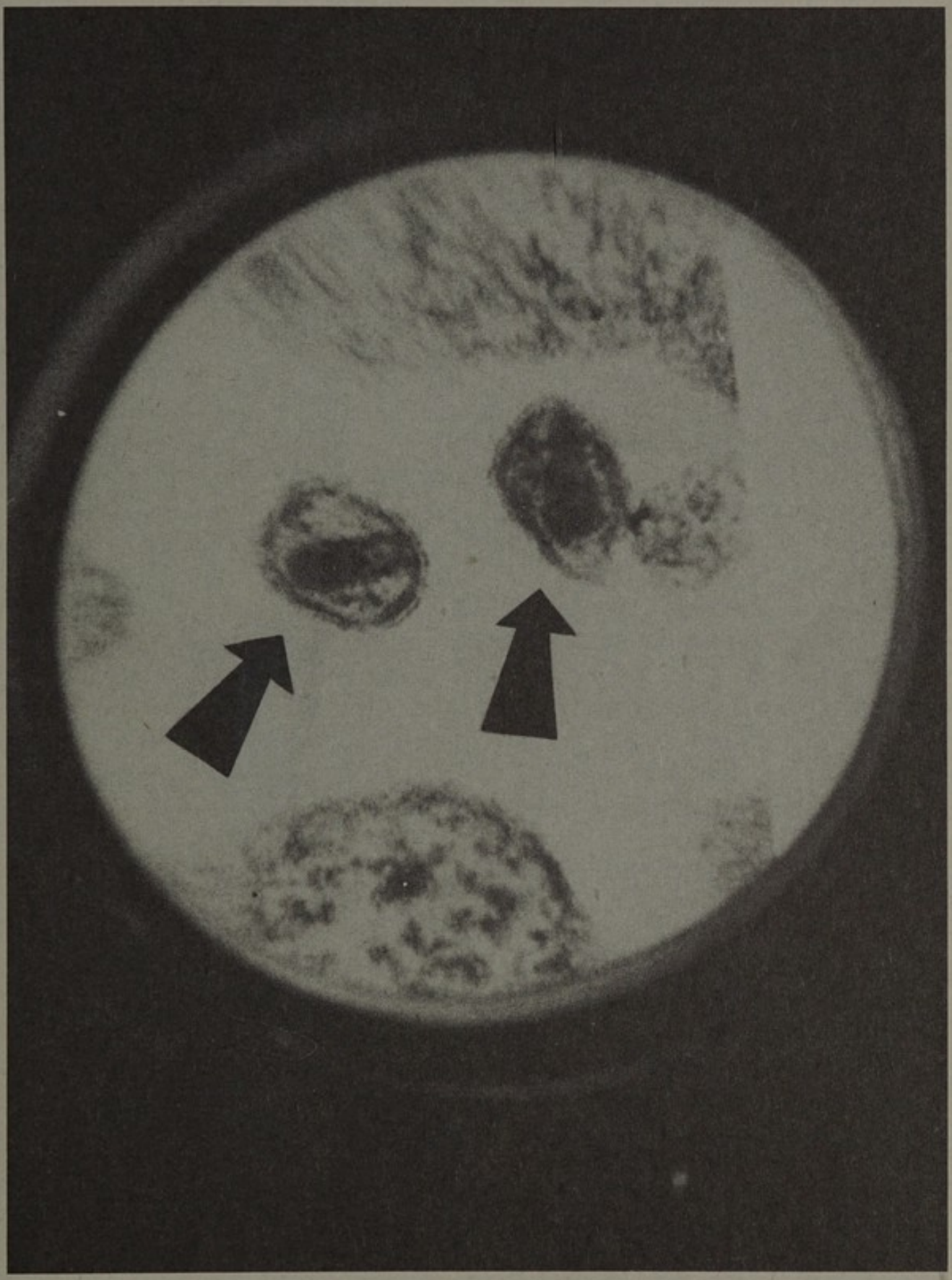
Most federal funding of cancer research is basic funding for institutions. In particular, one has to cite the Deutsches Krebsforschungszentrum (DKFZ, German Center for Cancer Research) in Heidelberg, the Max-Delbrück-Centrum für molekulare Medizin (MDC,Max Delbrück Center for Molecular Medicine) in Berlin-Buch, and the Center for Environment and Health (GSF) in Munich in this context. They pursue long-term basic research oriented around the objectives of the Federal Program. In addition, a series of priority fields were promoted by means of project funding, focusing on diagnosis, early detection, tumor immunology, therapy, and rehabilitation, as well as nonconventional methods of cancer control. Future project funding is to be aimed above all at prevention and

the structural improvement of clinical cancer research. Important contributions are also made by the priorities of the "Biotechnology 2000" and "Work and Technology" programs (especially involved in the goal of developing preventive measures for the occupational world), as well as the program on "Environmental Research and Environmental Technology," with its research aimed at estimating the risk of environmental factors.

Infectious Diseases

Infectious diseases represent a serious threat to health worldwide. Apart from the currently most prominent example of AIDS, the striking increase in the infectious salmonella and Legionaire's diseases is not limited to Germany. Advances in immunological and molecular-biology methods have resulted in new knowledge about pathogenetic and immunological mechanisms, while at the same time leading to a strong increase in the expectations and demands made of research. The prevention and treatment of secondary infections have become very important, especially as they occur in patients with weakened immune systems.

Infectious diseases lead to complex disruptions of the immune system. The course of the latter depend, on the one hand, on the receptiveness of the attacked organism and, on the other, on the aggressiveness of the intruding pathogen, as well as on as yet unknown interactions between all factors involved. The mechanisms of transmission, both in terms of molecular processes and population-related regularities, are not yet completely understood. This holds for numerous questions in the clinical study of infection, including the problem of hospital (nosocomial) infections in particular as well as tropical diseases widespread in developing countries, which were previously paid insufficient attention by research in Germany. Tropical disease-related research primarily involves the development of drugs, vaccinations, diagnostic techniques, and suitable methods of vector control that are in keeping with the conditions in developing countries, including their economic feasibility. Here, reference should be made to the EC program "Life Sciences and Technologies for Developing Countries" (STD 3). The Federal Program has been supporting research activities for several years already that aim to explain the pathogenetic mechanisms and means of transmission of important infectious diseases. Previous funding in this field has shown once again that the crucial precondition for effective research (here on infection) lies in the establishment of continuously productive structures at universities and nonuniversity institutions.



A cure for AIDS remains to be found: electron microscopic picture of the AIDS virus.

AIDS

The sudden emergence of AIDS and the difficulties that arose in trying to confront the new disease served to pinpoint weaknesses in the cognitive foundations of immunology, in infection-related and clinical research, as well as in the social sciences. With the aim of reducing these deficits, AIDS research funding was initiated in 1984, shortly after the first occurrence of the disease in the Federal Republic. The initial effort sought to establish broadly structured basic immunological and virological research on the HIV infection. It was supplemented by clinical, epidemiological, and social-scientific research activities.

At the beginning, research was focused on the development of diagnostic procedures and the establishment of biomedical etiological research. Subsequently, the spectrum of funded activities has expanded to include the improvement of therapeutic possibilities and the treatment of concomitant complications of AIDS. Research is now primarily concentrated on the development of vaccine-based protection and of an etiologically directed therapy. In addition to projects in molecular biology, immunology, and virology, social-science-based research proposals have also been incorporated into the priority field since the beginning of 1989. In order to concentrate research, topics initially funded in terms of individual proposals have by now been largely combined into network-organized projects, optimizing in this way mutual exchange between scientists.

In order to develop a vaccine and to effect the activation of the immune system in conjunction with therapy, it will also be necessary in the future to conduct basic research in immunology. Here, more weight has to be given to the typical problems of developing countries, since they are especially threatened by AIDS. Epidemiology represents another important area of research: it can provide the foundations needed for preventive strategies as well as information about means of infection and the speed at which it is spreading. This results in clear ties to other program priorities.

In terms of international cooperation, German AIDS research has to remain integrated in the European and worldwide activities undertaken to control the AIDS epidemic. To date, German scientists have already been commissioned by the World Health Organization (WHO) to develop reference serums for standardizing HIV-antibody testing procedures and have participated in international multicentric therapeutic studies. To intensify the inter-

national exchange of experience, a scholarship program was incorporated into the priority program in 1989, which is administered by a project group at the Heidelberg DFKZ. This program will also be continued.

It will be crucial in the next few years to connect the primarily basic-research-oriented disciplines more strongly with their related clinical fields and with epidemiology and to pay greater heed to the specific needs of developing countries. AIDS research will become an integral part of infection-related research, since this will produce considerable synergistic effects on the development of therapies not only for AIDS, but (it is expected) for other infectious diseases as well. Funding mechanisms supportive of network-organized research are especially well suited for developing the structural basis of infection-related research. It makes it possible both to solidify and expand already established priority fields and to create networks among established centers.

Allergies and Respiratory Diseases

From among the conditions that lead to the onset of allergies and respiratory diseases, discussion centers on those strains on the human body caused by environmental factors, notably by contaminants and substances found in the household and in the workplace. Even though considerable cognitive advances could be made in recent years, the processes by which allergies cause their effects remain largely unexplained. The allergenic potency, inflammatory effects, and fine structure of exogenous contaminants and their mutual effects upon one another are unknown in many cases and often difficult to determine, since the methods necessary still need to be further developed.

Even though respiratory diseases count among the most frequent causes of the inability to work and premature pension claims, clinical research is still comparatively underdeveloped in this field in Germany. The intensification of efforts in this direction, while incorporating its immunological, biochemical, and molecular-biological aspects, is an important goal of funding in the Federal Program. By establishing priority fields in pulmonary and allergy research[22], a promising initiative was put into effect in recent years, which should help cope with defi-

22) A joint priority of the *Research and Development in the Service of Health, Environment and Environmental Technology*, and *Work and Technology* programs.

cits in knowledge as well as structural problems of the relevant disciplines. The investigation of allergies and respiratory diseases will remain an important funding objective of the Federal Program. Here, too, the initial funding of individual projects will now be replaced by a focus on the structural consolidation of the specialization.

1.2.2. The Cardiovascular System

Like most highly industrialized countries, the Federal Republic has been confronted by a sharp rise in cardiovascular disease since the fifties. Contrary to expectations, this trend continued in the eighties. Experts have been pointing out for a long time now that curative approaches to the control of cardiovascular diseases have to be supplemented by the more important preventive behavior of every individual.

In the previous funding period, two complementary ways of proceeding with project funding[23)] were in keeping with this objective. On the one hand, attention was directed to the early recognition of those persons, who, unbeknownst to themselves and without noticing any signs of illness, were beset by a special risk of suffering from coronary heart disease. On the other hand, this individual patient-oriented conception of research was complemented by a strategy directed to the population of the whole. The latter aimed to help improve the health of wide strata of the population by implementing so-called primary preventive measures. Standards were set in this context above all by the Deutsche Herz-Kreislauf-Präventionsstudie (DHP; German Cardiovascular Prevention Study). The results of the funded projects are reflected in the expanded precautionary medical check-ups and the early-detection medical examinations now conducted.

Cardiovascular research is one of the well-established fields in university hospitals, in both the areas of basic research and clinical research. The DFG supports efforts here within Sonderforschungsbereiche (SFB, special research programs); Sonderforschungsbereiche), clinical research teams (klinische Forschergruppen), and priority programs (Schwerpunktprogramme). Nonuniversity institutions, such as the Max Delbrück Center for Molecular Medicine (MDC), are also committed to research of these diseases.

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23) *Herz-Kreislauf-Erkrankungen: Zum Stand der Forschung* (Cardiovascular Diseases: The State of Research) ED. BMFT. (Bonn, 1987)

Deficits continue to exist in the area of therapy research, for example, in the comparison of surgical and nonsurgical techniques. Also, in health-policy terms, there is a need for further knowledge on the practical use of the concept of "risk factor," on the improvement of early-detection strategies, and on the application of modern techniques of therapy and rehabilitation. This field will be promoted above all by means of basic funding.

1.2.3 Mental Health and the Nervous System

Research of mental illnesses and disorders represents an important task in humanitarian, societal, and economic terms. According to epidemiological studies, about 25%-30% of all German citizens undergo at least once in life a temporary mental disorder requiring treatment. Frequently occurring mental illnesses, such as depression, schizophrenia, and senile dementia place considerable strains on those affected and their families. Mental disorders are also gaining increasing importance as risk factors and partial causes of chronic physical illnesses and handicaps in all age groups.

Injuries to the central and peripheral nervous system are usually irreparable, since, according to the present state of scientific knowledge, nerve cells cannot be replaced. Severe breakdowns of the nervous system result from diseases and accidents, often forcing the afflicted into a wheelchair for life. The earliest possible rehabilitation of accident- or stroke-induced brain damage is thus of immense importance in health-policy terms. Basic research on the regenerative mechanisms of the nervous system and the restitution of functions can thus serve as the basis for better care in the future for these particularly severely afflicted patients. It is thus indispensable that, in terms of early rehabilitation, close cooperation between basic research, clinical research, and medical care also extend to research.

The great importance in health-policy terms of diseases of the nervous system and of mental illnesses, and, the research deficits manifested by international comparison already led to the 1978 Federal Program classification of these topics as urgent. To date, priorities have included above all the fields of therapy and prevention of the recurrence of mental illness in adults[24], mental health in

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24) Klinische Studien in der Psychiatrie: Therapie und Rückfallprophylaxe psychischer Erkrankungen im Erwachsenenalter. Materialien zur Gesundheitsforschung (Clinical Studies in Psychiatry: Therapy and Prevention of the Recurrence of Mental Illness in Adults). Materials on Health Research, vol. 14. Commissioned by the BMFT (Bonn, 1990)

Addiction Research

The concept of addiction generally covers the state of dependency induced by substances that effect the central nervous system. Thus, it is not limited to so-called hard drugs, but also includes certain medicinal drugs, solvents, alcohol, and nicotine.

The federal government passed the "National Plan for Controlling Narcotics" (*Nationaler Rauschgiftbekämpfungsplan*) in 1990. It calls upon the BMFT to help reduce the demand for narcotics. The sensible interlinking of various basic-research disciplines with clinical research and medical care appears especially promising for coping with the health problems arising from the consumption of illegal drugs. The general goal of this priority field is improvement in the prevention and therapy of various forms of dependency and, in this way, to reduce the demand for psychoactive substances at the same time. Moreover, this program also aims to increase knowledge of the neurobiological and psychosocial factors involved in the genesis of addiction, since this is urgently needed for effective prevention.

the aged, chronic pain, Parkinson's disease, and addiction research. Funding was clearly able to improve the relative importance of neurological and psychiatric research. In coming funding periods, addiction research[25)] is a topic that will receive special attention.

Research activity on the nervous system is also well established at nonuniversity research institutions. Special mention should be given to the MPG-institutes and to the BLI-institutes established in the new Länder. (Here, see also Appendix II, p. 100).

In neurological and psychiatric research, it will also be critical in the future to bring together the various specializations and disciplines of basic and clinical

25) Suchtforschung: Bestandsaufnahme und Analyse des Forschungsbedarfs. Materialien zur Gesundheitsforschung (Addiction Research: The State of Research and an Analysis of its Needs). Materials on Health Research, vol. 19. Commissioned by the BMFT (Bonn, 1991)

research, as well as the social and behavioral sciences, in order to let them profit from one another. Here, the results and advances in basic neurobiological research, already made or expected in the near future, should be quickly translated into suitable therapeutic procedures. In this way, they ought to contribute (among other things) to the clarification and improved treatment of age-related dementias and make possible improved therapies for paraplegics and stroke victims. Affiliating structures of medical care with the "domain of research" is also of special importance, something which has remained inadequate. In this connection, Health Research 2000 can provide structure-improving impulses in the regional formation of priorities.

1.2.4 The Locomotive and Supportive Apparatus

The causes of most rheumatic and other diseases of the locomotive apparatus are still largely unexplained. Accordingly, there are only causal treatment methods for a few of these diseases. Despite the undeniable successes achieved in the application of symptomatic treatment programs, basic research work is required to develop more effective therapeutic principles. Here, emphasis has to be placed on strengthening clinical research, which can make interdisciplinary use of the advances made in immunology, molecular biology, biochemistry, and molecular genetics.

The approaches of clinical research have to be accompanied by epidemiological research in particular. Like rheumatic-disorders research at the end of the seventies, epidemiological research finds itself in a phase of growing importance and recognition. To reinforce this trend, a priority program on epidemiological research[26)] and a scholarship program to foster international scientific exchange in the fields of epidemiology and rheumatology have been established.

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26) *Epidemiologie rheumatischer Erkrankungen: Forschungsbedarf und Empfehlungen für Schwerpunkte zukünftiger Forschung. Materialien zur Gesundheitsforschung* (Epidemiology of Rheumatic Disorders: The State of Research and Recommendations for Priorities in Future Research) Materials on Health Research, vol. 8. Commissioned by the BMFT (Bonn,1989)

The Federal Program has always considered rheumatic diseases an important part of health research, establishing priority programs from the outset. Today we see the fruits of long-term funding. Project funding was used to establish scientific-rheumatological research teams in the appropriate university departments; targeted, structurally formative measures served to increase the status of rheumatological research. As a result of these combined efforts, clinical research teams and exemplary forms of cooperation at various locations between basic-research disciplines and medical care-related research are forming on their own today or with the help of other sponsors. In the future, the task of the Federal Program will be to support the establishment of permanent structures for rheumatology in those fields that have not yet participated in this development to an adequate extent.

1.2.5 Metabolism and the Hormone System

Metabolism and the endocrine system affect – by means of networked control systems – the biochemical and physiological functions of the organism. Impairments to this system usually result in complex functional transformations, which manifest themselves in a wide spectrum of symptoms. The still open discussions found even among experienced clinicians about the classification of basic systemic ailments, such as hypertension (which affects the metabolism of sugar and fat and circulatory regulation), points to the need for knowledge in this area. Due to the inadequate knowledge of complex chains of effects and their repercussions on the overall system, many dysfunctions can only be tackled while disregarding serious delayed aftereffects, as in the case of diabetes mellitus.

Research in the field of metabolism is carried out in numerous universities, where the foundations of new therapies are also developed. What is often lacking is the collaboration between basic and clinical research, as well as the incorporation of epidemiology. Efficient preventive programs, for example for goiter (which is still endemic in Germany), or for osteoporosis would be desirable. It is to be hoped that even more clinical research teams will form in the future in this scientifically comparatively well-developed field. Start-up aid is probably required, especially for epidemiological and clinical research projects and for projects addressing germane questions of public health. Here, too, the key will be to create better networks between already existing priority programs.

2. Contributions of Basic Funding to Health Research

Institutions that receive basic funding from the federal government (GFE, institutes of the MPG and the FhG, BLI institutions, and federal research institutes) represent the greatest concentration of publicly funded scientific potential in health research in Germany outside of the universities. These notable capacities have to be taken into account in determining the deficits of health research and in formulating appropriate priorities for project funding in the framework of Health Research 2000. For this reason, in the following, research institutions that are financed in part or in full by the federal government will be depicted in terms of the activities they carry out that are in keeping with the Health Research 2000 program.

2.1 Priorities of Institutional Research

GFE and BLI contribute extensively to research on disease control and health services. Here, the focus is on disease-related research (such as etiological and pathogenetic research), but also on methodologically oriented research (such as the development of new diagnostic and therapeutic methods). In addition, several institutions concentrate on research on rehabilitation and on the health system. The federal institutes (Bundesanstalten), in the framework of direct departmental research (Ressortforschung), primarily produce research on prevention and the maintenance of health. A further priority is placed on studies on disease control. In the institutes of the MPG (MPI), the biological and medical sciences are well represented. The spectrum of topics researched has a basic-research and scientific orientation. Work at several institutes of the FhG is also related to health research. The research teams active in this field are, in keeping with the intent of the FhG, largely active in the area of applied research.

This institutional research domain has greatly expanded in the previous periods of the Federal Program. Institutes in the new states and in East Berlin have enlarged the spectrum of topics of nonuniversity research encompassed by the program, adding important aspects, such as molecular medicine, nutritional research, and pharmacology. An overview will make it clearer what the tasks of the institutions are and will be in regards to the solution of future problems and how their potential can be optimally used in conjunction with other research institutions and activities or, if required, reorganized for better outcomes.

2.2 Substantive Orientations

New approaches to research are becoming increasingly recognizable in light of the possibilities now given for investigating the molecular and cellular mechanisms of healthy and pathological functions of the human organism. The resultingly large number of potential directions of research makes it evermore difficult to set priorities. For this reason, it is important that institutions involved in health research give themselves enough leeway above and beyond their concrete research plans, so that they can quickly react to issues of great interest in health policy or scientific policy.

In coming years, the basic substantive orientations of the nonuniversity research institutions will continue to be based on the health-policy requirements of maintaining and reestablishing the health of the population. The focus is on making new advances in prevention, diagnosis, and therapy. But studies in the field of health-system research or public health will also demand the use of institutional research capacities.

Increased importance will be given to investigations of the interaction between external influences and processes at different levels of the human organism and concomitant degenerative and pathological changes. Scientifically important issues could arise in this context with wide-reaching practical consequences for the behavior of humans at all stages of processes of growth and aging. Answers have to be found, for example, to the question of the risks posed for health.

It will be necessary to employ a wide spectrum of methods to achieve these ambitious objectives. This includes methods from molecular biology and epidemiology and the testing of techniques and plans of action for medical care. A far-reaching networking of basic research with clinical research also represents one of the central intentions of scientific policy in nonuniversity health research. Here, the closest connection possible between theoretical and clinical research should be created, or where already existing, used in order to achieve substantive cooperation as well.

This is also the direction of the multicentric network for Clinical-Biomedical Research created by DKFZ, GBF, GSF, KFA, and MDC in 1992. The network is open to other research institutions. The network creates for the first time a focus on the clinical-biomedical aspects of health research funded at GFE. Its priority tasks should include the coordination of research in progress at its member institutions and joint peer reviews and appointment procedures. Especially collaboration with university hospitals needs to be improved. Both nonuniversity and university institutions would profit from this. The former would be granted

Examples of Fields of Basic Funding

- **Prevention and Health Services Research:** Research Center for Environment and Health (GSF), Munich, with studies for the further development and application of methods of

  * Describing the state of health of population groups
  * Describing, analyzing, and planning of the health system
  * Planning and evaluating medical studies and studies of the health care system, and
  * Assessing medical measures and institutions

- **Maintenance of Health and Prevention:** German Institute for Nutritional Research (DIfE), Potsdam-Rehbrücke, with studies on the prevention of chronic diseases that are in part caused by improper diet. Health-related nutritional research is also performed at the Forschungsinstitut für Kinderernährung (FKE; Research Institute for Child Nutrition), Dortmund.

- **Cancer Research:** German Center for Cancer Research (DKFZ), Heidelberg, with studies on the prevention, diagnosis, and therapy of cancer. The focus is on the determination of cancer-related risk factors and the investigation of the basic processes involved in carcinogenesis. In addition, the influence of radiation and environmental toxins on the organism, or on cells and cellular systems is investigated at the GSF, the Jülich Research Center (KFA; Forschungszentrum Jülich), the Karlsruhe Nuclear Research Center (KfK; Kernforschungszentrum Karlsruhe), the Max Delbrück Center (MDC) in Berlin-Buch, the Fraunhofer Institute for Toxicology and Aerosol Research (Fraunhofer-Institut für Toxikologie und Aerosolforschung) in Hannover, the Medical Institut for Environmental Hygiene (MIU; Medizinisches Institut für Umwelthygiene) at the University of Düsseldorf, and the Institute for Occupational Physiology (IfA; Institut für Arbeitsphysiologie) at the University of Dortmund. The Max Planck Institute (MPI) for Biochemistry (Max-Planck-Institut für Biochemie) in Martinsried is also engaged in research on the molecular-biological foundations of the genesis of cancer.

- **Cardiovascular Disease:** MDC, with studies of the molecular and cellular mechanisms of healthy and pathological reaction in the human organism; MPI for Physiological and Clinical Research (MPI für physiologische und klinische Forschung; also known as the W.G. Kerckhoff Institute), in Bad Nauheim.

- **Infectious Diseases:** Society for Biotechnological Research (GBF; Gesellschaft für Biotechnologische Forschung), Braunschweig; GSF; MPI for Biochemistry (MPI für Biochemie), Martinsried, and MPI for Biology (MPI für Biologie), Tübingen; German Primate Center (DPZ; Deutsches Primatenzentrum), Göttingen; Borstel Research Institute (FIB; Forschungsinstitut Borstel); Heinrich Pette Institute for Experimental Virology and Immunology (HPI; Heinrich-Pette-Institut für experimentelle Virologie und Immunologie) at the University of Hamburg; Bernhard Nocht Institute for Nautical and Tropical Diseases (BNI; Bernhard-Nocht-Institut für Schiffs- und Tropenkrankheiten), Hamburg; the Federal Health Office (BGA; Bundesgesundheitsamt) in Berlin; and the Federal Office for Serums and Vaccines: Paul Ehrlich Institute (PEI; Bundesamt für Sera- und Impfstoffe: Paul-Ehrlich-Institut), Langen, with investigations ranging from analyses on the cellular and molecular level to epidemiology.

- **Metabolic Diseases:** especially diabetes at the Diabetes Research Institute (DFI; Diabetes-Forschungsinstitut) at the University of Düsseldorf.

- **Neurological and Psychiatric Disorders:** KFA; MPI for Biophysical Chemistry (MPI für biophysikalische Chemie), Göttingen; MPI for Psychiatry (MPI für Psychiatrie), Munich; MPI for Neurological Research (MPI für neurologische Forschung), Cologne, with methodological studies on cerebral metabolism; and the Institute for Neurobiology (IfN; Institut für Neurobiologie), Magdeburg, with studies on understanding various learning processes and the organization of memory.

- **Molecular Pharmacology:** Research Institute for Molecular Pharmacology (FMP; Forschungsinstitut für Molekulare Pharmakologie), Berlin, with studies investigating degenerative cerebral processes and the effects of drugs on the cellular and molecular level; MPI for Cerebral Research (MPI für Hirnforschung), Frankfurt a.M., with studies of the biochemical and molecular-biological analysis of the active ingredients of various neuropharmaceutical products.

- **Clinical Research** is a research priority at the DKFZ, GSF, KFA, MDC, the MPI for Physiological and Clinical Research, the MPI for Psychiatry, the Borstel Research Institute, DFI, BNI, IfA, and DIfE. (On the research priorities of the individual nonuniversity research institutions, see also Appendix II, section 2)

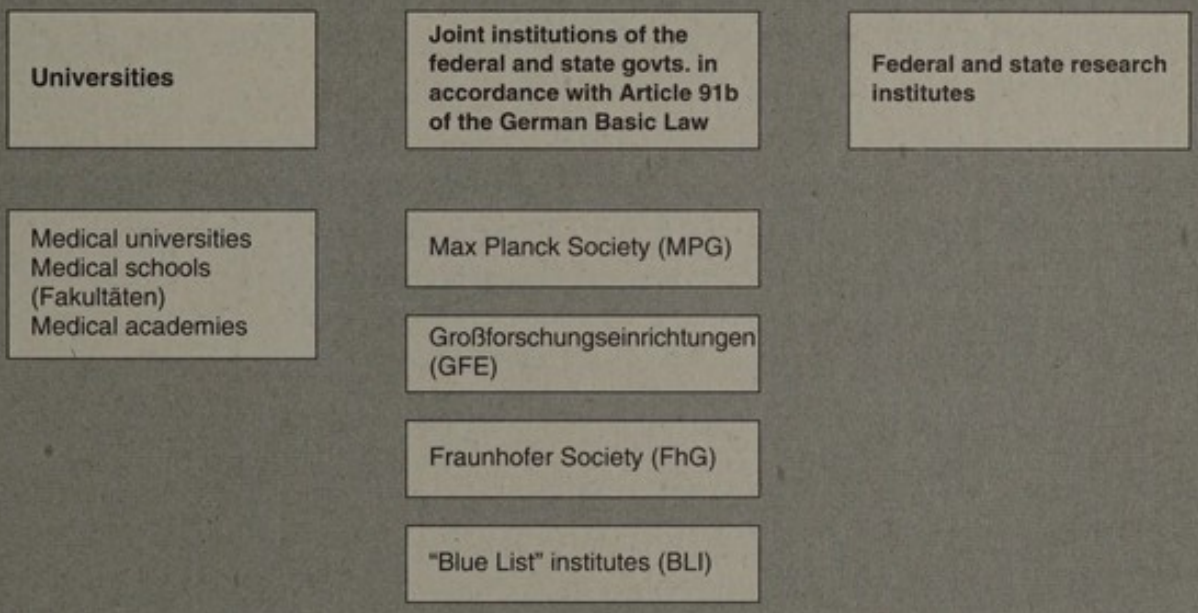
easier access to hospital beds. For the latter, such cooperation, i.e., the introduction of excellent nonuniversity research manpower into the hospital, would make it easier to form necessary priority programs that go beyond departmental and hospital boundaries and to help integrate such structures into the university[27].

27) Here, see also Wissenschaftsrat (German Science Council), *Empfehlungen zur Zusammenarbeit von Großforschungseinrichtungen und Hochschulen* (Recommendations on the Cooperation between GFE and Universities) (Cologne, 1991)

Chapter III. The Program of Action in Health Research

The two guiding aims of the Health Research 2000 program "To Foster Health and Fight Disease" and "To Improve the Structures of Health Research" will be tackled – as in past – by a great number of researchers in university and nonuniversity institutions and in the interaction of various funding agencies (cf. Fig. 2).

Fig. 2: The public-sector institutions that conduct health research in the Federal Republic of Germany



The Federal Program can build upon the wide and diverse foundations of research found in the university departments/schools (Fakultäten) of medicine and natural science. This research is made possible by the basic financing provided for research and education by state governments. It gains its scientific character primarily by means of the grants provided by the DFG and by means of its funding procedures. The DFG employs the following funding mechanisms to promote primarily basic and clinical research: normal-procedure grants (Normalverfahren), priority programs, special research programs, and research

teams. The quality of research is the basic criterion for funding. This DFG funding covers a broad field of topics in medical research (see also the overview in appendix II, section 1). In 1991, the DFG spend a total of about DM 430 million on medical research. Additional contributions come from nonuniversity institutions, in particular the Max-Planck institutes, GFE, BLI, and the institutions involved in departmental research.

1. Formative and Structural Funding for Clinical Research and Public Health

In order to succeed in realizing both the substantive and structural objectives of the Federal Program to an equal extent, efforts are made to create model structures as the basis of activities in the various funding priority fields. The hope is that these structures will help set new accents at universities and at nonuniversity institutions, interlink existing research teams, and develop innovative organizational forms.

Topically Specified Networks of Research	Topically Unrestricted Structural Models
* Local research networks * Nationwide research networks * Promotion of young talent	* Clinical research teams * Interdisciplinary centers for clinical research * Funding awards in health research

1.1 Topically Unrestricted Structural Models for Clinical Research

The topically unspecified structural models of the program aim to make use of organizational requirements to improve in the structures for clinical research at universities.

1.1.1 Clinical Research Teams

Clinical research teams are supposed to be the basic model units for research at university hospitals. The work done within them is supposed to exemplify how biomedical and clinical research should be conducted. The Program of Clinical Research Teams, which was recommended by the Wissenschaftsrat and is run by the DFG with extra funds from the health research program, seeks to create permanent structural changes in university hospitals in the interest of clinical research.

The program, begun in 1988, is supposed to consist initially of 25-30 teams according to the recommendation of the Wissenschaftsrat[28]. An intermediate assessment will be made at the time when each of the Länder has to decide whether to take on the financial sponsorship for the first generation of clinical research teams. An overview of the clinical research teams established to date is found in the Appendix II, section 1.3).

The success of this structural aid is premised upon the willingness of universities and states to provide the funded teams with a secure institutional niche after the funding program and its initiatory funding ends. This also entails endowing the core of the research teams in such a way they can continue to do research after this. And this presupposes that the projects are accorded priority within their respective departments (Fakultäten) and institutes, for example in the appointment of new professors or in the allocation of the basic technical resources and space available. An essential funding condition is the commitment on the part of the respective university to take on sponsorship of the clinical research team at the end of the funding period (which is ususally limited to 6 years).

1.1.2. Interdisciplinary Centers for Clinical Research in University Hospitals

The program of *Health Research 2000* seeks to give a new and lasting impulse toward the improvement of clinical research at universities. In the framework of

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28) Wissenschaftsrat (German Science Council), *Empfehlungen zur Förderung Klinischer Forschergruppen in den Hochschulen* (Recommendations for the Promotion of Clinical Research Teams at the Universities) (Cologne, 1987).

these funding measures, the initial aim is to work closely with universities and Länder to establish model centers for interdisciplinary clinical research at six to eight locations within Germany.

Centers for interdisciplinary clinical research are supposed to work out strategies for an optimal coordination of science, medical care, and teaching. Furthermore, they should establish stuctures that provide clinical research in particular with an advantageous organization and that can serve as models for other university hospitals. This is necessarily premised upon the existance of the desire of the university to create new and up-to-date structures for clinical research and thus to start a program in a clearly defined field where research is already well establised. The federal support is initiatory financing intended to be the precursor to the longer-term establishment of the centers under the financial responsibility of the respective states and to facilitate the acquisition of resources from other sponsors. The BMFT has initially set aside, for a period of 8 years, ca. DM 250 million for funding in the framework of the *Health Research 2000* program.

The goal of this funding measure, aside form the coordination of research topics at the centers, is to make the economic interrelationship of medical care, research, and teaching transparent. Though these three services are closely related, each is the financial responsibility of a different agency. For this reason, procedures are to be developed, tested, and established at the clinical research centers that allow scientific services to be clearly differentiated from expenditures made on patient care. This would allow medical care to be financed by the responsible agencies in accordance with services provided; at the same time, it should serve to secure clinical research, in the long term, with the funds it deserves[29].

In this way, the program also contributes to the goals of the Health Structure Law (*Gesundheitsstrukurgesetz*)

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29) The Council of Experts on Concerted Action in Health Services (*Sachverständigenrat für die konzertierte Aktion im Gesundheitswesen*) took a detailed postion on this problem in its annual report of 1991: *Das Gesundheitswesen im vereinten Deutschland* (Health Services in Unified Germany) (Baden-Baden: Nomos-Verlag, 1991).

Interdisciplinary Centers for Clinical Research at Universities

* Cooperation between clinical and basic research: formation of programmatic priorities in keeping with a university-specific research profile
* Transparency in the financing of research, medical care, and teaching; an incentive for improving cost accounting
* Scientific competition within the university and the granting of federal and state research funds according to structural and substantive criteria on the basis of peer review
* Optimal organizational assignment of the tasks of research, teaching, and patient care

A center can only be established on the basis of a "critical mass" of researchers and considerable investments on the part of the university and the state in which it is located. The centers should concentrate on departments that (a) strengthen the specific research profile of the university hospital and (b) in which scientific priority programs and grant-funded projects already exist whose respective scientific topics of inquiry can be programmatically complemented by means of additional funding[30]. The centers should incorporate the DFG-sponsored clinical research teams, DFG-sponsored Sonderforschungsbereiche (SFB,special research programs), and nonuniversity research groups in their research field existing at their location, strengthen the formation of networks between the various groups and disciplines, and train young scientists. A considerable share of funding provided by the Länder to the university hospital, should be devoted to such an interdisciplinary research center.

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30) * In pursuing this objective, the program of interdisciplinary centers takes up a key recommendation on clinical research made by the Commission on Basic Research (*Kommission Grundlagenforschung*). See *Förderung der Grundlagenforschung durch das Bundesministerium für Forschung und Technologie: Empfehlungen der Kommission Grundlagenforschung* (Funding of Basic Research by the BMFT: Recommendations of the Commission on Basic Research) (Bonn, 1991).

* *Grundsätze zur Bildungs- und Forschungspolitik der Bundesregierung vom 3.2.1993* (Principles of Educational and Research Policy of the Federal Government of 3 February 1993).

In topical terms, the centers should be oriented toward the substantive priorities of the Federal Program. This means above all: cardiovascular disease, cancer, infectious disease, metabolic disorders, and diseases of the nervous system and the locomotive apparatus. The behavioral and social-scientific fields of public health are also part of this program. Fields given little scientific weight at most universities can be integrated into the priority programs of the centers in so far as they represent a defining aspect of the research profile of the hospital in question.

The organization at interdisciplinary centers should also promote research by interconnecting research and patient care in an appropriate manner. Clearly defined cooperative activities should take place between the various research teams at a center, activities always accompanied by suitable structures of leadership and responsibility. Scientific competition should always regulate cooperation at the center. This entails the allocation of available resources strictly according to performance; this is accomplished, in keeping with international models, by means of an external peer-review procedure. In the decision to establish an interdisciplinary research center, not only the relevance and quality of the scientific research count; evaluation here also takes the structural conception of the proposal into account[31].

1.1.3 Funding Awards in Health Research

The funding award in health research should serve to recognize German scientists or groups of scientists for outstanding achievments in the goal areas of the Federal Program and promote their further research. The funding should improve the research opportunities of the chosen groups at university hospitals. The award provides the research team with funds for a certain period of time, which it can use flexibly according to its needs and desires. The award should also help relieve participating scientists of the burdens of patient care and non-scientific obligations and provide them with greater time for research.

Outstanding quality, successful interdisciplinary cooperation, and exemplary organization represent the key criteria for selecting the award-winning group.

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31) The BMFT will make the definitive requirements and evaluative criteria public in a separate publication.

One feature defining exemplary organization is the incorporation of capable young scientists from clinical research and related disciplines regardless whether from natural science, the social and behavioral fields of public health, or the humanities (Geisteswissenschaften). The BMFT prepares for its award decision by appointing a nominating committee made up of recognized scientists.

1.2 Topically Defined Networks of Research

In trying to reduce research deficits, it might be necessary to strengthen certain directions in research of great current interest that are underrepresented in Germany by providing reorientation support in the framework of a regional multicentric research. Or, it might be necessary to interconnect existing research groups as a way of promoting the transfer of knowledge, especially between hospitals and basic research centers, by forming regional or nationwide networks.

Local Research Networks

Scientific associates in a local or regional research network should work near to one another. The resulting structure should be a division of labor interdisciplinary in character, so that the individual projects complement each other synergistically. If possible, funding here should also be used to reinforce cooperation between university hospitals and nonuniversity research facilities.

Funding will only be granted those institutions interested in long-term structural measures that are willing to offer the new research directions an adequate future perspective and support from their own research programs and budgetary means such that the key research groups are guaranteed institutional support after funding ends and are in the position to acquire grants from other sources. This structural model has already been realized in exemplary fashion in local and regional priority programs in public health research.

Nationwide Research Networks

In selected priority fields, nationwide research networks should also receive funding. These are research groups at several locations that orient themselves around a commonly developed program. The participating scientists can be from basic research or from the clinical field of universities or nonuniversity research facilities. This funding makes it possible to carry out clinical reference studies and epidemiological pilot projects.

Among those proposals addressing the priority fields promoted by the Federal Program, projects with international participation deserve special support, especially if they involve EG programs. For this reason, in addition to the financial requirements of the German participant in the research network, expenditures necessary for the administration of such studies in an international framework can also be subsidized. Given suitable qualifications, there is an expressed desire to promote the participation of Central and East European groups of scientists.

1.3 Promotion of Young Talent

The national and international exchange of experiences with university and nonuniversity health research institutions is of special importance for clinical and public health research. The experience of past years has shown that the skills that talented young scientists have acquired in the framework of research scholarships can only be effectively put into use if they are given the chance to employ their acquired knowledge in established and qualified groups of researchers following their scholarships. Thus, it is of special concern to the Federal Program to provide young talent with just such an opportunity.

The program provides scientists from Central and Eastern Europe with the opportunity to take part in projects in Germany. This is premised upon integrating the young or guest scientist into a university or nonuniversity research facility that is taking part in one of the priority projects of the program.

2. The Closer Interlinkage of Nonuniversity and University Research

Great importance will continue to be attached to the basic funding provided nonuniversity institutions in health research for the purpose of creating a system of health research that spans all of (unified) Germany and for meeting the Federal Program's target goals in health and scientific policy.

Given the changing make-up of scientific and research policies, the aim is to maintain a sensible division of labor and the most effective cooperation possible between nonuniversity and university facilities in the important fields of basic research, applied research, and in the development of new systematic approaches. In its 1991 recommendations on cooperation between GFE and universi-

ties, the WR made statements on this[32] that serve as guidelines for the Federal Program.

There have been efforts (a) at creating a rational division of labor and collaboration between nonuniversity and university research facilities and (b) at interlinking basic funding and project funding with the goal of integrating priority topics in health policy and scientific policy into the research programs of nonuniversity research institutions. These efforts have resulted in the development of differing structural approaches.

2.1 The Cooperation of University and Nonuniversity Research Institutions in Clinical Research

Working in concert with university hospitals, there are different ways in which clinical research can be incorporated into the basic funding of an institution. For example, the hospital ward of the Institute of Medicine (IME) of the Jülich Research Center (KFA) is run by the medical facilities of the University of Düsseldorf at the KFA as a clinic for nuclear medicine. This is tied to a large-scale mutual exchange of services. KFA research findings are of immediate benefit for teaching and patient care.

The Center for Environment and Health (GSF) has chosen a different approach. Hematology represents an important priority in clinical research at the GSF. A hematological department of the GSF is located at the Großhadern Hospital of the (Ludwig Maximilian) University of Munich. This allows research to be highly patient oriented and makes for close and effective collaboration between basic-research scientists from GSF and physicians practicing at the Großhadern Hospital.

On the basis of a general agreement with the University of Heidelberg, the Deutsches Krebsforschungszentrum (DKFZ, German Center for Cancer Research) establishes cooperative clinical units on certain research topics at university hos-

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32) Wissenschaftsrat (German Science Council), *Empfehlungen zur Zusammenarbeit zwischen Großforschungseinrichtungen und Hochschulen* (Recommendations on Cooperation Between National Research Centers and Universities) (Cologne, 1991).

pitals. The aim here is to confront basic-research findings with questions of clinical practice and let them gauge themselves in terms of these questions in a very rapid and purposeful way.

For its research projects, the Max Delbrück Center (MDC) in Berlin-Buch will have access to the wards of the Robert Rössle (Oncological) Hospital and the Franz Volhard Hospital of the Rudolf Virchow University Hospital of the Free University of Berlin located on the Buch Campus. By forming project-oriented research teams, this will ensure that a close interlinkage of experimental and clinical research groups is achieved.

The cited cooperative models make a key contribution in improving clinical research in Germany. They strengthen the latter in both the universities and in nonuniversity research facilities. The aforementioned network for Clinical-Biomedical Research will make this easier.

With its objectives (see II.2.2 above), this network will be involved in further improving the collaboration between nonuniversity research institutions and universities. With its desire to promote clinical research nationwide and, in cooperation with the universities, to coordinate it, it can contribute to the further development of the aforementioned model structures. It can also succeed in this way in making more effective use of the potential of nonuniversity research institutions for one of the main objectives of the Federal Program, i.e., the improvement of the structures of clinical research.

2.2 Interlinkage of the Basic funding of Institutions and Project Funding

Basic-facility and project funding can be interlinked for mutual benefit. On the one hand, the institutions contribute to the Federal Program's goals. This takes place in a series of (multicentric) network projects in individual priority fields of the current Federal Program, e.g., on the control of disease (cancer, cardiovascular and infectious disease), in which nonuniversity research institutions take part, alongside of the universities. On the other hand, by acquiring project funds (grants) from various sponsors, the competitiveness of the successful institution is increased and demonstrated. This interaction will be further illustrated in terms of the research funding that occurs at GFE, BLI, and federal institutes.

The Initiatory Role of Project Funding in the Reorientation of Research

Competitively acquired project grants can facilitate topically related new structuring and restructuring at research institutions in keeping with Federal Program objectives. The WR emphatically recommended this approach for institutes in the new German Länder: the objective is to stimulate the expansion of research priority programs on topics relevant to health policy and to foster the concentration of efforts on fields with promising research capacities. The network-organized projects funded at the German Institute for Nutritional Research in Potsdam-Rehbrücke, which aim to help investigate diseases induced or contributed to by faulty nutrition, can serve as an example. However, the aforementioned structural model has also already been applied in what were formerly the states of West Germany. This is the case for AIDS research, for example, which was able to established itself at such institutions as the BGA, GSF, DPZ, and DKFZ.

The structural approach cited is especially important in the funding of clinical research. Notable capacities are found at GFE, MPI, and BLI, which could make a considerable contribution to clinical research in Germany, naturally, in close cooperation with university hospitals.

Basically, the same structural objectives hold for strengthening clinical research at nonuniversity research institutions as they do for the funding of clinical research at universities. Here, too, the goal is to establish clinical research at the facility more permanently. Good approaches in clinical research made by nonuniversity research institutions can be stimulated by means of project funding. Moreover, since these institutions cannot conduct clinical research in isolation, cooperation with universities also has to be promoted.

The network for *Clinical-Biomedical Research* also considers the goal of improving (in both quantitative and qualitative terms) the relative share of biomedical clinical research at its participating institutions in cooperation with outside capacities as one of its priority activities.

2.3 Conclusions and Future Prospects

Special attention has to be given to the substantive and structural objectives of *Health Research 2000* in continuing the cooperation between university and nonuniversity research and between project funding and basic-facility funding.

The further the aforementioned structural models are developed and disseminated, the easier it will be to meet health-policy requirements by means of federal

research funding. One could cite as an example the nationwide cooperative efforts between university and nonuniversity research institutions at improving the structure of clinical research.

In order to sustain and expand effective health research across all of Germany, it will be necessary in coming years to work out structural recommendations on the basis of comparative expert appraisals of the institutions active in each of the fields of research. These recommendations have to be capable of determining the level of performance in each research field, outlining the substantive perspectives for individual institutions in a way as to set priorities, and assessing the quality of the results they have achieved.

The cross-sectional expert appraisals planned by the WR in the field of biomedical research can be expected to provide further conclusions and orientational help in this context.

3. Program Management

The diverse spectrum of research found in Germany corresponds to an interlocking system of research sponsorship: The basic funding of universities is provided for by the Länder. The research activities of nonuniversity research institutions are jointly financed by federal and state governments, with the GFE and FhG receiving 90% of their funds from the federal government and 10% from the state in which the specific institute is located. The state and federal governments each provide half of the funding of BLI and MPI. The federal research institutes are supported by the federal government. (For a detailed depiction, see the appendix II, esp. section 2.) In addition, there are nonuniversity institutions that are financed exclusively by the Länder.

By means of various funding mechanisms, the state and federal governments make a considerable amount of other funds available. Special emphasis should be given to the Deutsche Forschungsgemeinschaft (DFG, German Research Association) in this context, which, according to funding program, receives one half to three quarters of its funds from the federal government and the rest from state governments (on this, see also appendix II, section 1). In addition, a series of foundations and the Association of Promoters of German Science (Stifterverband für die Deutsche Wissenschaft) also support health research. Moreover, a not inconsiderable amount of research funds is provided by the pharmaceutical and medical-technology industries.

Given the diversity of research and funding institutions in health research, coordinating mechanisms are needed that mediate between the different programs and institutions. The WR plays a prominent role here, advising the federal government on the substantive and structural development of universities and research. In addition, activities coordinating the university system and health research are also conducted by the following organizations: the Conference of the Ministers of Education and the Arts (KMK; Kultusministerkonferenz), the Conference of University Rectors (HRK; Hochschulrektorenkonferenz), the Arbeitsgemeinschaft der Großforschungseinrichtungen (AGF, Association of National Research Centers), the medical academies and the Arbeitsgemeinschaft der wissenschaftlich-medizinischen Fachgesellschaften (AWMF, Association of the Scientific Medical Societies).

3.1 Coordination and Consultation in the Health Research 2000 Program

The program is implemented jointly by the participating federal departments. Here, the funding of direct departmental research remains the task of the Federal Ministry of Health (BMG), whereas the research funding going beyond that in the framework of the Federal Program is largely implemented by the BMFT. Regularly held meetings of an interministerial coordinating committee under rotating chairmanship take place to plan the Federal Program, to conceive new funding priority programs, and to provide information on funding activities in progress. In addition, the various departments are informed of any results of planning or consultation that might occur. According to circumstances, coordination may sometimes also be reached at the level of individual funding decisions, especially in regards to projects that have great health-policy significance, that directly involve tasks of the specialized departments, or that will be jointy implemented.

3.2 Scientific Consultation

The Gesundheitsforschungsrat (GFR, Health Research Council)

The Gesundheitsforschungsrat (GFR; Health Research Council) was established in 1990. Representatives of the major research and funding organizations are members. Its mission consists, on the one hand, in giving counsel to the BMFT

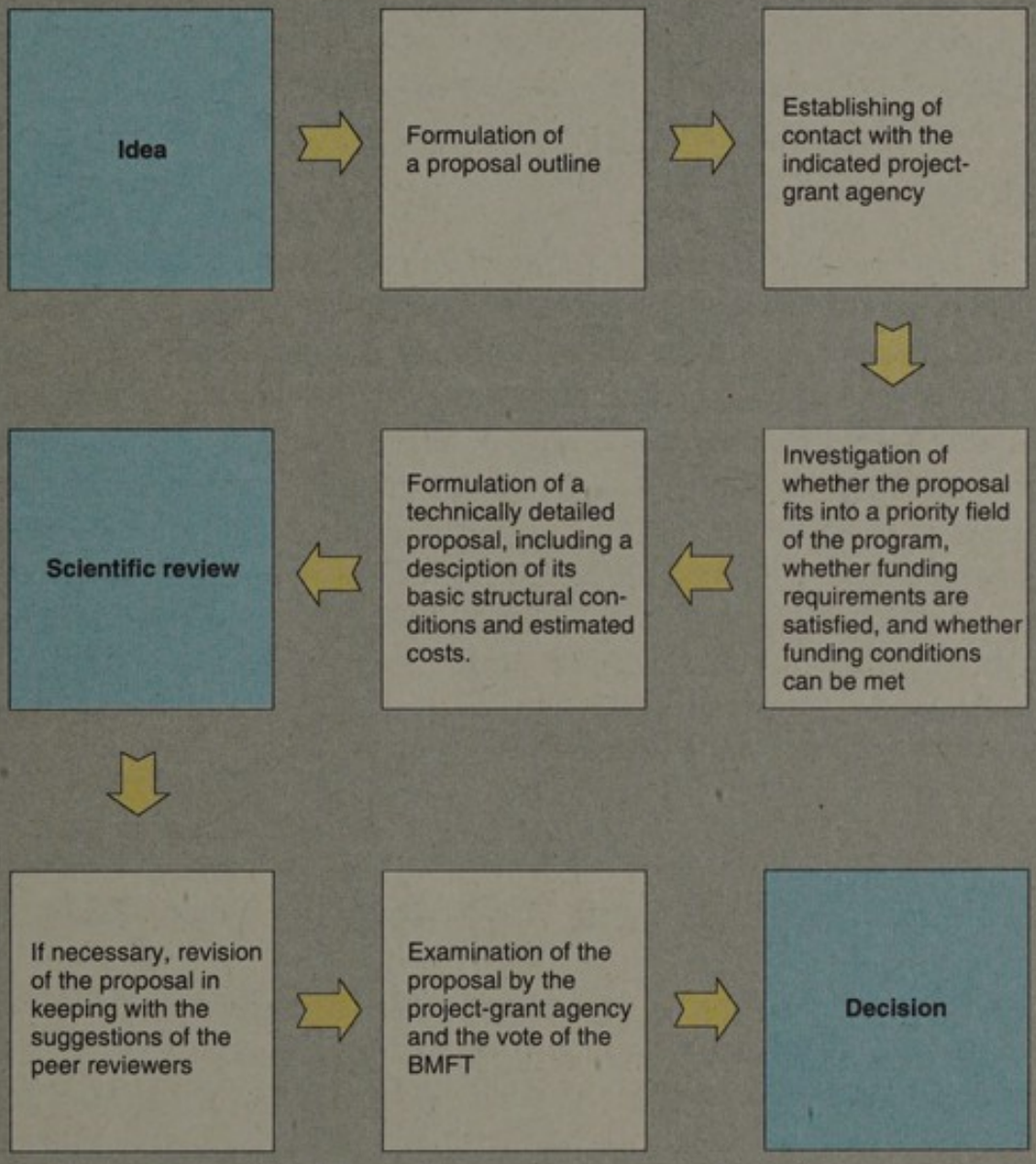
in the drawing up of the Federal Program. On the other hand, it provides a forum for discussing general questions of health research and for fostering the exchange between research and funding institutions. In addition, the GFR has the task of advancing collaboration between federal and state governments in health research and stimulating the dialogue between representatives of research and health services.

The Council is supported by a scientific committee, which takes up various areas of the Federal Program and attends to their development. The committee serves to supplement the activities of the Council. In collaboration and coordination with the Council, the committee gives counsel to the BMFT in the setting of funding priorities. In this sense, the scientific committee attends to and evaluates funding priority programs in progress, assesses newly recommended topics for research funding, and formulates recommendations for substantive and structural perspectives while taking into account existing basic funding of institutions in the field under review.

Organizations currently represented in the Health Research Council

* Wissenschaftsrat (German Science Council)
* Hochschulrektorenkonferenz (Conference of University Rectors)
* Kultusministerkonferenz (Conference of the Ministers of Education and the Arts)
* Deutsche Forschungsgemeinschaft (German Research Association)
* Max-Planck-Gesellschaft (Max Planck Society)
* Arbeitsgemeinschaft der Großforschungseinrichtungen (Association of National Research Centers)
* Stifterverband für die Deutsche Wissenschaft (Donor´s Association for the Promotion of Science and Humanities)
* Deutsche Akademie der Naturforscher Leopoldina (German Academy of Natural Scientists Leopoldina)
* Arbeitsgemeinschaft der wissenschaftlich-medizinischen Fachgesellschaften (Association of the scientific medical Societies)
* Sachverständigenrat für die Konzertierte Aktion im Gesundheitswesen (Council of Experts on Concerted Action in Health Services)
* Commission of the European Communities
* National Institutes of Health (USA)

Scheme of events entailed by the procedure of applying for project funding



Scientific Advisory Bodies in Nonuniversity Research Institutions

Activities of nonuniversity research institutions receiving basic funding, especially GFE and BLI, are attended to by supervisory and scientific advisory bodies. The latter provide the preparatory groundwork for decisions of the supervisory body involving scientific questions by furnishing regular reports on the state and progress of activities in research. They thus contribute to the internal quality control of the scientific research performed at these facilities. In this way, they also have the responsibility for the continuous evaluation of research findings provided by external (also international), temporarily appointed, scientific peer reviewers. The votes cast here define the further development of individual institutes and research priority programs.

Peer Review Groups

The task of peer review groups (*Gutachterkreise*) is to scientifically evaluate funding proposals and research projects in progress within the framework of existing funding priority programs. Peer review groups are also used as scientific advisory committees that attend to complex network-organized projects. Peer review groups, the GFR, and its scientific committee are appointed according to the rotation principle for three years. The peer review groups evaluate submitted research proposals according to their scientific quality and program relevance. The goal is to ensure a uniformly high level of quality and an internationally competitive state of research. Since the main objective of the Federal Program is to strengthen the application orientation of the general current of health research, consultations pay heed not only to scientific requirements, but also to evaluative criteria related to health policy and research policy.

3.3 The Project Management Organizations of the BMFT

The extensive tasks of planning and coordination involved in BMFT project funding demand a considerable amount of managerial activities. In part, the latter are carried out by Project Management Organizations (*Projektträger*), i.e., by working units that are usually located at federal GFE. Project Management Organizations have the following tasks:

- Consultation of the grant applicant
- Preparation of funding decisions in consultation with external peer reviewers
- Responsibility for the administrative and scientifically specialized processing of proposals

- Evaluation of results, including applications testing
- Preparation of program priority fields
- Active part in international cooperation and consultation of parties interested in EC funding in the health field

In implementing these tasks, Project Management Organizations become the direct contacts for researchers. In this way, they represent the link between science and the government authorities responsible for the Federal Program. (The addresses and contact persons of the Project Management Organizations as well as their specific task areas are found in Appendix III.)

4. Expenditures on Health Research

In 1990, more than DM 300 billion was spent on health by the public and private sector (cf. Fig. 4) in Germany. The expenditures for research and teaching in the field of health research make up about 1.8%[33] of overall expenditures on health. This represents a six-fold increase over 1970. Accordingly, expenditures on research and teaching have risen faster than general health costs (Fig. 5).

Approximately DM 6 billion is spent in the Federal Republic of Germany annually on health research. In 1987, about DM 2.8 billion were allotted by federal and state governments. Table 1, taken from a study recently published by the Federal Office of Statistics in Wiesbaden as commissioned by the BMFT,[34] gives a detailed breakdown of who conducted health research in the Federal Republic of Germany in 1987 and how it was financed.

As a whole, around DM 3 billion was spent on research and development in health research in the sector "Economy" and ca. DM 2 billion in the university

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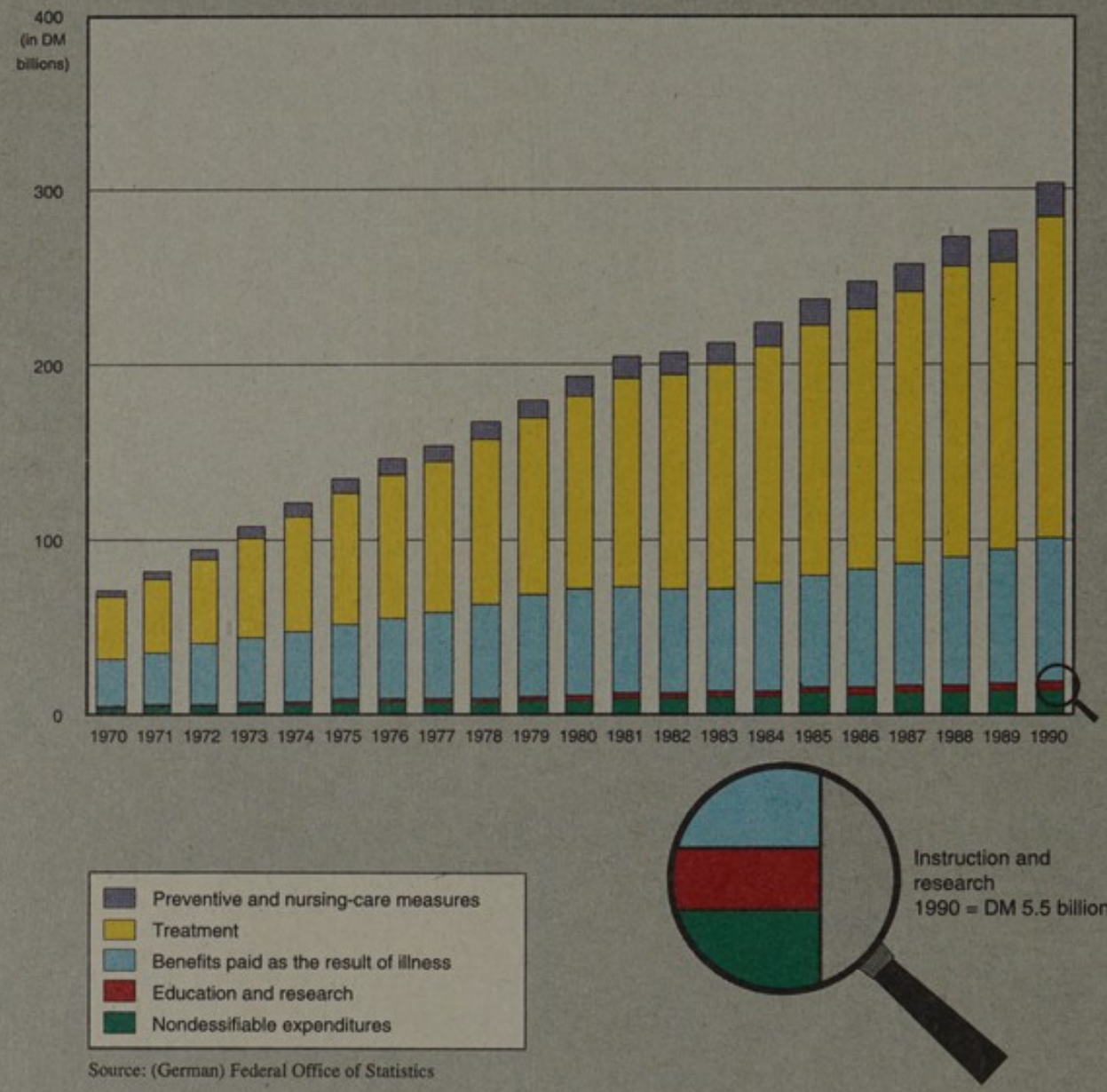
33) Expenditures made on research and teaching were combined in this calculation. The source of the calculation: Statisches Bundesamt Wiesbaden (Federal Office of Statistics in Wiesbaden), *Fachserie 12, Reihe S.2, 1970-1990* (Series to Special Area 12, Subfield S.2, 1970-1990).

34) *Ausgaben für die Gesundheitsforschung: Projektbericht im Auftrag des BMFT* (Expenditures on Health Research: A Project Report Commissioned by the BMFT). Ed. Statistisches Bundesamt (Federal Office of Statistics, Wiesbaden 1992). (Stuttgart: Metzger-Poeschl, 1992).

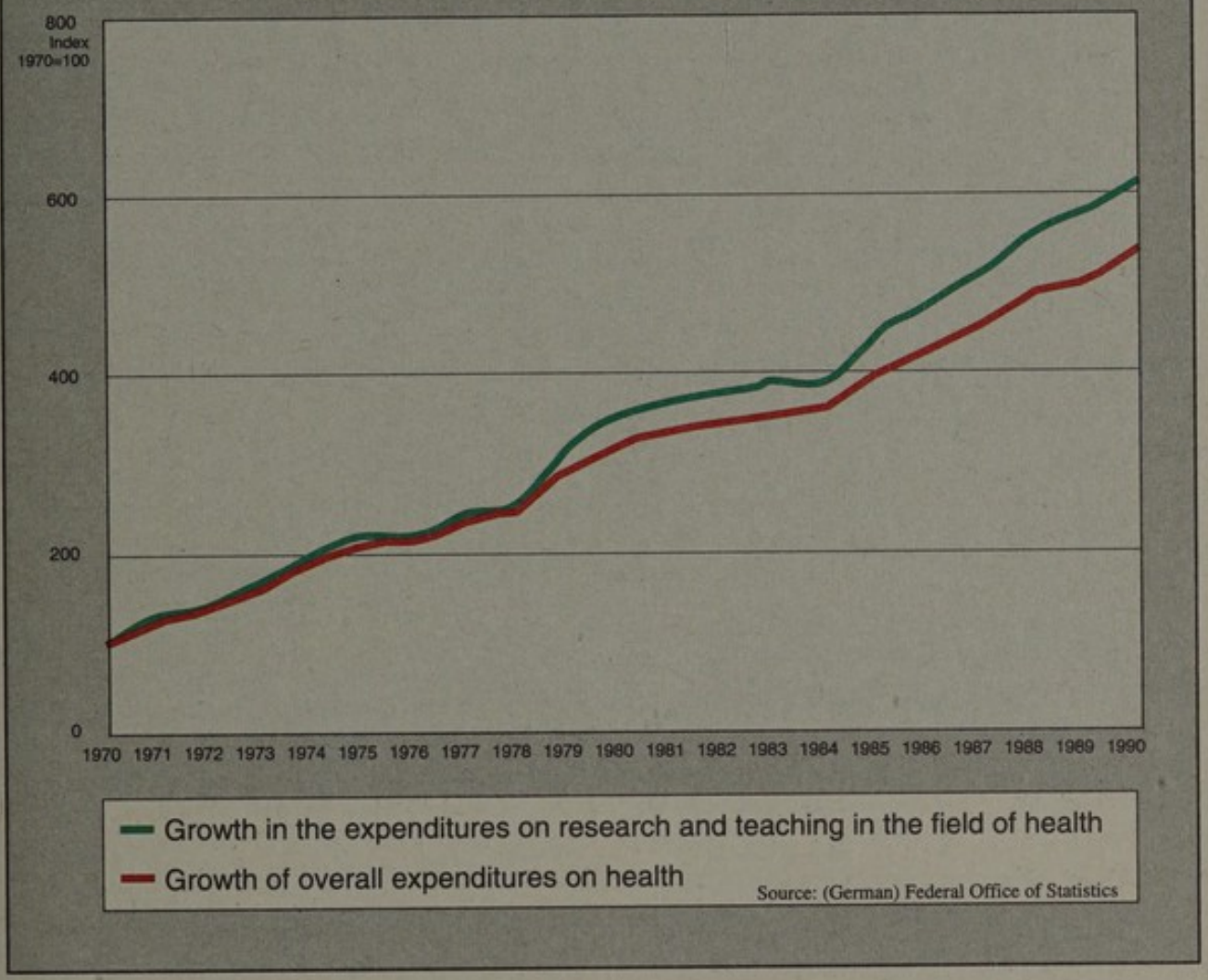
Fig. 4: Experditures on health in the Federal Republic of Germany



Source: (German) Federal Office of Statistics

sector. Markedly less was spent on health research in the sector "State/Nonprofit Organizations." In this category, the greatest level of expenditures in 1987 was allotted by GFE (DM 230.5 million) and MPI (DM 224.6 million), while federal institutes and BLI spent DM 122.2 million and DM 109 million, respectively. There has been a shift in the absolute size (and probably also in the relative size) of these expenditures since German unification. Exact numbers have

Fig. 5: Growth in the expenditures on research and teaching relative to overall experditures on health



been collected, but were not yet available at the time of the continuation of this program (i.e., at publication).

The *Health Research 2000 program* is financed in the framework of the appropriations of the currently valid financial plan for the BMFT budget. This is supplemented by expenditures made by the Federal Ministry of Health (BMG). According to the currently valid federal financial plan (as of 1992), DM 4 billion are available for 1993 through 1996 for projects, institutions, and government-departmental tasks in health research. The two tables in Appendix I (Tables 3-4) provide an analysis of the funds to be spent until 1996 (based on expenditures of recent years). Figure 6 summarizes a longer time series of BMFT expenditures.

Table 1: Public- and private-sector institutions responsible for financing and conducting health research in 1987 (OECD classification)

Sector financing research	Total	Industry	Universities	State	Nonprofit organizations
			(in DM millions)		
Sector conducting research					
Industry	3,091	3,004		64	23
Universites[1)]	2,102	123	1,710[2)]	258[3)]	12
State (state research institutions and research institutions closely affiliated to the state)	744	4		722[4)]	18
Nonprofit organizations	29	4		18	7
			1,710	1,062	
National total[5)]	5,966	3,135	2,772		60

1) Estimated on the basis of the university hospitals of the individual states.
2) Basic funding of the federal government.
3) Inclusive of DFG.
4) This includes administrative revenues of DM 67.1 million, which can also come from industry or other sectors.
5) Payments made for health research in other countries are not taken into account. In 1987, the federal and state governments of the FRG spent DM 1.6 million for health research conducted in foreign countries. The producers of health-related goods probably spent ca. DM 140 million abroad. (Estimation based on SV data.)

Source: (German) Federal Office of Statistics, SV Wissenschaftsstatistik GmbH (SV Scientific Statistics Ltd.)

Of the financial resources of the Federal Program for project funding (allocated from the BMFT budget), about one third are used for projects from the public health field and about two thirds for those in clinical research. In a detailed depiction in Appendix I, the priorities of research placed on the immunological system, and of funding placed on clinical research teams, interdisciplinary centers, and reconstruction funding in the new German Länder can be clearly recognized according to relative dimensions of funding directed toward them (see esp. Tables 3-4). The Federal Program's funding resources are largely made claim to by universities and nonuniversity research institutions (as Fig. 7 shows), while the share of industry and other institutions has continually dropped in recent years.

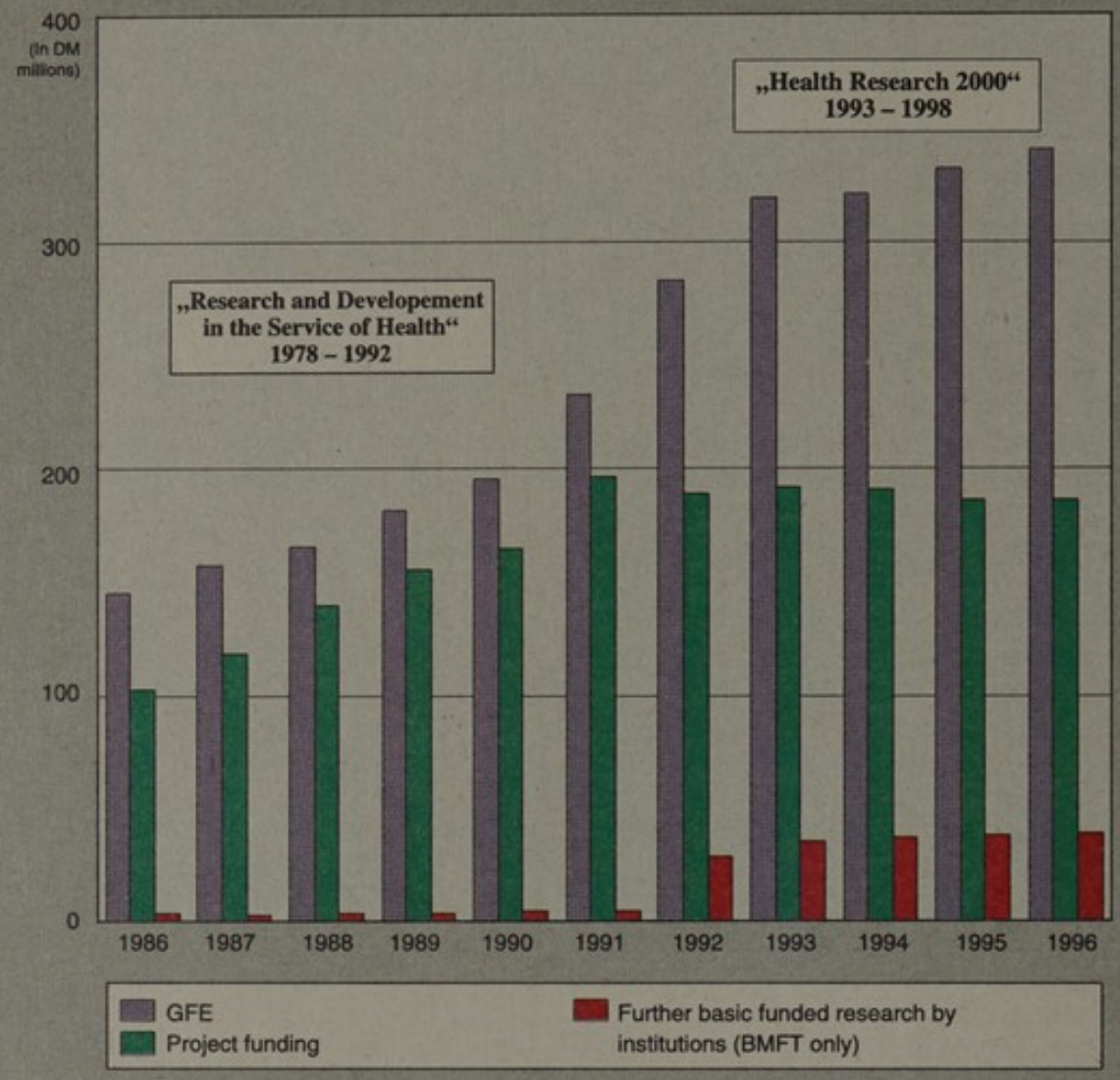
Table 2: Expenditures on health research in the Federal Republic of Germany in 1987 according to the sector in which research was conducted[1)]

Sector	Expenditures (in DM Mill.)	(Sub)totals (in DM Mill.)
Industry		
Applied R & D for		
* Medical-technology goods from entrepreneurs in		
* Electrotechnology (WZ 250)	411.3	
* Precision engineering and optics (WZ 252)	200.9	
* Pharmaceutical products		
* From enterprises in the chemical industry	2,449.7	
* From other branches of industry	29.2	
* Industry as a whole		3,091.1
(With a reported share of DM 247.8 million spent on basic research[1)]		
Universities		
* Human medicine	2,001.3	
* Pharmacy	77.8	
* Sports medicine, nutritional sci., med. tech.	22.7	
Universities as a whole		2,101.8
Federal and state governments, nonprofit organizations		
* Federal institutes	122.2	
* State- and local-government research institutes[3)]		
* National Research centers	230.5	
* Max-Planck Institutes	224.6	
* Fraunhofer Institutes	28.2	
* "Blue List" institutes (BLI)	109.0	
* Libraries, museum, and the other, largely publicly financed research institutions	29.2	
* Other nonprofit organizations (public nonprofit sector)	29.1	
* Public health services	–	
* Hospitals (not including university hospitals)	–	
* Health offices, hygiene institutes, and other comparable institutes	–	
Federal and state governments, nonprofit organizations as a whole		772.8
Total		**5,965.7**

1) The figures refer to the territory of the Federal Republic of Germany prior to 3 October 1990; they include West Berlin
2) Expenditures for basic research in the chemical, electrotechnical, precision-engineering, and optical industries ran to DM 1,153.3 million.
3) Included in the figure on BLI expenditures

Source: (German) Federal Office of Statistics, SV Wissenschaftsstatistik GmbH (SV Scientific Statistics Ltd.)

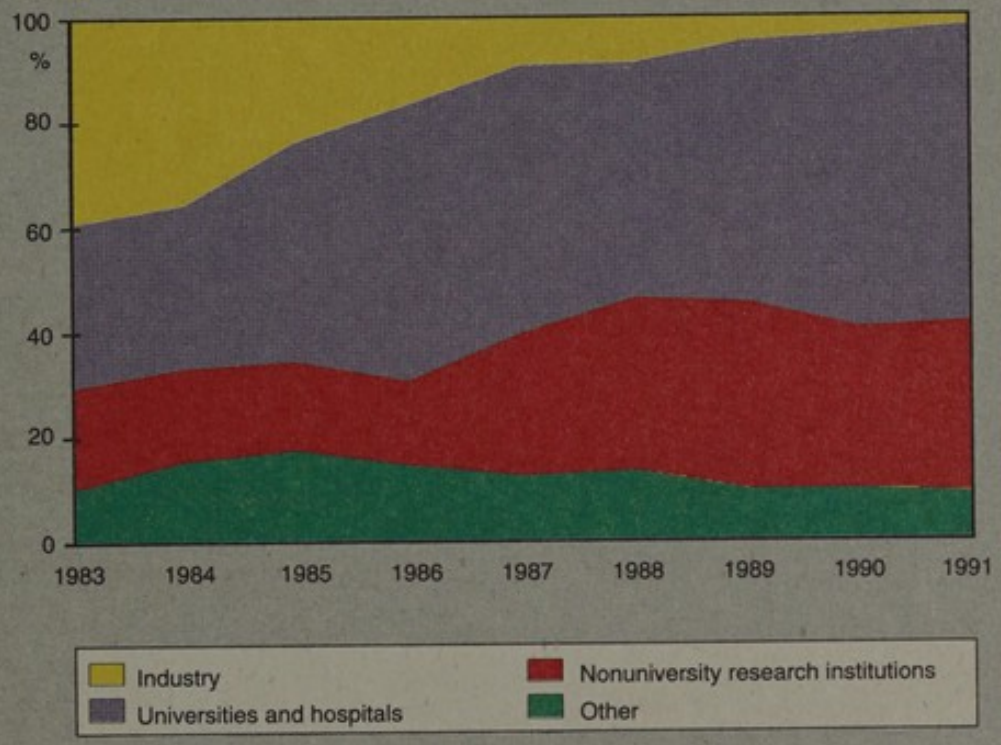
Fig. 6: BMFT expenditures on health research



Source: „Health Research 2000"; each of the figures on basic funded research (i.e., all figures outside of project funding) includes the federal share of funding; the figures for 1993–1996 represent the currently valid financial planning (as of February 1993).

The funding provided by the BMG also contributes in complementary fashion to the goals of the Federal Program in keeping with the specific restrictive conditions of direct departmental research. The project-oriented contributions of this research have their priorities in the fields of addictive and drug research, psychological health, and AIDS. This is joined by the contribution of nonuniversity, institutional research, whose capacities act primarily to strengthen the

Fig. 7: Project funding of health research (BMFT): Analysis of grant recipients (%).



Source: „Health Research 2000"

biomedical part of Federal Program activities, and, in cooperation with university facilities, serve clinical research by helping integrate biomedicine into clinical practice. A detailed overview of federal expenditures in health research is found in the Appendixes.

Appendixes

Contents

Appendix I. Financing of Health Research by the German Federal Government

In Tables 3 and 4, the figures given represent the actual expenditures for all years prior to and including 1991, represent target expenditures for 1992 and 1993, and correspond to the presently valid financial plan for all years thereafter. The figures are based on the amounts budgeted in the financial planning for 1992–1996. They are valid, provided that the financial plan is perpetuated in present form in future annual budgets.

1. Project Funding

Table 3. Project funding of the BMFT and contributions of direct government-departmental research, 1983–1996 (in DM millions). *Sources:* BMG, BMFuS, BMVg and calculations of the BMFT.

Project funding of the BMFT	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
	Actual figures									Projected figures		Financial plan		
Total	**77,2**	**79,7**	**84,7**	**102,4**	**118,0**	**139,8**	**155,8**	**165,0**	**196,6**	**189,2**	**191,5**	**191,0**	**186,0**	**186,0**
Divided among the following funding areas:														
Research on preventive health and health service	**43,0**	**40,3**	**35,8**	**43,4**	**44,6**	**48,0**	**45,3**	**40,5**	**41,8**	**42,3**	**44,6**	**50,0**	**43,0**	**40,0**
Area of public health	6,0	6,7	12,0	17,2	19,5	21,2	20,5	20,7	25,1	27,6	34,1	40,0	35,0	35,0
Evaluation of diagnostic and therapeutic procedures	37,0	33,6	23,8	26,2	25,1	26,8	24,8	19,8	16,7	14,7	10,5	10,0	8,0	5,0
Clinical research on disease control	**31,0**	**37,5**	**44,1**	**54,2**	**68,0**	**84,5**	**102,7**	**120,8**	**138,4**	**134,9**	**135,8**	**133,0**	**137,0**	**140,0**
System of immunity and resistance	12,0	13,2	16,3	20,0	26,7	36,7	52,9	69,6	65,3	66,3	62,8	55,0	50,0	45,0
Mental health and the nervous system	2,0	2,8	3,3	3,8	5,7	8,1	9,5	12,0	13,9	17,3	15,3	10,0	10,0	10,0
Locomotive and supportive apparatus	6,0	6,6	8,6	13,0	18,3	18,7	20,2	16,8	14,6	13,7	6,8	7,0	5,0	5,0
Cardiovascular system	11,0	14,9	15,9	17,4	17,3	20,3	15,5	14,8	15,8	3,1	1,4	1,0	2,0	5,0
Clinical research teams/interdisciplinary centers						0,7	4,6	4,8	7,3	13,5	20,0	30,0	40,0	45,0
Reconstruction funding for the new German Länder								2,8	21,5	21,0	29,5	30,0	30,0	30,0

Contributions of departmental research (1)	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
	Actual figures									Projected figures		Financial plan		
BMG (total)	**20,8**	**18,3**	**21,0**	**24,8**	**24,3**	**31,4**	**34,5**	**49,0**	**46,8**	**70,3**	**94,3**	**80,0**	**79,0**	**83,0**
Government-departmental research (general) (2)	7,9	7,3	8,4	10,4	9,1	9,2	9,5	9,4	6,1	11,8	12,0	12,0	12,0	12,0
Model project in psychiatry	2,5	2,0	2,4	2,3	3,0	3,1	2,7	2,4	2,9	7,0	11,8	3,0	3,0	3,0
Model actions in health	1,0	1,0	1,2	1,9	1,5	1,2	0,9	1,3	1,1	1,4	1,4	1,4	1,4	1,4
Reference centers (AIDS and communicable diseases)	0,4	0,4	0,5	0,8	0,8	0,5	0,6	0,7	1,6	1,8	1,8	1,9	1,8	2,0
WHO collaboration centers	0,8	0,9	0,9	1,0	1,2	1,4	1,4	1,4	1,5	2,0	2,3	2,3	2,3	2,1
Addiction, drugs and psychohygiene	7,5	5,8	6,8	7,5	7,7	6,1	8,7	21,5	20,6	31,0	50,8	51,0	51,0	55,0
Research in the field of AIDS (only R&D)	0,0	0,0	0,0	0,0	0,0	8,9	9,6	11,2	11,0	12,0	11,0	5,0	5,0	5,0
Surveys on cancer	0,7	0,9	0,8	0,9	1,0	1,0	1,1	1,1	2,0	3,3	3,2	3,4	2,5	2,5
BMFuS (3)								**1,8**	**5,2**	**6,9**	**4,8**	**1,4**		
BMU (4)						**4,7**	**5,5**	**5,2**	**6,8**	**8,1**	**5,8**	**6,7**	**6,8**	
BMVg (4)						**21,5**	**22,5**	**22,6**	**18,7**	**18,6**	**17,4**	**17,7**	**17,7**	**18,5**

BMG, Federal Ministry of Health; BMFuS, Federal Ministry for Family and Senior Citizens; BMU, Federal Ministry for Environment, Conservation and Reactor Safety; BMVg, Federal Ministry of Defense.

(1) Largely follows the classification of the federal R & D performance-plan system (funding area G: Research and Development in the Service of Health).
(2) Not all figures are available for 1994–1996.
(3) Figures starting in 1994 refer to approved projects (as of February 1993).
(4) Not all figures are available for 1994–1996.

2. Basic Funding for Institutions (Federal Share)

Table 4. Basic-facility funding of the BMFT (federal share) and basic-facility funded departmental research, 1983–1996 (in DM millions). *Sources:* BMA, BMG, BMU, and calculations of the BMFT (as of February 1993).

Basic funding of the BMFT (federal share)	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
	Actual figures									Projected figures		Financial plan		
Total	**127,8**	**135,9**	**148,8**	**149,3**	**161,2**	**169,3**	**185,4**	**200,7**	**237,4**	**312,2**	**354,1**	**358,5**	**371,2**	**380,3**
Of which:														
Big science centers	**122,4**	**128,9**	**145,1**	**145,6**	**157,6**	**165,3**	**181,7**	**195,8**	**232,6**	**283,0**	**318,9**	**320,8**	**332,4**	**340,6**
German Cancer Research Center (DKFZ), Heidelberg	81,0	86,6	87,4	92,3	102,1	110,4	116,7	126,1	133,7	127,0	132,3	134,3	143,3	147,6
Max Delbrück Center (MDC), Berlin										57,1	74,7	76,2	74,9	74,7
GSF Research Center of Environment and Health (GSF), Neuherberg	25,6	26,2	31,1	29,9	34,4	36,7	43,9	47,0	64,1	63,9	66,2	66,3	69,8	72,4
Society for Heavy-Ion Research (GSI), Darmstadt	2,4	2,5	2,8	2,4	0,0	0,0	0,0	0,0	6,6	6,2	6,5	6,4	6,7	7,0
Hahn Meitner Institute (HMI), Berlin	2,4	3,7	3,4	2,7	2,8	2,5	2,6	3,3	3,2	4,3	3,6	3,6	3,8	3,9
Jülich Research Center (KFA), Jülich	11,0	9,9	20,4	18,3	18,3	15,7	18,5	19,4	25,0	24,5	26,2	25,7	25,7	26,5
Karlsruhe Nuclear Research Center (KfK), Karlsruhe											9,4	8,3	8,2	8,5
"Blue List" institutes	**5,4**	**7,0**	**3,7**	**3,7**	**3,6**	**4,0**	**3,7**	**4,9**	**4,8**	**29,2**	**35,2**	**37,7**	**38,8**	**39,7**
German Institute for Nutritional Research (DIfE), Potsdam-Rehbrücke										10,7	13,8	14,2	14,5	14,9
German Primate Center (DPZ), Göttingen	5,4	7,0	3,7	3,7	3,6	4,0	3,7	4,9	4,8	5,5	5,7	6,1	6,4	6,6
Research Institute for Molecular Pharmacology (FMP), Berlin										8,4	9,5	11,1	11,4	11,6
Rossendorf Research Center (FZR), Rossendorf										4,6	6,2	6,3	6,5	6,6

Basic funding departmental research(1)	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
	Actual figures									Projected figures		Financial plan		
BMG (total)	**219,6**	**224,7**	**248,3**	**280,5**	**334,6**	**341,2**	**350,0**	**358,9**	**338,9**	**413,9**	**429,2**	**384,2**	**379,0**	**367,6**
Federal Health Office (BGA), Berlin	157,0	152,4	160,9	166,0	182,0	200,6	227,4	246,9	226,9	290,4	302,0	277,3	269,5	258,7
Paul Ehrlich Institute (PEI), Langen	14,1	21,9	37,0	62,0	99,3	86,7	63,0	59,8	45,5	59,7	62,1	41,4	40,3	39,1
German Institute for Medical Documentation and Information (DIMDI), Cologne	22,0	22,6	23,5	24,4	25,0	23,0	24,2	24,5	25,2	23,0	23,2	23,5	23,5	23,6
Federal allocations to scientific research institutions of nationwide importance ("Blue List") (2)	26,5	27,8	26,9	28,1	28,3	30,9	35,4	27,7	41,3	40,8	41,9	42,0	45,7	46,2
BMU (total)	**7,6**	**7,7**	**8,0**	**8,4**	**8,6**	**8,8**	**7,3**	**9,7**	**9,8**	**10,8**	**10,6**	·	·	·
Medical Institute for Environmental Hygiene (MIU), Düsseldorf (3)	7,6	7,7	8,0	8,4	8,6	8,8	7,3	9,7	9,8	10,8	10,6	·	·	·
BMA (total)	**31,8**	**28,7**	**32,6**	**33,4**	**36,6**	**39,3**	**45,9**	**59,5**	**86,8**	**93,2**	**95,3**	**78,3**	**77,8**	**0,0**
Federal Institute for Occupational Safety (BAU), Dortmund (3)	27,4	24,1	27,8	28,5	30,8	33,4	40,5	54,2	68,6	69,9	70,0	50,1	50,4	·
Federal Institute of Occupational Medicine (BAfAM), Berlin (3)									11,6	16,4	17,9	20,2	20,3	·
Federal allocations to the Institute for Occupational Physiology at the University of Dortmund (3)(4)	4,4	4,6	4,8	4,9	5,8	5,9	5,4	5,3	6,6	6,9	7,4	8,0	7,1	·

BMG, Federal Ministry of Health; BMU, Federal Ministry of Environment, Conservation, and Reactor Safety; BMA, Federal Ministry for Labor and Social Order.

(1) The basic-facility funding of the BMFT reported here is based on what the institutions themselves assigned to funding area G. For the other departments, the overall expenditures of institutions with tasks in the field of health research were included. These overall expenditures include, aside from expenditures on research and development, expenditures for department services and for activities in the field of public health services. Sometimes more than 50 % of the expenditures of federal agencies and federal institutes go to such activities. Greater detail can be found in the *Bundesforschungsbericht 1993* (1993 Federal Research Report).

(2) Bernhard Nocht Institute, Borstel Research Institute, Diabetes Research Institute, Research Institute for Child Nutrition, Central Medical Library, Heinrich Pette Institute, and the Center for Psychological Information and Documentation.

(3) Not all figures are available for 1994–1996.

(4) Funding in the framework of the "Blue List".

Appendix II. Schematic Overview of the Institutions and Programs of Research Funding

The following will schematically depict those federally and state financed funding and research organizations, federal funding programs and priority fields, and research programs of international organizations that are connected to the *Health Research 2000* program presented here.

1. Funding Organizations: Deutsche Forschungsgemeinschaft (DFG, German Research Association)

The Deutsche Forschungsgemeinschaft e.V. (DFG; German Research Association) is a central institution of German science that plays a key role in research funding, especially in universities of the Federal Republic of Germany. It promotes projects in all parts of science. Most universities and numerous non-university research institutes are members of the DFG, and in this way the organization represent by far the majority of all scientists outside of industry. The traditional principle of peer review serves as the basis of the DFG's self-governing research funding. The primary selection criteria are scientific innovation and creativity. Scientists active in research democratically elect reviewers from their own ranks by secret ballot. Elections occur every four years.

In addition, senate commissions appointed by the DFG play an important role in scientific policy consultation on such matters as hazardous work materials and foodstuffs.

The DFG basically finances its budget by drawing half of its funds from the states and half from the federal government. Presently, it devotes ca. 25 % of its total expenditures to the funding of biomedical research.[35] In 1991, this came to about DM 430 million.[36]

The DFG funds basic and applied research in terms of normal-procedure grants (*Normalverfahren;* grants for individuals) and priority program procedures

35) Deutsche Forschungsgemeinschaft (DFG), *Jahresbericht 1991* (Annual Report for 1991). Vol. 1.
36) Taken from *Bundesbericht Forschung 1993 (Governmental Report)* Ed. BMFT (Bonn 1993).

(*Schwerpunktverfahren*), or by supporting research teams (*Forschergruppen*) or special research programs (*Sonderforschungsbereiche*). The emphasis is on the quality of research, free from any topical restrictions imposed by outside parties. The following lists those DFG funding areas and senate commissions that are closely related to the *Health Research 2000* program.

1.1 Priority Programs in Biology and Medicine

* Causes and effects of insulin deficiency
* Virulence-defining factors and host tropism of animal viruses
* Follow-up monitoring and further development of dental implants
* Neuropeptides
* Neurobiological determinants of sensory motoric and cognitive disorders in schizophrenics
* Hereditary retinal degeneration
* Genetic factors in psychiatric disease
* The analysis of the human genome using the methods of molecular biology
* Dynamics and stabilization of neuronal structures
* Molecular foundations of biological pattern recognition
* Functional domains of cellular structural proteins
* Novel reactions and catalytic mechanisms in anaerobic microorganisms
* Functions of glia cells
* Physiology and theory of neuronal networks
* Molecular and immunological mechanisms of host-parasite infections
* Molecular mechanisms of signal transducing in membranes
* Construction of proteins with new traits (protein design)
* Nucleus-cytoplasm transport
* Control mechanisms in the development and function of striated muscle
* Molecular foundations of cell-matrix interactions in biology and medicine
* New microscopic techniques for biology and medicine

1.2 Research Teams in Biology and Medicine

* Psychobiology of perception, Munich
* Neurobiology of visual systems, Bochum
* Plasticity and gene expression in the nervous system under pathological conditions, Heidelberg
* DNA viruses of the hemotopoietic system, Erlangen
* Regulation of masculine reproductive functions, Münster
* Regulatory systems in the gonads and accessory sexual glands, Hamburg

* Membrane control of cellular activity, Bochum
* Molecular mechanisms in the development of neuronal and neurally influenced cell systems, Hamburg
* Molecular biological studies of gametic differentiation and early embryonic development in mammals, Göttingen
* Pathogenetic mechanisms of viruses, Gießen
* Virus-cell interactions: modulation through viral and cellular regulatory elements, Munich
* Transcription signals and regulator proteins, Erlangen
* Transcription control of cell differentiation, Marburg
* Biomechanics and biology of the operative treatment of injuries to the locomotive apparatus, Ulm

1.3 Clinical Research Teams[37)]

The clinical research team program is implemented with special funds of the BMFT. The conception of the long-term structural transformation is to have the scientifically recognized head of the program-supported research team appointed to a professorship and to finance him or her for the period of funding with program funds. The introduction of a research professorship at university hospitals, the provision of funds for the research team, and the implementation of the scientific projects are aimed to permit concentrated efforts on research projects relevant to the hospital.

* Immunological and molecular-biological analyses of autoreactive T and B cell clones and their affiliated autoantigens in patients with rheumatoid arthritis, Freiburg
* Mechanisms of hepatic damage, Düsseldorf
* Cardiovascular biochemistry, Würzburg
* Biomagnetism and biosignal analysis, Münster
* Common neurobiological mechanisms of dependency: a project on the pathogenesis of alcoholism and opioid dependency and the development of new therapeutic concepts, Berlin
* Pathogenesis, early diagnosis, and follow-up monitoring of glaucoma, Erlangen/Nuremberg
* Respiratory insufficiency, Gießen

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37) Special program using governmental program funds; described here as of the end of 1992.

* Immune dysregulation and malignant lymphoma, Cologne
* Cyclical guanosine monophosphate (clinical pharmacology), Munich
* Clinical neuroendocrinology, Lübeck
* Regulation of hemotopoietic stem cells, Frankfurt
* Cell differentiation and local regulatory systems, Würzburg
* Pathophysiology and clinical research of kinetic vision, Tübingen
* Molecular pathology of mucoviscidosis, Hannover
* The role of endothelium in the induction of inflammatory reactions of the skin, Münster
* Auditory research, Tübingen
* Clinical relevance of tissue-associated proteinases and their receptors, Munich

1.4 Sonderforschungsbereiche (SFB, special research programs) in Medicine

120 Leukemia research and immunogenetics, Tübingen
154 Clinical and experimental hepatology, Freiburg
165 Gene expression in vertebrate cells, Würzburg
172 Molecular mechanisms of primary cancerigenic transformations, Würzburg
174 Risk assessment of prenatal defects, Berlin
175 Implantology, Tübingen
194 Structural transformations and dysfunction of the nervous system, Düsseldorf
207 Foundations and clinical significance of limited extracellular proteolysis, Munich/Erfurt/Magdeburg
215 Tumors and the endocrine system, Marburg
217 Regulation and genetics of human immune response, Munich
220 Functionally oriented adaptation and differentiation of neuronal systems, Munich
232 Functions and defects of neuronal systems, Hamburg/Lübeck/Kiel
234 Experimental cancer chemotherapy, drug synthesis and testing on hormone-dependent tumors, Regensburg
242 Coronary heart disease: prevention and therapy of acute complications, Düsseldorf
244 Chronic inflammation, Hannover
246 Protein phosphorylation and intracellular regulation of membranous processes, Homburg (an der Saar)
249 Pharmacology of biological macromolecules, Gießen

258 Indicators and risk models of the genesis and course of psychic disorders, Mannheim
263 Immunological mechanisms in infection, inflammation, and autoimmunity, Erlangen
265 Immunoreactions and pathomechanisms in organ transplants, Hannover
272 Molecular genetics of decision-making processes in the cell, Gießen
280 The gastrointestinal barrier, Hannover
286 Intracellular transport and protein maturation, Marburg
302 Regulatory factors in tumor genesis, Mainz
307 Neurobiological aspects of behavior and its pathological deviations, Tübingen
311 Immunopathogenesis, Mainz
320 Cardiac function and its regulation, Heidelberg
322 Lymphohematopoiesis, Ulm
325 Modulation and learning processes in neuron systems, Freiburg
330 Organ protection, Göttingen
351 Hormone resistance: biochemistry and clinical research, Düsseldorf
353 Pathobiology of the genesis and assimilation of pain, Erlangen/Würzburg
354 Genetic and chemical foundations of carcinogenesis and metastasis, Essen

1.5 Sonderforschungsbereiche (SFB, special research programs) in Biology

4 Sensory performance: adaptation of structures and mechanisms, Regensburg
9 Structure, function, and biosynthesis of peptides and proteins, Berlin
43 Biochemistry of cell surface and membranous components, Regensburg
45 Comparative neurobiology of behavior, Frankfurt
156 Mechanisms of cellular communication, Constance
169 Structure and function of membrane-resident proteins, Frankfurt/Darmstadt
171 Membrane-linked transport processes in the cell, Osnabrück
176 Molecular foundations of signal transmission and material transport in membranes, Würzburg
184 Molecular foundations of the biogenesis of cell organelles, Munich
189 Differentiation and regulation of energy-converting biological systems, Düsseldorf
190 Mechanisms and factors in genetic activation, Munich
204 Reception and processing of messages in the auditory system of vertebrates (hearing), Munich

206 Biological signal reaction chains, Freiburg
223 Pathomechanisms of cellular interactions, Bielefeld/Münster
229 Molecular mechanisms of gene expression and differentiation, Heidelberg
236 Foundations of cellular interaction and signal transmission, Göttingen
243 Molecular analysis of the development of cellular systems, Cologne
274 The structure of genetic material, Würzburg
284 Glycoconjugates and contact structures of cell surfaces, Bonn
310 Intra- and intercellular recognition processes, Münster
312 Directed membranous processes, Berlin
317 Molecular biology of neural mechanisms and interactions, Heidelberg
344 Regulation structures of nucleic acids and proteins, Berlin
352 Molecular mechanisms of intracellular transport processes, Heidelberg

1.6 Graduate-Student Programs

* Cell and molecular biology of normal and malignant cells, Essen
* Microbiology, Tübingen
* Enzymatic chemistry, Marburg
* Signal-mediated transport of proteins and vesicles, Göttingen
* Infectional research, Würzburg
* Cognition, brain, and neuronal nets (*Kognet*), Bochum
* Molecular and cellular neurobiology, Heidelberg
* Biotechnology, Hamburg-Harburg
* Cell and tumor biology, Marburg
* Experimental renal and circulatory system research, Heidelberg
* Molecular pathophysiology of cell growth, Hannover
* Toxicology and environmental hygiene, Düsseldorf
* Immunological mechanisms in infection, inflammation, and autoimmunity, Erlangen
* Molecular cell biology with concentration on membrane biology, Osnabrück
* Biomolecular medicine, Ulm
* Biosynthesis of proteins and the regulation of their activity, Bayreuth
* Biogenesis and mechanisms of complex cell functions, Bochum
* Organization and dynamics of neuronal networks, Göttingen
* Molecular and cellular mechanism of pathogenesis, Mainz
* Molecular and cell biology of connective tissue, Leipzig
* Structure and function of the genome of eukaryotes, Cologne
* RNA synthesis and processing: diversity of strategies in bacteria and viruses, Erlangen/Nuremberg
* Biochemical pharmacology, Constance

* Molecular biology and pharmacology, Gießen
* Cell and molecular biology in veterinary medicine, Hannover

1.7 Senate Commissions

* Hinterzartener Kreis (Hinterzartener Society; cancer research)
* Senate Commission on Questions of Safety in the Recombination of Genes
* Senate Commission on Clinical Research
* Senate Commission on Vivisectional Research
* Senate Commission for the Health Clearance of Foodstuffs
* Senate Commission for the Testing of Unhealthy Work Materials

2. Research Institutions

2.1 Universities

Universities are assigned a key role in health research. This is especially true for university hospitals, which represent the main vehicles for basic medical research, and, in the clinical field, for applied research as well. Through its participation in the federal project of university construction and its financing of 50% of its costs, the federal government made available on the average 36.8% of its overall expenditures on university construction for investment projects in the field of human medicine from 1988 to 1991. This came to ca. DM 2.188 billion.

2.2 Max-Planck-Gesellschaft (MPG)

The Max-Planck-Gesellschaft (MPG; Max Planck Society) is the sponsoring organization for institutes of basic research. The biological-medical sciences are strongly represented.[38)] The recommendations contained in the *Health Research 2000* program can also be seen as a contribution to the discussion concerning the fields in which and criteria according to which new research priority fields in biomedical-clinical research should be established at the research facilities of the MPG.

Currently, the following research institutions pursue projects in keeping with aspects of the *Health Research 2000* program:

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38) The MPG spent ca. DM 124 million on medical oriented research (including project funding) in 1991.

* Max-Planck-Institut (MPI; Max Planck Institute) for Educational Research, Berlin
* MPI for Biochemistry, Martinsried (near Munich), with a research team on "Cell division regulation and gene substitution" at the Humboldt University in Berlin, a research team on "Enzymology of peptide bonds" at the Martin Luther University of Halle-Wittenberg, and a research team on "Modulation of the signal transmission of growth factors" at the Friedrich Schiller University of Jena
* MPI for Biology, Tübingen
* MPI for Biophysics, Frankfurt am Main
* MPI for Biophysical Chemistry, Göttingen, with a research team on "Molecular and cellular physiology" at the Friedrich Schiller University of Jena
* MPI for Experimental Endocrinology, Hannover
* Friedrich Miescher Laboratory at the MPG, Tübingen
* MPI for Molecular Genetics, Berlin
* MPI for Brain Research, Frankfurt am Main
* MPI for Immunobiology, Freiburg
* Max Delbrück Laboratory at the MPG, Cologne
* MPI for Experimental Medicine, Göttingen
* MPI for Medical Research, Heidelberg
* Research teams on structural molecular biology of the MPG at the German Electron Synchroton Foundation (DESY), Hamburg
* MPI for Neurological Research, Cologne
* MPI for Physiological and Clinical Research, Bad Neuheim, with a research team on "Pharmacological hemostasiology" at the Friedrich Schiller University of Jena
* MPI for Psychiatry (German Research Institute for Psychiatry), Munich
* MPI for Psycholinguistics, Nijmegen
* Clinical research teams on rheumatology at the Third Medical Hospital of the University of Erlangen/Nuremberg, Erlangen
* MPI for Systemic Physiology, Dortmund

2.3 Fraunhofer Gesellschaft

The Fraunhofer-Gesellschaft (FhG; Fraunhofer Society) supports 45 institutions of applied research in the field of engineering and natural sciences.[39] It makes

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39) The FhG spent ca. DM 106 million (not including supplementary funding) on the field of environment and health in 1992.

its research capacities available to government agencies in the form of project and direct departmental research and does commissioned research for commercial enterprises. Two Fraunhofer Institutes (FhI) devote their activities largely to research in the service of health, namely,

- FhI for Toxicology and Aerosol Research, Hannover, and
- FhI for Biomedical Technology, St. Ingbert

In addition, activities at the following FhI are related to priority fields of the *Health Research 2000* program:

- FhI for Interface Engineering and Bioengineering (IGB), Stuttgart
- FhI for Materials Mechanics (*Werkstoffmechanik*) (IWM), Freiburg
- FhI for Microelectronic Circuits and Systems (IMS), Duisburg
- FhI for Solid-State Technology (IFT), Munich
- FhI for Integrated Circuits (IIS), Erlangen

Of this last group of insitutes, the IGB develops, for example, materials for artificial organs and produces active biological substances. The IWM tests the mechanical behavior of biomaterials and implants. And the institutes in the field of microelectronics (IMS, IFT, IIS, and others) develop microsystems for use in medical technology.

2.4 Großforschungseinrichtungen (National Research Centers)

GFE lie within the responsability of the BMFT. They conduct natural scientific-technical and biomedical research and development (R & D) that requires multidisciplinary collaboration and a concentration of human, financial, and instrumental resources. The centers focus on cross-sectional problems, which often require the use of large-scale apparatus and long-term and continuous treatment. The following GFE will conduct R & D in conjunction with the *Health Research 2000* program:

- Deutsches Krebsforschungszentrum (DKFZ, German Center for Cancer Research), Heidelberg
- Max Delbrück Center for Molecular Medicine (MDC), Berlin-Buch
- GSF Research Center for Environment and Health (GSF), Neuherberg (near Munich)
- Jülich Research Center (KFA), Jülich

Further contributions are made by the following institutions:

- Society for Biotechnological Research (GBF), Braunschweig

- Alfred Wegener Institute for Polar Exploration and Oceanography (AWI), Bremerhaven
- German Institute for Aeronautics and Space Research (DLR), Cologne
- Geesthacht Research Center (GKSS), Geesthacht-Tesperhude
- Society for Heavy-Ion Research (GSI), Darmstadt
- Hahn Meitner Institute (HMI), Berlin
- Karlsruhe Nuclear Research Center (KfK), Karlsruhe

The activities of the GFE that are in keeping with the *Health Research 2000* program focus primarily on projects in basic biomedical research; and on projects on the prevention, diagnosis, and therapy of cancer, cardiovascular and viral disease, as well as of immunological, neurological, nephrological, and pneumological disease. In this context, immunological, molecular- and cell-biological methods and techniques, as well as "classical" ones are developed or refined and their clinical applicability is tested. Biotechnological techniques are used, for example, to produce endogenous regulatory substances. Topics involving the ecological damage caused by man are also treated. Thus, GFE activities are clearly related to the Federal Program topics of "Environment and Health," "Control of Cancer," "Cardiovascular System," and "Plans of Action in Medicine: Clinical Evaluation of Preventive, Diagnostic, and Therapeutic Techniques."

These GFE activities are carried out in close cooperation with a large number of university institutes and hospitals, with other German and non-German research institutions, and with private industry.

In the following, some of the basic activities of individual GFE that are in keeping with the *Health Research 2000* program are listed:

* **Cardiovascular Research**

- Investigations to clarify the primary genetic causes of high-blood-pressure disorders
- Interdisciplinary studies of the molecular, biochemical, and ultrastructural foundations of the regulation of the contraction and relaxation of the heart and smooth-muscle tone as well as the chronic adaptive processes in functional disorders of these tissue.

Participating GFE: MDC

* **Cancer Research**

- Studies of the traits and biological behavior of cancer and cancer cells (tumor biology)

- Explanation of mechanisms of carcinogenesis
- Detection and analysis of cancer-inducing factors
- Diagnosis and therapy of carcinogenic diseases: molecular aspects of multi-resistance in tumor therapy; identification and characterization of genes and chromosomal structures that could be significant in the development of cancer; development of immunoreactants that specifically interact with tumor cells. Analysis of proteins and cell membrane-analogous phospholipids that specifically intervene in cell growth and the regulation of cell division.

Participating GFE: DKFZ, GSF, GSI, MDC

* **Medical Techniques**

- Nuclear medical diagnosis and therapy
- Trace-elements analysis
- Extension of laser use in biology and medicine
- Further development of transplant and transfusion techniques
- Further development of minimal invasive surgery techniques
- Data and communications technologies for medicine
- Molecular analysis and diagnosis of human monogenetic diseases; structural and bioinformatic, data-bank-supported analysis of genomic and protein structures and of their stability and dynamics.

Participating GFE: DLR, GSF, HMI, KFA, KfK, MDC

* **Data Processing in Medicine**

- Methods for analyzing the health system
- Techniques for evaluating medical services and technologies
- Medical knowledge bases and knowledge-based systems
- Creation of high-performance information and evaluation systems: development of new computer-supported knowledge-based systems as a diagnostic aid, especially in the field of prophylaxis and treatment of cardiovascular illness

Participating GFE: GSF, MDC

* **Environmental Influences on Biological Systems**

- Active mechanisms and toxicology of contaminants
- Ecological behavior of contaminants

- Investigation of cell damage and regenerative processes after the influence of radiation and contaminants
- Study of effects of environmental factors, such as diet and stress, on the genetically defined, cardiovascular regulatory mechanisms
- Investigation of structure, function, and medical relevance of cell-endogenous oxidoreductase systems that are involved in the formation and detoxification of pathogenic noxae
- Analysis of the combined effects of radiation and chemicals
- Estimation and assessment of the risks of environmental chemicals and radiation

Participating GFE: AWI, DLR, GSF, KFA, KfK, MDC

* **Biotechnology for Medicine**

- Characterization and production of medically interesting substances
- Tests of stereospecificity in potential active substances for regulating high blood pressure
- Investigations of the active mechanism of synthetic and natural regulators of cell growth and viral replication

Participating GFE: GBF, KFA, MDC

* **Technologies for Human and Environmental Safety**

- Minimization of pollution emissions in energy-conversion processes

In 1992, the five GFE—DKFZ, MDC, GSF, KFA, and GBF—established a network for *Clinical-Biomedical Research* for coordinating their germane research and development projects. The objective is to further strengthen clinical and biomedical research already in progress and to develop common standards.

2.5 Other Independent Research Institutions Jointly Funded by Federal and State Governments ("Blue List" Institutes)

Activities in keeping with the program of *Health Research 2000* can be found in the following nationally active research institutions, which receive half of their funds from the federal government and half from the Länder (with one exception, see 2.5.15):

2.5.1 Bernhard Nocht Institute for Tropical Medicine in Hamburg (A "Blue List" Institute [BLI] Under the Jurisdiction of the Federal Ministry of Health [BMG])

The mission of the Bernhard-Nocht-Institut (BNI) is to research the causes and courses of tropical diseases, to treat patients with tropical and infectious diseases, and to provide for the education and advanced training of physicians and other qualified personnel in tropical medicine. The research division of the institute is divided into sections on molecular biology, parasitology, and medical microbiology. In addition, there are facilities outside of the sections, in such fields as clinical chemistry, electron microscopy, and for the maintenance of animal holdings. Use is made nationally of a centralized, tropical-medical diagnostic laboratory. In- and out-patient care is performed in the institute hospital (68 beds). BNI has run its own field office since 1968; initially in Liberia, since the outbreak of the Liberian civil war in 1990, it has been moved to Benin until further notice.

Special importance is given to the institute-wide, interdepartmental research programs on the pathogenicity of *Entamoeba histolytica* and *Onchocerca volvolus*. Research in the field of parasitology will be continuously intensified in coming years. A clinical research team will also be established (1993).

2.5.2 German Institute for Nutritional Research in Potsdam-Rehbrücke (BLI under BMFT Jurisdiction)

The Deutsches Institut für Ernährungsforschung (DIfE) was established on 1 January 1992 as a public foundation of the state of Brandenburg, out of the former East German Central Institute for Nutrition of the Academy of Sciences. The mission of the institute is to investigate the interconnections among food, diet, and health on the molecular, cellular, physiological, and epidemiological levels. Scientifically based programs for healthy dietary behavior will be worked out in order to translate cognitive advances made in biochemistry and medicine, as well as in psychology. Thus its orientation toward nutritional medicine places the institute firmly in the service of the prevention of diet-induced, chronic-degenerative diseases. The topics to be treated are classified according to the following priority fields: nutritional physiology and energy metabolism, toxicology, microecology, epidemiology, dietary behavior, immunology, molecular genetics, and preventive-medical foodstuffs research.

DIfE activities should be seen as closely connected to the research topics falling under the rubric of "Life-Style, Nutrition, and Environment" in the *Health Research 2000* program. By carrying out its tasks, the DIfE will serve in the future to

meet the requirements of the field of health-related dietary research. Clinical research will play a major role at the Institute. The diagnosis, clinical observation, and treatment of patients with nutritionally induced diseases are to take place in a metabolic research ward with six beds that is to be established at DIfE and run in conjunction with a hospital.

2.5.3 German Primate Center in Göttingen (BLI under BMFT Jurisdiction)

The mission of the Deutsches Primatenzentrum Göttingen (DPZ) consists of basic biological and biomedical research with and on primates. In the department of reproductive biology, research is conducted on the foundations of reproductive processes and their regulatory mechanisms. The focus of the department is on developmental physiology, on the one hand, and on questions of the regulation of fertility, on the other. In the department of neurobiology, research involves the neuronal foundations of phonation and hearing. These investigations are complemented by studies in behavioral biology.

The department of virology and immunology works on retroviruses, especially on the human immunodeficiency viruses, HIV I and HIV II, and related viruses in non-human primates. Efforts focus on the clarification of the pathogenetic mechanisms of these viruses and the development of vaccines and an antiretroviral therapy.

The chief task of the department of pathology and veterinary care is to service the other departments of DPZ and outside institutions that have primates. In addition, this department gives special consideration to the genesis and course of certain metabolic and renal diseases and to the spontaneous occurrence of tumors. The results of these studies may be important for similar syndromes found in humans.

Two further research teams at DPZ work on biomedical problems. Investigations involve the biochemically definable central-nervous and peripheral processes connected to the regulation of blood pressure and the immune system of primates, with emphasis on the respiratory and gastrointestinal tracts. Thus, one can recognize a close connection between these research teams and *Health Research 2000* topics of "Immunity and Resistance" and "Cardiovascular System."

2.5.4 Diabetes Research Institute at the Heinrich Heine University of Düsseldorf (BLI under BMG Jurisdiction)

The spectrum of tasks of the Diabetes Forschungsinstitut (DFI) is related to the *Health Research 2000* topic "Metabolism and Hormonal System."

Work at the DFI can be summarized in terms of the following complexes:

- Clinical epidemiology and genetics of diabetes mellitus
- Etiology and pathogenesis of diabetes mellitus, types I and II
- Mechanisms of insulin action and insulin resistance
- Pathogenesis of secondary diseases of diabetes mellitus (diabetic macro- and microangiopathy, neuropathy, and cardiopathy)
- Measurement of carbohydrate-metabolic and lipometabolic rates in vivo
- Optimization of diabetes therapy
- Biometry (e.g., development of efficient procedures for deciding among several working hypotheses, implementation of the theory of stochastic processes across the spectrum of techniques in order to evaluate longitudinal studies in epidemiology)

A clinical department is integrated into the Institute, with both in-patient and outpatient services. This provides good preconditions for cooperation between basic and clinical research.

2.5.5 Institute for Occupational Physiology at the University of Dortmund (BLI under BMA Jurisdiction)

Through its activities, the Institut für Arbeitsphysiologie (IfA) contributes to the improvement of prevention and preventive care. Priorities are placed on questions from the fields of the environment (in the broadest sense) and health. The subject of research in the priority field of environmental physiology is the stress and strain on humans at work caused by environmental influences, especially heat, cold, and vibrations (noise). In the priority field of ergonomics (work design), methods and rules are developed for reducing strain-induced, health impairments in the planning and establishment of workplaces and work routines (e.g., in the production process). The priority field of sensory and neurophysiology deals with the reception and processing of optical and acoustic data (signal processing). Topics involving the health-related evaluation of chemical substances from the environment (at the workplace) are taken up in a further priority field.

The IfA also offers good prerequisites for clinical research. Clinical tests connected to the harmful effects of lead and solvents or those caused by oil mist are conducted in the field of occupational medicine.

2.5.6 Borstel Research Institute: The Institute for Experimental Biology and Medicine (BLI under BMG Jurisdiction)

The Forschungsinstitut Borstel (Institut für Experimentelle Biologie und Medizin; FIB), with its research program of pneumology, focuses on

- Bacterial infections
- Inflammatory diseases with concomitant granuloma formation
- Pulmonary fibrosis
- Immunodeficiencies
- Allergies

Thus, this program is seen to be related to the topic of "Respiratory Diseases and Allergies," but also to that of "Infectious Diseases" found in the *Health Research 2000* program. The methods and techniques used at FIB include the following:

- Tests of humoral and cellular immune reactions
- Development of monoclonal antibodies and molecular reagents for purposes of diagnosis
- The influencing of immunoregulation
- Chemical and biophysical analysis techniques (MRI, mass spectroscopy)

A medical hospital is integrated into the Institute, which makes clinical research possible. Questions treated there involve the diagnosis and therapy of chronic and chronically recurrent inflammatory processes of diverse origin, especially of the lung.

2.5.7 Dortmund Research Institute for Child Nutrition (BLI under BMG Jurisdiction)

A close connection can be seen between the tasks of the Forschungsinstitut für Kinderernährung Dortmund (FKE) and the *Health Research 2000* program's topic of "Nutrition and Health." These tasks include the dietary behavior and nutritional problems of healthy children and youth (including prematurely born infants) and the primary prevention of diet-related diseases.

In order to carry out these tasks, the FKE uses, for example, the following methods: longitudinal and cross-sectional studies (diet, metabolism, growth, development) by means of surveys, where the data collected are then evaluated in conjunction with clinical findings on the state of health of those surveyed; and the objectification of findings, for example, through tests of nutritional balance, interactions between RNA and protein degradation, and kidney function tests.

2.5.8 Research Institute for Molecular Pharmacology in Berlin (BLI under BMFT Jurisdiction)

The Forschungsinstitut für Molekulare Pharmakologie (FMP) was founded as a BLI in the Research Network of Berlin (Forschungsverbund Berlin e.V.),

out of the former "Institut für Wirkstoffforschung" of the East German Academy of Sciences. The following directions in research have been thematically conceptualized for the FMP: neuropharmacology and toxicology, peptide pharmacology, cell communication, and the biology of evolution and adaptation.

The central topics of pharmacology are worked on in the framework of these priority fields, e.g., cerebrally degenerative processes and the effects of drugs on the cellular or molecular levels. The priorities are future oriented and provide the FMP with viable, innovative fields of activity, even in a long-term perspective. They also provide the framework for the intense treatment in the future of the problem of addiction. Diverse clinically pharmacological questions can be tackled in conjunction with the high-performance medical facilities of Berlin's universities and other agencies.

2.5.9 Rossendorf Research Center (BLI under BMFT Jurisdiction)

The Forschungszentrum Rossendorf (FZR) was established on 1 January 1992 out of the former Central Institute for Nuclear Research of the East German Academy of Sciences. In an institute for "Bioorganic and Radiopharmaceutical Chemistry," tasks in keeping with *Health Research 2000* are worked upon. This institute performs long-term *basic research on special tracer designs and developments for medicine.*

The research program is oriented toward special biochemical investigations of features of the human organism that are only accessible by means of positron emission tomography (PET). This requires the establishment of a PET center. As the first PET center in the new German Länder, it is to be run in conjunction with the future medical school at the Technical University of Dresden and serve to clarify questions of diagnosis and those arising in therapy. Methodological work and clinical research, on cerebral-function disorders and oncological diseases in particular, are intended to contribute to the development of the new trend in research: molecular medicine. Chemical, pharmaceutical, and biochemical investigations are conducted, with preference given to the use of ^{11}C- and ^{18}F-labeled biomolecules in these studies.

Moreover, for a wide spectrum of routine uses of nuclear-medical methods, photon-emitting technetium 99 m and single photon emission computed tomography (SPECT) are used. Given this fact, FZR's research program is also oriented toward basic research on coordinating compounds of technetium. The two orientations of the institute are combined in the overarching objective of translating the biochemical tracer designs of PET, if at all possible, into technetium com-

pounds. In this way, this method could be made accessible for widespread clinical use. (In short, the goal is to move "from PET to SPECT.")

2.5.10 Heinrich Pette Institute for Experimental Virology and Immunology at the University of Hamburg (BLI under BMG jurisdiction)

The Heinrich-Pette-Institut für experimentelle Virologie und Immunologie (HPI) is active in the field of infectious disease, specializing in viral diseases. HPI tackles problems such as

- Interrelations between viral structure and immunogenicity
- Control of a viral infection
- Pathogeneses of viral diseases and possibility of exerting pharmacological influence on these processes
- Viral persistence
- Cell differentiation, the influence of viruses, e.g., retroviruses
- Virus-induced mutagenesis (such as carcinogenesis)

Investigations are conducted on or with polio, lymphocytic choriomeningitis, measles, rubella, mumps, retro-, and hepatitis B viruses.

2.5.11 Institute for Molecular Biotechnology in Jena (BLI under BMFT Jurisdiction)

The Institut für Molekulare Biotechnologie was founded on 1 January 1992, out of the former East German Central Institute of Microbiology and Experimental Therapy of the Academy of Sciences.

IMB's mission is to develop new and pioneering methods in biotechnology by assimilating cognitive advances from molecular biology, biophysical chemistry, and structural biology. Research interest is focused on new techniques in the synthesis and clarification of the molecular structure of active biological substances. The aim is to discover new practical applications by modifying natural or synthetic biomolecules, either in a specific way or according to the trial-and-error principle of biological evolution.

IMB's research findings will also be useful for medicine. Here reference should be made to the development of new diagnostic and therapeutic agents, and this points to links to the *Health Research 2000* topic of "Plans of Action in Medicine: The Clinical Evaluation of Preventive, Diagnostic, and Therapeutic Procedures."

The research activities at IMB are divided into working domains of structural research, analysis of genetic information and its carriers, design of proteins and other biomolecules, and evolutionary biotechnology.

2.5.12 Institute for Neurobiology in Magdeburg (BLI under BMFT Jurisdiction)

The Institut für Neurobiologie (IfN) was founded on 1 January 1992, out of the former East German Institute for Neurobiology and Cerebral Research of the Academy of Sciences. Basic neurobiological research at IfN, working to effect the synthesis of molecular-biological and cell-biological neurosciences with systems-oriented cerebral research, will contribute to the better understanding of learning and memory in particular. Four departments were formed for this purpose: neurochemistry/molecular biology, systemic physiology, neurophysiology, and neuromorphology. The Institute's program is pursued in terms of a "top down" analysis, i.e., from the systemic level of the brain down to molecular biology.

Work in all departments is oriented around the following topical priority fields:

- Synaptic proteins in intra- and extracellular information processes, their molecular structure and function during synaptogenesis and in the expression of synaptic plasticity
- Significance of cellular mechanisms and small networks in the regulation of synaptic plasticity (long-term strength, epilepsy, hypoxia/ischemia)
- Morphological transformations and neurochemical correlates in imprint models
- Auditory cortex plasticity (cochlear electrostimulation, problem of auditory prosthetics
- Modeling of cognitive functions by means of neuronal nets

In this way, the Institute's activities show themselves to be related to the field of "Mental Health and the Nervous System" in the *Health Research 2000* program.

2.5.13 Medical Institute for Environmental Hygiene at the Heinrich Heine University of Düsseldorf (BLI under BMU Jurisdiction)

The Medizinisches Institut für Umwelthygiene (MIU) has the task of uncovering environmentally induced health hazards and developing the scientific foundations for measures suited to averting harm to health. Accordingly, it is easy to show the connection between MIU activities and topics of project funding in *Health Research 2000* in the field of "Prevention and Preventive Care" (Envi-

ronment and Health) and in the field of allergies and respiratory disease. These activities are focused on the following topical complexes:

- Influence of air pollution on the respiratory tract (investigations ranging from the cell-biological level to epidemiology)
- Basic research on pneumoconiosis (e.g., investigations of possible genetic predisposition)
- Environmentally induced genesis of pulmonary carcinoma (e.g., the relation between dosis and effect of environmental carcinogens, epidemiological studies, analyses of cell cultures, and risk assessments)
- Investigation of the response mechanisms of the human organism to environmental contaminants (virological, immunological, cell-biological, and epidemiological methods)
- Biomonitoring (methods for studying the harmful health effects on the population caused by environmental contaminants
- Studies of the connection between allergies and air pollution
- Investigation of the toxic effects of contaminants in the environment, especially in low concentrations, on the human organism, and especially on the bronchia, nervous system, kidneys, and testes
- Effect of the environment (noise, odors, environmental contaminants) on human behavior (also behavioral toxicology)

Knowledge gained is made use of in terms of an environmental-medicine consultation center. Here, symptoms are clarified in connection with existing levels of toxic exposure, and a knowledge-based information system is created as an aid to diagnosis of environmentally related disease.

2.5.14 Science Center for Social Research in Berlin (BLI under BMFT Jurisdiction)

The Wissenschaftszentrum für Sozialforschung, Berlin (WZB) conducts application-oriented basic research in the social sciences and helps to promote the widespread use of social-scientific knowledge. The general topics of research are: the developmental tendencies, adaptive problems, and innovative opportunities of modern democratic societies

There are four research priority fields at the WZB:

- Labor market and employment
- Technology—labor—environment
- Social change, institutions, and intermediating processes
- Market processes and entreprenurial development

Projects conducted within these fields frequently include questions concerning the causes and management of health risks.

The working group on the "Coverage of Social Affairs" and the research team on "Health Risks and Preventive Policy" are directly connected to health research.

The aforementioned research team starts from the realization that the phenomena of illness and death in industrialized countries are largely characterized by chronic disease, the causes of which are largely found in the fields of environment, labor, and life-style. By the time they manifest themselves, they usually can no longer be cured. Preventive or risk-reducing strategies differ in terms of the area of intervention, scientific-disciplinary substantiation, and institutionalization. The research team studies and compares the risk concepts, effects, and developmental conditions of various preventive interventions and strategies. Research here, in part in international comparison, includes such topics as AIDS, nutrition, work-related musculoskeletal diseases, infant mortality, and unemployment.

2.5.15 The Central Medical Library in Cologne (BLI under BMG Jurisdiction)

The Zentralbibliothek der Medizin (ZBM) is the central medical library for the Federal Republic of Germany. It is a facility of the state of North Rhein-Westphalia, receiving 30% of its budget from the federal and 70% from the state government.

The library's task is to acquire, classify, and make accessible the scientific literature on human medicine and its foundational sciences and that of physical anthropology. The priority of the collection is placed on the most important medical periodicals in all languages of the world; special attention is given to the effort to maintain complete series of those periodicals included in widely used documentation services. The collection incorporates German- and English-language monographs in particular, but also monographs from other European countries. Included is both literature from the publishing trade as well as from the writings of government agencies, associations, companies, universities, and conferences. At the end of 1991, holdings encompassed 800,000 volumes and 7,500 periodicals kept up to date.

2.5.16 Center for Psychological Information and Documentation at the University of Trier (BLI under BMG Jurisdiction)

The Zentrum für Psychologische Information und Dokumentation (ZPID) has the task of (a) documenting current German-language data relevant to the field

of psychology quickly, comprehensively, and in concise form and (b) by using data banks and publications, making it accessible to the professional public both within Germany and abroad. Moreover, it also should make documentation collections of third parties, especially relevant foreign-language data banks, accessible to the professional public in Germany.

2.6 Superior Federal Authorities and Federal Institutes

Federal agencies and federal institutes fulfil important advisory, executive, and service functions (in addition to certain jurisdictional responsibilities) for the federal government. In the framework of these activities, the scientists employed at these facilities also contribute to health research. The following federal institutes have important connections to the program presented here, especially to topics in the field of "Prevention and Preventive Care":

2.6.1 Federal Health Office in Berlin (Bundesoberbehörde, [Superior Federal Authority] under the Jurisdiction of the BMG)

The tasks of the Bundesgesundheitsamt (BGA) include project and commissioned research; scientific consultation for federal and state governments, the EC, the Food and Agricultural Organization (FAO) of the World Health Organization (WHO), and other international bodies; and licensing and monitoring functions in all fields of public health care (and especially in the field of narcotics and pharmaceutical law). In these activities, it pursues the following goals:

- Improvement of health-related consumer protection
- Reduction of health risks from the environment
- Research on the causes of disease and its early detection
- Disease control
- Increase in drug safety

The following six institutes are active in the pursuit of these goals in the areas listed:

- Robert Koch Institute: virology; bacteriology; natural-science-based microbiology; microbial biochemistry; immunology; biological safety (genetic technology); disinfection, sterilization, and hospital hygiene; and epidemiology of infectious disease. The Institute has at its disposal numerous reference laboratories for examining various bacterial and viral infectious agents and is also active in the fields of mycology and parasitology.
- Institute for Water, Soil, and Air Hygiene: environmental hygiene, construction and settlement hygiene (sanitation), human ecology and health techno-

logy, water sanitation for personal consumption and industrial use, sewage and environmental sanitation in the prevention of water pollution, air hygiene, soil hygiene, hygiene of water extraction.
- Max von Pettenkofer Institute: plant and wood protectants and pesticides, toxicology, chemistry and toxicology of foodstuffs and consumer goods, evaluation of chemicals and nutritional medicine.
- Institute for Social Medicine and Epidemiology: public health services, coverage of health issues, health statistics, epidemiology of health risks, empirical health research, primary-prevention programs.
- Institute for Veterinary Medicine (Robert von Ostertag Institute): foodstuffs hygiene, general and special zoonosis and animal epidemic research, resistance to infection, genetic technology, evaluation and licensing of veterinary drugs, chemical residue research, animal nutrition and animal feed supplements, animal protection, registration and evaluation of methods of supplementing and substituting for animal experimentation.
- Institute for Pharmaceutics: drug licensing, preparation, and post-licensing; pharmaceutical chemistry, biology, and technology; drug toxicology, experimental and clinical pharmacology; drug traffic; narcotics (federal opium center).

2.6.2 Paul Ehrlich Institute in Langen (Bundesoberbehörde [Superior Federal Authority] under BMG Jurisdiction)

The Paul-Ehrlich-Institut, Bundesamt für Sera und Impfstoffe (PEI; Federal Office for Sera and Vaccines), supports the health-policy tasks of the Federal Minister of Health (BMG) in terms of epidemic prophylaxis and the safety of immunobiological drugs. It is responsible for the government testing, licensing, and clearing for use of individual batches of drugs, such as sera, vaccines, test allergens, test sera, and test antigens.

In addition, PEI also has a role to play in the granting of production licenses, in the monitoring of the marketing of the aforementioned drugs, and in the evaluation of their risks. The Institute conducts research in the fields of these drugs, especially for the purpose of developing testing procedures, standards, and standardized preparations for measuring the effectiveness of immunological preparations.

Moreover, largely grant-funded research projects also take place at PEI in the field of the biology of infectious disease, with special analysis of immunological resistance to bacterial and viral infections (including HIV) and excessive allergic reactions. Connections can be seen between these activities and topics in the

field of "Infectious Diseases" in *Health Research 2000*. A further priority field of PEI is the development of alternatives to animal experimentation.

2.6.3 German Institute for Medical Documentation and Information in Cologne (Federal Institute under the Jurisdiction of the BMG)

The Deutsches Institut für medizinische Dokumentation und Information (DIMDI) is the most important information center for specialized literature in medicine in the Federal Republic of Germany. It was established as a federal institute for addressing the informational needs of government departments. Its activities are defined by the following objectives:

- To guarantee the upkeep of information in health services, the entire medical field, and its adjoining areas
- To give priority to information use and division of labor in providing information over its own documentational needs
- To make use of the most recent technical advances and to allow information seekers to access them in an economical and profitable manner
- To work on improving documentation and information systems for the bioscientific field, for example, by presenting examples of and refining user-friendly software

The information in the bioscientific field collected and stored at DIMDI is accessible to the professionally interested public, in so far no legal restrictions apply. The services it offers are supplemented by cooperation

- Between DIMDI and the Center for Agrarian Documentation and Information (ZADI), which results in the incorporation of data banks from the field of nutrition, agriculture, and forestry. The same holds for documentation provided by the Federal Institute for Science of Sports (BISp).
- Among DIMDI, the Center for Psychological Information and Documentation at the University of Trier (ZPID), the Institute for Documentation and Information in Social Medicine and Public Health Services in Bielefeld (IDIS), the Institute for Hospital Construction at the Technical University (TU) of Berlin (IFK), and the Information Center for Biology at the Senckenberg Research Institute in Frankfurt am Main (IZB) in the development and provision of additional data banks.

Due to its coordinated user services and aid, standardization of data techniques and teaching materials for users, and the use of the CCL-compatible software GRIPS (general relation based information processing system) with its efficient user guidance, the service has enjoyed great acceptance and use in a primarily

European user world from the legislative and executive areas of government, from research, teaching, and health services, and from the practice-oriented fields of application (especially medicine). The roughly 100 data banks that the Institute maintains serve the transfer of knowledge between research and practice in problem domains important to health policy (such as toxic traits of substances, AIDS and HIV infection, chronic diseases, genetic technology, and environmental medicine). The stored data is retrievable 21.5 hours per day and can thus be accessed (by means of Datex-P, WIN, and Btx) by individual users on an ad hoc basis for the sake of specific problems.

DIMDI provides consultative services primarily to the BMG, BGA, and PEI in the development of data and work systems. It takes on the responsibility for the analysis, development, implementation, and operation of such systems. Basically, its infrastructure allows the DIMDI to function as a general computer center that provides departmentally specific, specialized information to other government departments.

2.6.4 Federal Office for Radiation Safety in Salzgitter (Federal Institute under the Jurisdiction of the BMU)

The Bundesamt für Strahlenschutz (BfS) assists the federal government, especially the BMU, in matters of nuclear-technology safety, transportation of radioactive substances, radioactive-waste management, radiation safety, and radiation hygiene. In addition, the BfS carries out federal tasks in keeping with legislation on preventive safety involving atomic and other forms of radiation (*das Atom- und das Strahlenschutzvorsorgegesetz*), assists the BMU in carrying out federal monitoring, and conducts scientific research in the aforementioned fields.

In organizational terms, the administrative offices of the Reactor Safety Commission (RSK), the Radiation Safety Commission (SSK), and the Nuclear Technology Committee (KTA) are classified as part of the BfS. However, they are not subject to its directives in terms of technical questions. Their medically relevant research priority fields include:

- Detecting the sources of natural and man-made environmental radioactivity and resulting radiation levels
- Detecting the radiation levels brought about by mines and their surroundings
- Determining radiation levels of natural environmental radiation and natural radiation influenced by civilization
- Detecting the radiation levels caused by nuclear-technology sites

- Determining occupational radiation levels and analyzing radiation safety measures taken at the workplace
- Investigating the effect and making a health-related evaluation of ionizing and nonionizing rays
- Registering, documenting, and evaluating radiation exposure levels of occupationally exposed individuals over their entire occupational life

The connection to the *Health Research 2000* topic of "Environment and Health" is obvious.

2.6.5 Federal Environmental Office in Berlin (Federal Institute under the Jurisdiction of the BMU)

The primary tasks of the Umweltbundesamt (UBA) include:

- Provision of scientific assistance to the BMU (especially in developing legal and administrative regulations) in the fields of air cleanliness, noise control, economics of waste management, economics of water, soil protection, and environmental chemicals
- Development of forms of assistance for environmental planning and environmental impact assessment of measures affecting the environment
- Informing the public on environmental questions and problems
- Provision of environmental data by means of the environmental information and documentation system UMPLIS
- Provision of key services and forms of assistance for purposes of direct departmental research and the coordination of federal environmental research
- Provision of assistance in the implementation of legislation on chemicals, pesticides, detergents and cleansing agents and genetic technology (*Chemikalien-, Pflanzenschutz-, Wasch- und Reinigungsmittel-,* and *Gentechnikgesetze*)
- Operation of an environmental-specimens archive

The UBA commissions research directly connected to health questions in the fields of environmental chemicals and the effects of contaminants (especially on humans). It can thus be viewed in connection with the *Health Research 2000* topic of "Environment and Health."

The information and documentation system UMPLIS provides environmentally related information to federal, state, and municipal agencies, to science and industry, as well as to the interested public. In addition to literature and research documentation, fact-collecting data banks are set up and operated, for example, in the field of environmental chemicals.

The Federal Hazardous Substances and Materials Rapid Information Service (Gefahrstoff-/Gefahrgutschnellauskunft; GSA) is a fact-collecting data bank on environmentally hazardous substances. Continously updated, it exists through the collaborative efforts of the UBA and its users. It lends assistance (a) in the fight against disruptions of normal operations in nuclear plants and other accidents involving environmentally hazardous substances and (b) in the dissemination of information on the storage and transport and lawful handling of these substances.

There is also a special information service at UBA for nuclear-plant operations disruptions.

2.6.6 Federal Institute for Occupational Safety in Dortmund-Dorstfeld (Federal Institute under the Jurisdiction of the BMA)

The Bundesanstalt für Arbeitsschutz (BAU) is a legally nonautonomous public institute. It assists the BMA in the area of occupational safety. Here it collaborates with

- Authorities of the Länder responsible for occupational safety and the carriers of statutory accident insurance
- All institutions and persons involved with tasks of occupational safety, public health safety, and the design of humane working conditions

The BAU monitors and analyzes the occupational safety and health and working conditions found in plants and offices. It applies cognitive advances from safety technology, occupational medicine, ergonomics, and other fields of occupational research in its development of solutions to specific problems. Here, it either does the necessary research itself or commissions others to do so. Points in common with the *Health Research 2000* topic of "Prevention and Preventive Care" can be seen in this context. BAU promotes the practical application of cognitive advances and recommended solutions. Further tasks include

- Publication of information materials and reports
- Participation in establishing regulations
- Development of materials and conducting of events in education and advanced training (with the events serving as models for others)
- Consultation (also as a model)
- Exhibits
- Events for specialists in the field

- Revision of the existing law on chemicals (*Chemikaliengesetz* of 14 March 1990, BGBl [Federal Law Gazette] I:493)

According to the law on chemicals, the BAU is also the registration office.[40)]

2.6.7 Federal Institute of Occupational Medicine in Berlin (Federal Institute under the Jurisdiction of the BMA)

The Bundesanstalt für Arbeitsmedizin (BAfAM) was founded on 1 January 1991 out of the former East German Central Institute of Occupational Medicine. It is a legally nonautonomous public institute and carries out tasks in occupational safety, especially

- Investigations of the effects of working conditions on the health of employees and the drafting of reports on the preventive design of working conditions, the prevention and control of occupationally related disease (including occupational disease), and preventive care in occupational medicine.
- Provision of assistance to the BMA in the task domains assigned the BAfAM, especially in work on legal regulations and in terms of European cooperation
- Conducting and awarding of research projects on medical aspects of occupational safety, development of model solutions from research findings, and funding for application-directed activities
- Informing the general and specialized public on medical aspects of occupational safety by means of publications, public events, exhibits, and the publication of papers from the field
- Funding and implementation of advanced and continued training and professional-qualification programs in the medical aspects of occupational safety

These activities are in keeping with the *Health Research 2000* topic of "Prevention and Preventive Care."

2.6.8 Federal Road System Institute (Field of Accident Research and Road Traffic Technology) in Bergisch-Gladbach (Federal Institute under the Jurisdiction of the BMV)

The Bundesanstalt für Straßenwesen (BASt) is a federal scientific-technical institute. The BASt has been working in the field of traffic-safety research since 1970. The objective of activities is to reduce the number and severity of traffic

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40) *Verordnung zur Bestimmung der Anmeldestelle* (Decree Determining the Registration Office) in accordance with the *Chemikaliengesetz* of 2 December 1982 (BGBl I:1238).

accidents, and, thus, in an extended sense, to protect human life from physical injury. The BASt commissions research to this effect and also performs research itself in problem domains of special importance. It collects the national and international findings of research, assesses and documents them, and prepares them for practical use.

Research priorities in the field of accident and safety research are

- Human behavior in traffic
- Traffic education and information
- Biomechanics and motorized vehicles
- Rescue services
- Collection and preparation of accident-relevant data
- Documentation and information

2.6.9 Federal Institute for the Science of Sports in Cologne (Federal Institute under the Jurisdiction of the BMI)

Since the decree for its construction, the tasks of the Bundesinstitut für Sportwissenschaft (BISp) have included

- Planning and coordination of research in sports science and sports medicine (including doping analysis)
- Active participation in the planning of central federal athletic facilities and the coordination of research on sporting apparatus and equipment
- Recording of findings in a central federal documentation and information collection and making them accessible to the professional public
- Advising the federal government on sport funding projects in developing countries

Questions of sports medicine represent one priority field in the work of the BISp.

2.6.10 Federal Center for Health Information in Cologne (Federal Institute under the Jurisdiction of the BMG)

The special tasks of the Bundeszentrale für gesundheitliche Aufklärung (BZgA) include

- Developing principles and guidelines for practical health education
- Providing education and advanced training for persons active in this field
- Coordination and reinforcement of health-informational measures and health education nationwide
- Cooperation with international partners

Research at the BZgA is oriented around substantive tasks. Its goal is to assimilate advances in science for the purposes of the planning and regulation of informational measures and then to assess the effectivity of the latter, in order to optimize the results of their work.

2.6.11 Federal Physicotechnical Institute in Brunswick and Berlin (Federal Institute under the Jurisdiction of the Federal Ministry of Science)

The Physikalisch-Technische Bundesanstalt (PTB) is both a research institute in the natural sciences and engineering and a federal technical supervisory agency. The PTB is responsible, for example, for the construction design testing and licensing of measuring instruments as well as for construction design testing in the fields of safety technology, radiation safety, and medicine. In the service of health, the PTB conducts construction design testing of medical apparatus for purposes of official verification of their specifications. It also carries out such testing on the basis of agreements and in terms of R & D tasks for guaranteeing standardized measurement. In this context, it also takes part in national and international committees and organizations on measurement and standardization.

2.6.12 Federal Research Institutes under the Jurisdiction of the Federal Minister of Nutrition, Agriculture, and Forestry

These institutes have the task of developing scientific foundational knowledge as assistance in decisions in nutritional, agricultural, and forestry policy and in federal consumer policy. The research activities of the total of ten institutes includes the following priority programs:

- Quality maintenance and improvement of the products of the agricultural and food industry
- Development of safe and non-polluting production and processing procedures in this industry
- Improvement in the situation of world nutrition

The activities of the following institutes in particular are connected to the *Health Research 2000* program:

- Federal Research Institute for Nutrition, Karlsruhe
- Federal Institute for Dairy Research, Kiel
- Federal Institute for Research on Meat, Kulmbach

- Federal Institute for Research on Grain, Potatoes, and Fat, Detmold and Münster
- Federal Research Institute on the Fishing Industry, Hamburg

2.7 Documentation of Hospital Services

The Technical University of Berlin, Institute for Hospital Construction, produces, in a European cooperative project, the data bank *Health Care Literature Information Network* (HECLINET). In its performance of this task, the institute is part of the specialized information network *Health, Medicine, Biology, and Sports*. HECLINET serves to register and assess information in the field of hospital services, especially on the construction, organization, and operation of hospitals. It then makes it accessible to the professionally interested public, particularly for on-line use via DIMDI (see Appendix, section 2.6.3). HECLINET is a professionally indispensable German and European supplement to the large U.S.-oriented data banks in this field.

3. Funding of Biomedical Research in the Framework of Other BMFT Programs

Medical research is largely funded within the framework of the Federal Program Health 2000. However, funds are also made available for specific topics in other BMFT programs. These include such topics as application-related basic biomedical research, the development of medical technologies and apparatus, and the materials and pioneering methods of occupational, environmental, and space medicine. The funding activities are cooperatively planned and realized by the departments of BMFT.

3.1 Biotechnology 2000

Biotechnology is one of the core areas of technologies of the twenty-first century. Human medicine and pharmacology belong (along with plant breeding, new materials, environmental biotechnology, and nutrition) to the primary fields of application of biotechnology. Various priority programs fund topics in basic biomedical research that are expected to lead a better understanding of cellular processes. Especially wide scope is given in the *Biotechnology 2000* program to the promotion of research networks between science and industry in the fields of cell and neurobiology, genome research, genetic technology, plant breeding,

natural molecular substances (especially in glyco- and protein technology), biological safety research, and biological sensors.

3.2 Work and Technology

The funding of research in occupational medicine in the framework of the *Work and Technology* program is directed toward the development of preventive strategies in occupational and health safety in workplace operations. This includes such funding measures as the development of instruments for identifying and evaluating stresses and strains or health hazards, the further development of approaches in company health reporting for use in small or medium-sized enterprises, and the development of simple measurement techniques for practitioners, in order to help in the operational management of the problem of hazardous substances.

In this context, funding is focused on research fields of special urgency, where results lead to the most effective improvements at the workplace and where good opportunities for translating these results into practice can be expected. The research activities are conducted in close coordination with the BMA, BAU, and BAfAM, as well as with the Federal Ministry of Education and Science (BMBW) and the Federal Institute for Occupational Training (BIBB).

3.3 Microsystems Technology and Laser Research

The development of new methods and techniques in medical technology, including the requirements arising out of micro-invasive therapy, is supported by the funding programs of "Microsystems Technology" and "Laser Research." Apart from the technical side of development, the focus is also on questions of acceptance on the part of practicing physicians, risks and stress caused the patient, and the economic effects of the new technology on health-system costs. All of these questions will be addressed in a cooperative effort with the *Health Research 2000* funding program.

3.4 Environmental Research and Technology

The funding program "Environmental Research and Technology in Health" provides support for the investigation of chemical contaminants that enter the environment from different sources (such as industry, automobile traffic, or in private households), and that can effect human health by means of the air or food intake, or skin contact. The priority fields of the funding program are analyses of the allergenic, carcinogenic, mutagenic, and teratogenic effects of potentially harmful pollution in the environment.

3.5 Materials Research

The funding program for materials research includes studies on the development of biologically absorbable materials for medicine. Their primary objective is to attain mechanical attributes in conformity with the organism, biodegradable products, and the temporal regulation of the process of absorption. In other priority fields, it is sought to optimize the bioactive surfaces of medical implants, especially to stimulate new bone formation and to prevent thrombosis. The limiting conditions of funding are in keeping with those of the general materials research program. The focus is on network-organized projects with the participation of industry.

3.6 Space Medicine

The national funding program of "Space Medicine" of the German Agency for Space Affairs (DARA) attempts to make use of outer space to conduct basic research that seeks to acquire new knowledge about human bodily functions in the absence of gravity. Special program priorities are placed on investigating the adjustment of biological systems over time to the conditions of outer space and on maintaining the health of astronauts under such conditions.

4. Contributions of Other Government Departments to Health Research

The funding of research on urgent health-policy problems of the population is not restricted to the BMFT; other government departments also contribute, in so far as their special tasks require such activities.

4.1 Funding by the Federal Ministry of Health

The research funding of the BMG has special importance: on the one hand, it helps shape the Federal Program, and on the other, it also promotes its own research projects, which are for the most part oriented around questions of the health care of the population and health services. The funding priorities of the BMG are placed on the fostering of health, the controlling of disease, health care, and health insurance.

- *Fostering health* encompasses epidemiological research, preventive measures, the publication of relevant recommendation and information, and consul-

tation. Important fields include the improvement of nutrition (dietary behavior, ingredients and hygiene of foodstuffs and sumptuary goods [alcohol, tobacco, etc.]) and measures taken against the risks of addiction (to alcohol, drugs, solvents, and nicotine) and against widespread diseases (cancer; cardiovascular, rheumatic, and mental illnesses; AIDS, and other viral and bacterial infectious diseases).

- *Controlling disease* encompasses studies on pathogenesis, improvement of early-detection techniques, clinical research that aims at developing more effective therapies, aftercare, and rehabilitation. Priorities are placed on the fields of allergy and autoimmune disease, respiratory illness, infectious disease, diseases of the supporting (connective) tissue, cardiovascular and metabolic diseases, and cancer.
- Research funding in the fields of *health care and health insurance* serve to make the costs and services in the health care system more transparent, to determine more precisely the costs of illness, and to work out criteria and forms of cost reduction. Furthermore, the need for preventive, curative, supportive, and rehabilitative services (including tests of new forms of organization) is examined. The depiction of the state of health of the population and its dependence on age, quality of life, the state of the environment (ecological damage), and the quality of medical care represents a further objective of research. Funding also goes to overall quality measures, for example, in terms of the training of medical and nursing personnel and hospital infrastructure.

4.2 Funding by the Federal Ministry of Labor and Social Order

The BMA funds research aimed at *optimizing nursing and rehabilitation*. The following research programs are planned or already in progress:

- Coverage of potential nursing care requirements in selected European countries
- Quality of nursing care in in- and out-patient care
- Development of curricula for the continued training of general practitioners in the field of medical rehabilitation

4.3 Funding by the Federal Ministry of Environment, Conservation, and Reactor Safety

The funding of research in the field of health-related environmental protection by the BMU is carried out with the goal of producing *scientific criteria or scientific aids for developing the legal regulations of environmental protection* and assists in the

- Recognition and quantification of risk and an assessment of environmental contaminants
- Investigation of the effects of individual contaminants (e.g., carcinogenic, mutagenic, or allergenic) and their effects on risk groups
- Determination of combined effects and interactions of different forms of pollution
- Determination of effects of changes in environmental conditions, and of noise and nonionizing rays on health
- Evaluation and early detection of abiotic attributes of chemical products

In addition, direct departmental research is conducted by BMU, based on the legal obligations arising from radiation safety regulations, which require the protection of the population and the environment from the risks of ionizing radiation from nuclear technology and medical applications. In the medical field, the research goal emerges to develop examination techniques that reduce exposure to radiation as much as possible while at the same time guaranteeing optimal success of treatment, or, to develop alternative examination techniques in the interest of patients that do not involve the use of ionizing radiation.

The research field of "Nonionizing Rays" is also one of the government-departmental tasks of the BMU. Here, research tasks focus in particular on the nonionizing rays emitted by power lines, transformers, radio stations, and radar. In addition, research on the effects of ultraviolet rays is especially important in the prevention of skin cancer. Departmental activity aims to determine the possible biological effects of nonionizing rays.

4.4 Funding by the Federal Ministry of Nutrition, Agriculture, and Forestry

Research activity under the supervision of the BML contributes to the general goal of working out scientifically based assistance for decisions made within the department and, at the same time, extending scientific knowledge for the common good. One of the most important aims of nutritional policy is to ensure consumers a widely diversified supply of high-quality foodstuffs as a prerequisite for a healthy diet. A further task of nutritutional policy consists in providing consumers with information on proven nutritional findings and proper nutritional habits. Recent findings show once again that the nutritional habits of German consumers are not yet optimal.

The research activities of the total of ten institutes includes the following priority programs:

- Quality maintenance and improvement of the products of the agricultural and food industry
- Development of safe and non-polluting production and processing procedures in this industry
- Improvement in the situation of world nutrition

The activities of the following institutes in particular are connected to the *Health Research 2000* program:

- Federal Research Institute for Nutrition, Karlsruhe
- Federal Institute for Research on Grain, Potatoes, and Fat, Detmold and Münster
- Federal Institute for Dairy Research, Kiel
- Federal Institute for Research on Meat, Kulmbach
- Federal Research Institute on the Fishing Industry, Hamburg

4.5 Funding by the Federal Ministry of Family and Senior Citizens

The funding of family-related research and gerontology by the Bundesministerium für Familie und Senioren (BMFuS) has the goal of *analyzing changes in society*, determining their causes and trends, and *determining any possible need for action* in terms of the basic societal conditions that help define life in families and the fulfilment of family tasks. On the other hand, research should also contribute to *maintaining the competency of elders, reducing or eliminating their need to be cared for,* and *improving the quality of life of the aged*. The research program has the following priorities:

- Description of the situation of the family and an international comparison
- Changes in the structure and ways of life of families and in their direct social setting and general milieu
- Families with special problems and in crisis situations
- Promotion and protection of children

Gerontology, especially in the fields of

- Maintenance and promotion of the autonomy and competency of older persons
- Promotion of the integration and participation of the elderly in society
- Requirements of assistance and care
- Improvement in the structures of assistance for the elderly

4.6 Funding by the Interior Ministry

The Bundesministerium des Innern (BMI) promotes medical research in the context of *fulfilling the tasks of civil defense*, in order to ensure an improvement in the strategies and procedures of *medical first aid under the restricted conditions of extreme situations caused by military attack or catastrophes*. In this context, the Commission for the Defense of the Civilian Population advises the Interior Minister on scientific questions of population defense. The research findings appear in the publication series entitled *Civil Defense Research*.

The Federal Institute for the Science of Sports (BISp), under the juridiction of the BMI, also contributes to health research within its targeted scientific research in the field of sports. This especially holds for the topics of "Medicine in Sports," "Sport Injuries and Their Prevention," "Strength Building," "Women and Sports," and "Sports and Aging."

4.7 Funding by the Federal Ministry of Defense

The Bundesministerium für Verteidigung (BMVg) funds medical research for the purpose of *protecting* (maintaining, and reestablishing) *the health of the members of the armed forces in all conceivable conditions*. Medical research among members of the armed services should give priority to contributing to the early detection and improved treatment of health disorders caused by the military environment or its effects on service members.

Aside from questions arising from the peace mission of the medical corps, special attention is given to the professional-scientific preparation of medical care for sick, injured, and wounded soldiers.

4.8 Funding by the Federal Ministry of Postal Service and Telecommunications

The Bundesministerium für Post und Telekommunikation (BMPT) promotes research projects that take a critical look at the biological effects of the electromagnetic fields produced by telecommunications equipment (radio-wave transmitters). A research association, *Funk* e.V., was founded for this purpose at its initiative.

The research association funds in particular

- The implementation of scientific investigations on the effects of high-frequency fields on human life and the environment

– The working up of suggestions for national and European regulations and recommendations for protecting human life and the environment

Special priority is given to research topics targeted to the field of the nonthermal effects of electromagnetic fields.

5. Funding of Health Research in the Programs of the European Communities

The "Framework Program of Community Activities in the Field of Research and Technological Development" represents the basis for European research and technology funding. It summarizes the goals, priorities, and financial scope of research funding for five-year periods.

The third framework program is currently in progress[41] (1990-1994) and encompasses a total of 15 specific programs. Three of these programs, to varying degrees and with varying objectives, support research in medicine.

5.1 Biomedicine and Health Services (BIOMED 1)

Reference has to be made first of all to the "Program for Research and Technological Development in the Field of Biomedicine and Health Services" (1990-1994) (referred to hereafter as BIOMED 1).[42] The program is divided into the following areas:

1. Development of coordinated research in the field of prevention, care, and health systems
   (a) Pharmaceuticals and prescription practices
   (b) Risk factors and occupational medicine
   (c) Biomedical technology

41) The EC Commission publishes a "Guideline for Applicants," which offers an overview of the entire framework program. The latest (third) edition is available at EC missions and advisory centers.

42) Published in the Official Journal of the EC, Nr. L 267, 24 September 1991. More detailed information on this and other European programs related to health research can be obtained from the German advisory and coordinating office at the project-grant agency "Research in the Service of Health"; for the address, see Addresses in the Appendix).

2. Important health problems and diseases of far-reaching socioeconomic importance, with priorities set on
   (a) AIDS
   (b) Cancer
   (c) Cardiovascular illnesses
   (d) Mental and neurological disorders, and the
   (e) Aging process, age-related health problems and handicaps
3. Analysis of the human genome
4. Research in the field of medical ethics

A total of ECU 132 million (i.e., about DM 264 million) are available for these purposes. A wide spectrum of possible research activities is addressed in fields 1, 2 and 4 above, whereas in field 3 the program focuses on a narrowly defined question. The type of funding provided is also in keeping with these very different approaches. Thus, the Commission finances so-called concerted actions in fields 1, 2 and 4, whereas it takes part in financing field 3 in terms of a sharing of costs.

The goal of a **concerted action** is to give research teams from various European countries the opportunity to work together on topics listed in the BIOMED 1 program. Participating research teams are expected to finance their own scientific activities, be it with funds from their own institution or from national project funding.

Aside from the aforementioned goals of the program, the hope is that this funding mechanism will result in greater efficiency and increasing integration in European research in medicine and health services. More generally, the hope is for a transfer of knowledge aimed at achieving the highest possible standard of research across the EC and, in addition, the early development of binding and generally accepted standards and procedures in medicine and health services.

The BIOMED 1 program is not considered as competition for the various national research programs. Instead, it is actually dependent upon them, builds upon them, and makes available for international cooperation precisely that which is not provided otherwise. Just on the basis of this limiting condition alone, it is ensured that an important and self-evident principle in research funding in federally organized Germany also directly holds for the EC: EC funding is used in those cases, and only in those cases, where the funding mechanisms of member states no longer offer support, just as on the federal level in Germany, the BMFT only provides funding in those areas not covered by the funding policy of the states. In this way, the principle of subsidiarity is also inherent to the BIOMED 1 program.

It is important to note one thing: concerted actions are hardly suitable for replacing financial funding that could not be received elsewhere. This would also not even be possible, given the array of topics, the number of countries involved (12 member states and other associated ones), and a program of five years duration provided with relatively modest funds. It is true that in comparison to its predecessor program (which ended in December 1991), the EC is willing for the first time in its new BIOMED 1 program to also provide funds, of modest scope, for personnel and materials used in research. Nevertheless, it remains faithful to its basic tenet that each team participating in a concerted action has to provide its own funds.

5.2 Advanced Informatics in Medicine (AIM)

Medical research is also funded in the framework of the specific "telematics" program, namely, in field 3, "Advanced Informatics in Medicine" (AIM; see Official Journal of the EC, Nr. L 192, 16 July 1991). ECU 97 million have been made available for this field for the period from 1990-1994 (ca. DM 194 million).

This program, conducted in terms of cost-sharing, is expected to have far-reaching consequences for medical practice, since the registration, storage, and processing of medically relevant data will become increasingly important. This is especially true in terms of the creation of European standards that should make it possible to ensure suitable medical care, independent of barriers of language, across all of Europe.

5.3 Life Sciences and Technologies for Developing Countries (STD)

In order to complete the picture, one more program should be mentioned, though as its name indicates, its aims are certainly not restricted to Europe: "Life Sciences and Technologies for Developing Countries" (STD). Its field 2 "Improvement in Health" has a budget of ECU 22.4 million (i.e., ca. DM 45 million; see Official Journal L 196, 19 July 1991). In terms of European integration, it is a lower-priority program. The fact, however, that the Commission is clearly going beyond narrow European interests in terms of scientific collaboration is something to be applauded.

Appendix III. Glossary of Acronyms and Special Terms

Academy of Sciences	Akademie der Wissenschaften
AGF	Arbeitsgemeinschaft der deutschen Großforschungseinrichtungen Association of National Research Centers
AWI	Alfred Wegener-Institut für Polar- und Meeresforschung Alfred Wegener Institute for Polar Exploration and Oceanography
AWMF	Arbeitsgemeinschaft der wissenschaftlich-medizinischen Fachgesellschaften Association of the Scientific Medical Societies
BAfAM	Bundesanstalt für Arbeitsmedizin Federal Institute for Occupational Medicine
Basic funding	Institutionelle Förderung (For an explanation, see ftn. 3)
BAU	Bundesanstalt für Arbeitsschutz Federal Institute for Occupational Safety
BGA	Bundesgesundheitsamt Federal Health Office
BGBl	Bundesgesetzblatt Federal Law Gazette
BIBB	Bundesinstitut für Berufsbildung Federal Institute for Occupational Training
BIOMED 1	Program for Research and Technological Development in the Field of Biomedicine and Health Services (EC program)
BISp	Bundesanstalt für Sportwissenschaft Federal Institute for the Science of Sports
BLI	Blaue Liste Institut(e) "Blue-List" Institute(s)
BMA	Bundesministerium für Arbeit und Sozialordnung Federal Ministry of Labor and Social Order
BMBW	Bundesministerium für Bildung und Wissenschaft Federal Ministry of Education and Science
BMFT	Bundesministerium für Forschung und Technologie Federal Ministry of Research and Technology
BMFuS	Bundesministerium für Familie und Senioren Federal Ministry for Family and Senior Citizens

BMG	Bundesministerium für Gesundheit Federal Ministry of Health
BMJFFG	Bundesministerium für Jugend, Familie, Frauen und Gesundheit Federal Ministry of Youth, Family, Women, and Health
BML	Bundesministerium für Ernährung, Landwirtschaft, und Forsten Federal Ministry for Nutrition, Agriculture, and Forestry
BMU	Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit Federal Ministry of Environment, Conservation, and Reactor Safety
BMV	Bundesministerium für Verkehr Federal Ministry of Transportation
BMVg	Bundesministerium für Verteidigung Federal Ministry of Defense
BNI	Bernhard-Nocht-Institut für Schiffs- und Tropenkrankheiten Bernhard Nocht Institute for Nautical and Tropical Diseases
Bundesoberbehörde	Superior Federal Authority
departmental research	Ressortforschung
DFG	Deutsche Forschungsgemeinschaft German Research Association
DFI	Diabetes-Forschungsinstitut Diabetes Research Institute
DIfE	Deutsches Institut für Ernährungsforschung German Institute for Nutritional Research
DIMDI	Deutsches Institut für medizinische Dokumentation und Information German Institute for Medical Documentation and Information
DKFZ	Deutsches Krebsforschungszentrum German Center for Cancer Research
DLR	Deutsche Forschungsanstalt für Luft- und Raumfahrt German Institute for Aeronautics and Space Research
DPZ	Deutsches Primatenzentrum German Primate Center
EC	European Communities

FhG	Fraunhofer Gesellschaft Fraunhofer Society
FIB	Forschungsinstitut Borstel Borstel Research Institute
GBF	Gesellschaft für Biotechnologische Forschung Society for Biotechnological Research
GFE	Großforschungseinrichtung(en) National Research Center(s)
GFR	Gesundheitsforschungsrat Health Research Council
GSF	Forschungszentrum für Umwelt und Gesundheit Research Center for Environment and Health
GSI	Gesellschaft für Schwerionenforschung Society for Heavy-Ion Research
HMI	Hahn-Meitner-Institut Hahn Meitner Institute
IfA	Institut für Arbeitsphysiologie Institute for Occupational Physiology
KFA	Forschungszentrum Jülich Jülich Research Center
KfK	Kernforschungszentrum Karlsruhe Karlsruhe Nuclear Research Center
Land (Länder)	States of the Federal Republic of Germany
MDC	Max-Delbrück-Centrum für molekulare Medizin Max Delbrück Center for Molecular Medicine
MIU	Medizinisches Institut für Umwelthygiene Medical Institute for Environmental Hygiene
MPG	Max-Planck-Gesellschaft Max Planck Society
MPI	Max-Planck-Institut(e) Max Planck Institute(s)
New German Länder	States formed out of the former German Democratic Republic (former East Germany)
Project Management Organization	Projektträger
WHO	World Health Organization
WR	Wissenschaftsrat German Science Council

Appendix IV: Addresses and Persons to Contact

Greater detail about the funding priority fields of the Federal Program can be elicited from the Project Management Organizations (Projektträger):

For the area
"Clinical Research on the Control of Disease":

Deutsche Forschungsanstalt für
Luft- und Raumfahrt e.V. – DLR –
Projektträgerschaft Forschung
im Dienste der Gesundheit
Südstraße 125
53175 Bonn
Germany
Tel.: (02 28) 38 21-210
Fax: (02 28) 38 21-257

For the area
"Research on Preventive Care and Public Services: Public Health":

GSF – Forschungszentrum für
Umwelt und Gesundheit
– Bereich Projektträgerschaften –
Kühbachstraße 11
81543 Munich
Germany
Tel.: (0 89) 65 10-88 11
Fax: (0 89) 65 10-88 44

Information on EC-Programs can be obtained through:

National Contact Point Medical Research / BIOMED
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