Introduction Erasmus MC Research Annual Report 2011

Mission
Erasmus MC is an internationally recognized *University Medical Centre* for high-quality, compassionate care, high-quality knowledge development and highly-rated transfer of knowledge in the fields of illness and health. Our objectives are:

- to create new knowledge on health and disease by performing outstanding research in each of our 3 research domains: the biomedical, the clinical, and the health sciences;
- to provide high grade education in the fields of medicine, health care, health policy and research;
- to provide advanced patient care of an exemplary quality;
- to disseminate knowledge by participating in advisory bodies, in the policy debate and by informing the general public;
- to promote the medical application of new discoveries by an explicit valorisation policy.

This report concerns research. It describes research, and gives a tabular survey of input and output of the research of the Erasmus MC. A general description of all activities (research, education and patient care) of Erasmus MC can be found in 'Betere zorg dankzij topwetenschap - 2011' (on the intranet and only available in Dutch).

Research organization Erasmus MC and structure of the Research Annual Report
At Erasmus MC we believe that progress in medicine and health care is only feasible, if fundamental biomedical research, clinical research and health sciences collaborate in close synergy. In the Erasmus MC Graduate School five internationally highly renowned, KNAW accredited, research schools are closely working together to create this synergy and to offer young people an outstanding foundation for a career in medical and life sciences, by organizing six MSc and five PhD programs.

Most departments participate in these research schools (or institutes). As part of the underlying agreement, departments make a five-year commitment to pool specific researchers and resources in the research school. The heads of departments thus grant authority over part of their research budget and staff to the research schools for a limited period of time. Generally, department heads are also members of the Board of the research school.

Table 1 shows the Erasmus MC research schools. Co-operation between research schools is increasing.

Research schools Erasmus MC	Research themes
Cardiovascular Research School Rotterdam (COEUR)	COEUR promotes basic, translational and clinical cardiovascular research, aimed at improving the understanding of the pathophysiology as well as the prognosis and quality of life of patients with cardiovascular disease. It also trains future national international leaders in the cardiovascular field through a systematic scientific education and training program.
Graduate School Neurosciences Amsterdam Rotterdam (ONWAR Erasmus MC part)	The aim of ONWAR is to coordinate the training program of the PhD-students participating in the school; to organize courses, lectures, annual meetings in the field of neurosciences; to stimulate collaboration in neuroscientific research between the various participating institutes and to stimulate improvement of the quality of research and education in the neurosciences.
Medical Genetics Centre (MGC; Erasmus MC part)	MGC offers its PhD students a number of courses in the broad field of biomedical science, supplementary to the usually highly specialized research programs. This is of great value to both the MGC and the PhD student, improving their marketability and thereby increasing their chances on the job market.
Molecular Medicine (MM)	MolMed stimulates clinically oriented molecular biomedical research. Its core business is translational research. The four main themes of the school are endocrinology, metabolism and ageing; hematopoiesis, lymphopoiesis and immune regulation; solid tumors; infections and host response.
Netherlands Institute for Health Sciences (NIHES; Erasmus MC part)	Its mission is to contribute the identification of determinants of health and disease, prognostic treatment of disease, the identification of factors determining the efficiency of health services and to further develop methods for the acquisition and interpretation of medical data.
Musculoskeletal Science Centre (MUSC, Research Institute)	Fundamental, Patient-related and Public Health Research of Back Pain, Hip- and Knee Disorders, Upper Extremity Disorders.

This Erasmus MC Research Annual Report follows the pattern of the research programmes of the research schools and institute as described in the next section. Thus, results cannot be found looking at the level of departments, but only at the level of research schools/-institutes and programmes. A small proportion of research is not part of research schools/-institutes and is shown separately as other research (OR, at the

back of the report). Via cross-reference tables at the back of the report, one can trace down the contributions of the individual departments.

The programme code EMC MM-03-32-04 can be read as follows: Research school Molecular Medicine (MM), theme three, programme code 32-04 with the title 'Improving accuracy and therapeutic ratio in radiation oncology'. Some themes also contain programmes associated to the research school (indicated with an 'A'). Associated research programmes are scheduled to enter the core of the research school in due time.

Input, output and assessment of quality
The total input into Erasmus MC research reaches approximately 1,350 full time equivalents (fte) of scientific personnel. Funding of research personnel takes place via four so-called budget sources.

- *First source*. Erasmus MC appointment and funding.
- *Second source*. Appointment by the Erasmus MC and funding by the Netherlands Organization for Scientific Research (NWO), the Royal Netherlands Academy of Arts and Sciences (KNAW), the European Union (EU) or the (USA) National Institutes of Health.
- *Third source*. Erasmus MC appointment through sponsoring by charity funds with an independent scientific research council and working on a national level (e.g. Heart Foundation, Cancer Foundation and so on).
- *Fourth source*. Erasmus MC appointment and direct sponsoring by industry, Ministries and various foundations.

More than 60% of total fte input is sponsored by national science foundations, charity funds, industry etc.

Quality control is an indispensable tool in improving research. Research schools are being assessed once every 6 years. The Erasmus MC Research Schools perform on a high quality level as indicated by the accreditation committees of the Royal Netherlands Academy of Arts and Sciences (KNAW). Next to the Research School assessment the research programme of the Erasmus MC as a whole has been assessed. The Centre for Science and Technology Studies (CWTS) performed a bibliometric analysis of the scientific output of Erasmus MC for the period 1997-2010.

In summary, the first bibliometrical assessment indicated a mean normalized citation score of all Erasmus MC publications of 1,61, which means an Erasmus MC publication is cited 61% more than the average scientific publication in the world.

Research funding
In 2011 75% of the first budget source has been allocated as a lump sum and 25% according to performance, i.e. number of PhD theses, amount of external funding (second and third budget source) and top-publications in (Social) Science Citation Index journals.

Apart from the structural and the performance based budget, various extra internal Erasmus MC budgets are made available in order to meet the following objectives: innovation and multidisciplinary cooperation. These budgets add up to about 3.5 M€ per year. In particular these budgets are made available for research in the areas translational research, efficiency research and care related research.

Innovation of research facilities
The Board of the Erasmus MC values the importance of an innovative, state of the art research infrastructure. In order to maintain such an infrastructure new investments are necessary. Jointly, Board and departments invest in equipment and facilities. Moreover, Erasmus MC is very successful in external funding from public and private sources.

Knowledge transfer and starting life science companies
Ultimo 2011, the Erasmus MC Holding B.V. contained 28 companies with a total turnover of EUR 26,4M.
In 2011 6 new companies have been started. The 2012 turnover is expected to be EUR 34M.

Furthermore, the Erasmus MC has established an incubator for start-up companies. The incubator supports researchers starting an innovative company with respect to advise, business planning, housing etc. In 2011 there are 50 participants, 28 of them having started a company within the incubator as yet. During 2012 the Incubator II will be realized in the Rotterdam Science Tower. We expect that the first companies can set up shop in Q3 2012.

The Erasmus MC generates a stream of intellectual property on various aspects of biomedical and clinical research. The financial benefits of intellectual property are being reinvested in research infrastructure and in attracting and retaining of research expertise. In 2011, 15 new patents were applied for.

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Explanation of abbreviations

- Fte: full time equivalent
- SP1: fte scientific personnel 1st budget source
- SP2: fte scientific personnel 2nd budget source
- SP3: fte scientific personnel 3rd budget source
- SP4: fte scientific personnel 4th budget source
- SPtot: total fte scientific personnel
- T1: thesis PhD; graduation internal, research internal
- T2: thesis PhD; graduation internal, research external
- T3: thesis PhD, graduation external, research internal
- IS: international scientific publications in prominent journals with an impact factor
- FS: international scientific publications in journals with expectations of obtaining an impact factor and further scientific publications
- OP: other publications
- Ptot: total number of publications