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Mapping the Landscape II: Biomedical Research in the UK, 1989-2002

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Table of Contents

Abstract

This report presents a map of the landscape of biomedical research in the UK, based on an analysis of biomedical papers published in the UK in the 12 years between 1989 and 2000 as recorded in Research Outputs Database (ROD). It provides an analysis of published research outputs for all of UK biomedicine and for 32 selected biomedical sub-fields. The analyses include the examination of the types of biomedical research carried out in the UK and their potential impact as well as of funding sources, authorship patterns and domestic and international collaboration.

It also sets the UK in an international context, providing and comparing data on the biomedical outputs of 12 OECD nations and other selected countries around the world. The global comparison uses data from 1989-2002. These data is sourced from CD-ROM versions of both the Science Citation Index (SCI) and the Social Sciences Citation Index (SSCI) produced by the Institute for Scientific Information in Philadelphia.

Finally, the report explores new possible directions for an evaluation of the impact of research. For instance, it explores the relationship between different countries' research commitments to the individual sub-fields, and their relative burden of disease, expands on the citation of research papers by clinical guidelines and explores the possibilities of assessing the impact by analysing citations of research by newspapers and in medical education. It also reports new methodological developments aimed at improving our analyses, for instance, a new method of assigning research levels to journal articles.

EXECUTIVE SUMMARY

1 This report presents the results of an analysis of UK biomedical research from 1989-2000 based on papers published in the serial literature and recorded in the Research Output Database. The study analysed 355,183 papers for information on the type of biomedical research conducted in the UK (research level: from clinical to basic), its impact (potential impact category, PIC, of journals), areas of research (32 biomedical subfields), numbers of authors and addresses on individual papers, leading postcode areas, domestic and international collaboration, geographic distribution of biomedical research in the UK (as defined by authors' addresses) and funding information.

2 The report sourced data on the international status of the UK biomedical research from the Institute for Scientific Information Science Citation Index and Social Sciences Citation Index, for the years between 1989 and 2002. The UK was the second biggest producer of biomedical papers in the world after the USA, with a share of around 10% (368,770 papers between 1989 and 2002) of global paper production. However, in the last couple of years, Japan has surpassed the UK's biomedical paper production. (Chapter 2).

3 The UK has shown a consistent downward trend in relative government commitment to civil R&D, over the past decade, its share falling from 0.5 percent of GDP in 1989 to 0.44 percent in 2000. Of the G7 countries, only the USA government sector currently devotes a smaller proportion of national wealth to non-military research. (Chapter 2).

4 Total spending from all sources, public and private, on UK public domain biomedical research is estimated at £2 129 million in 1999-2000. This represents an increase of 14.2 per cent in real terms on the equivalent estimate in the previous edition of Mapping the Landscape for 1994-95. (Chapter 2).

5 Within UK regions, Scotland performs best out of UK regions – producing more papers per one million of population (810 papers) and one million of GDP (83 papers) than England (510 and 51 papers respectively), Wales (387 and 47 papers) or Northern Ireland (348 and 43 papers). (Chapters 2 and 3)

6 The number of papers the UK produced in each of the 32 subject areas analysed varied from nearly 4,000 papers per year (infectious disease research) to only 39 in motor neurone disease research. In terms of absolute numbers, UK produced the most papers in infectious diseases research, genetics, endocrinology and cardiology. In terms of the proportion of the world output, the UK's biggest fields are malaria and asthma (UK publishes over 17% of the world production) and the smallest are tropical veterinary medicine and renal medicine (with only slightly over 8% of world production) and surgery (with 7.5%). (Chapter 2)

7 Between 1989 and 2000, ROD listed 355,183 UK biomedical papers. Over time there has been an increase in numbers of authors and numbers of addresses per paper. There was also an increase in the numbers of papers authored jointly with non-UK scholars (mostly from the US and other EC countries). (Chapter 3)

8 Within the UK, London produced nearly 35% of biomedical outputs. London WC was the leading producer with 7.5% of outputs and was followed by Cambridge (5.6%) and Oxford (5.5%). UCL, University of Cambridge, University of Oxford and University of Edinburgh were the biggest producers of biomedical papers in the UK, each with over 10,000 in the years between 1989 and 2000. (Chapter 3)

9 Funding acknowledgements are present in about 64% of UK biomedical papers. The UK government was the leading source of funds – the Medical Research Council received most individual acknowledgements. However, support from the government sector is decreasing – slightly in

terms of actual numbers of papers funded but more significantly in terms of its share of all UK funded papers. The most dramatic growth was observed from non-UK and international funders and foundations within the UK non-for-profit sector (notably the Wellcome Trust). Basic sub-fields such as genetics are much more likely to record funding than clinical ones such as surgery or dentistry. Papers with more funding acknowledgements were published in higher impact journals: the effect persists to up to six acknowledgements. A positive correlation was also noted between potential impact and numbers of authors per paper, but not numbers of addresses. (Chapters 4 and 5)

10 The link between research publications and clinical practice was explored through an analysis of the citations on clinical guidelines published by the Scottish Intercollegiate Guidelines Network (SIGN) and Health Technology Appraisals commissioned by the National Institute for Clinical Excellence (NICE) in London. Of 6,299 references to papers in the SCI or SSCI, almost 90% were classed as clinical (RLs 1 and 2) and as many as 45% were published in the UK, particularly London and Oxford. The cited papers were also quite recent. The leading funder of cited UK papers was the MRC, followed by the Department of Health (13% each); but the Wellcome Trust was acknowledged on fewer than 3% of such papers (despite being second most frequently acknowledged funder of UK biomedical papers). (Chapter 5)

11 Chapter 6 describes new, exploratory types of bibliometric analyses which attempt to measure the impact of biomedical publications on the heath improvement as well as new methodological approaches.

Chapter 1

1 INTRODUCTION

Biomedical research can be defined as that undertaken to gain knowledge and understanding of basic biological processes and causes of diseases and having direct or indirect medical benefits. For the purpose of this project, it encompasses basic biology (excluding botany and ecology), clinical medicine and biochemistry. It also includes animal health and social sciences allied to medicine. Biomedical research considered in this report was carried out in a range of institutional settings, including medical centres, hospitals, universities, research centres and institutes as well as pharmaceutical and biotech companies.

UK biomedical research is growing fast. It is a vast and vital sphere of science requiring high levels of funding. A strong research base is expensive and the government, non-for-profit organisations and pharmaceutical companies – among many others – provide the money to support the research activity.

What analytical tools do they have that can help them decide which areas need investment and what is value for money? And what is available for administrative bodies managing biomedicine that allows them to see the full scope of the research activities and forces and trends at work?

Mapping the Landscape aims to provide such a tool – a map of biomedical research in Britain. Using data from over 350,000 biomedical research papers published between 1989 and 2000, it filters these papers into 32 disciplines within biomedicine and analyses their funding sources, their authorship, their places of origin and the impact they have on other research. It examines where the UK fits into the international biomedical research world – in terms of international collaboration as well as production levels.

The report relies on the analysis of published outputs of the research process (i.e. a journal article), considering a journal paper to be a worthwhile proxy for research activity – its volume and impact.

The authors of *Mapping the Landscape* hope to provide practitioners of biomedicine and funding agencies with a useful tool for decision-making. Its distillation of the information extracts trends and details that could be invaluable for anyone who wants to know more about what is happening in biomedicine in the UK.

This rich seam of data that *Mapping the Landscape* mines is the Research Output Database (ROD), developed by the Wellcome Trust and maintained at City University, London. ROD contains details of publications from the Science Citation Index (SCI) and the Social Sciences Citation Index (SSCI) and enriched by funding acknowledgement information.

2 Layout of the report

Chapter 2: Global Biomedicine. The chapter provides an overview of research expenditures around the world on science and biomedical research. It also looks at the published outputs of major countries in biomedicine, as a share of their overall science outputs and in absolute terms, in particular those of 12 leading OECD countries. It introduces the 32 sub-fields and the countries' relative commitments to biomedical research (expressed as their share of global production). The expenditure data in this chapter are derived from official sources (the OECD and the UK Office for National Statistics) and from industry sources (the Association of British Pharmaceutical Industries and the Association of Medical Research Charities). The bibliometric data are sourced from the SCI and SSCI (volume of published outputs) and cover the years from 1989 to 2002.

Chapter 3: UK National Outputs. This chapter uses the Research Outputs Database as the source of data on the volume and characteristics of the UK biomedical research output. It examines the numbers of authors and addresses in each paper, geographical distribution of authors, the major research institutions, and the extent of collaboration, both domestic and international. The papers are classified into four research levels (from clinical to basic) and the distribution by research level of UK biomedical and papers in 32 sub-fields is shown. In this and the subsequent chapters data is analysed for years 1989-2000.[1]

Chapter 4: Funding of UK Research. This chapter categorises biomedical funders into five sectors (UK government, UK private-non-profit, industrial, international and non-UK national) and presents the volume of papers and leading funders (i.e. most frequently acknowledged funders) in each sector. It

[1] This is dictated by the delay in data entry into the ROD (one to two years behind the ISI's databases).

also analyses papers without funding acknowledgements and gives data on how the numbers of acknowledgements per paper have changed over time. The report also looks at the distribution of funding acknowledgements for papers in four research levels. The analysis includes data for the individual sub-fields.

Chapter 5: Measuring impacts. This chapter describes the distribution of UK biomedical papers by the potential impact category of the journal and presents data for individual sub-fields. The chapter also analyses the citations on the Health Technology Appraisals published by NICE and the Clinical Guidelines of the SIGN, to show their characteristics and the part played by them in UK research and its individual funders.

Chapter 6: New directions in the analysis of bibliometric outputs. The chapter suggests ways of assessing the impact of bibliometric indicators on the health improvement. For instance, a preliminary examination was made of the relationship – if any – between the burden of disease in a country and the numbers of papers in that field in the country concerned. It also argues for exploratory research on citations of biomedical research papers in medical education and by newspapers. Also, a new way of determining research levels of biomedical papers is proposed.

Annex: Methodology and glossary of terms.

Appendix: Detailed tables and charts.