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Commentary

Annals of Occupational Hygiene at Volume 50: Many Achievements, a Few Mistakes, and an Interesting Future

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The past 10 years have seen a doubling of the number of papers submitted to the Annals, and a 5-fold increase in the number of institutions with access to the journal. Electronic access is now far more important than print access. Papers from British authors dominated the first 20 years of the journal, but the rest of Europe is now more important, with Scandinavia and The Netherlands being the major continental sources. North America is the other major source. For British papers, there has been a big growth in government authors, and a decline in papers from industry and armed forces. From many possible topics, trends are selectively reviewed in: standards and exposure limits; measurement methods and criteria; sampling strategy and statistics; fibres; control banding; dermal exposure; and evaluation of control. For the future, we will continue to have the same aims and standards, but the changes of the past few years, and the growth of new approaches such as open access, have emphasized the difficulty of forecasting. The growth in submissions from countries which we presently regard as 'developing', and especially the growth in higher education in China, and the amount of occupational disease there, are bound to have major impacts. Perhaps the English language will not continue to dominate scientific publishing, but in any case an eastward shift in the source of papers must lead to other changes.

Keywords: history; standards; measurement methods; sampling strategy; fibres; dermal exposure; developing countries

This issue completes the 50th volume of *Annals of Occupational Hygiene*. We have not made much of this occasion, partly because we celebrated BOHS's own jubilee 3 years ago, and partly because the journal does not have its real 50th birthday for another 2 years—in the past volume numbers did not always coincide with calendar years. However, the main reason for not making too much of volume 50 is that the journal's present and future are more interesting than its past, but with that in mind we will spend a few pages looking at where we have come from and where we plan to be going.

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THE REVOLUTION

Scientific journals such as ours are going through perhaps the greatest revolution since they started in the 17th century. Two aspects are illustrated in Figs 1 and 2.

Figure 1 shows that in the 1990s, the Annals, like most scientific journals, was experiencing a steady decline in the number of libraries subscribing, because of budgetary pressures. This was a concern partly for financial reasons, but mainly because it meant that we were reaching fewer and fewer people. This decline in the print edition continues, but Fig. 1 shows that this is now irrelevant because of the number of institutions taking on-line access. The current figure illustrated in Fig. 1 includes almost 1000 institutions in developing countries receiving free or

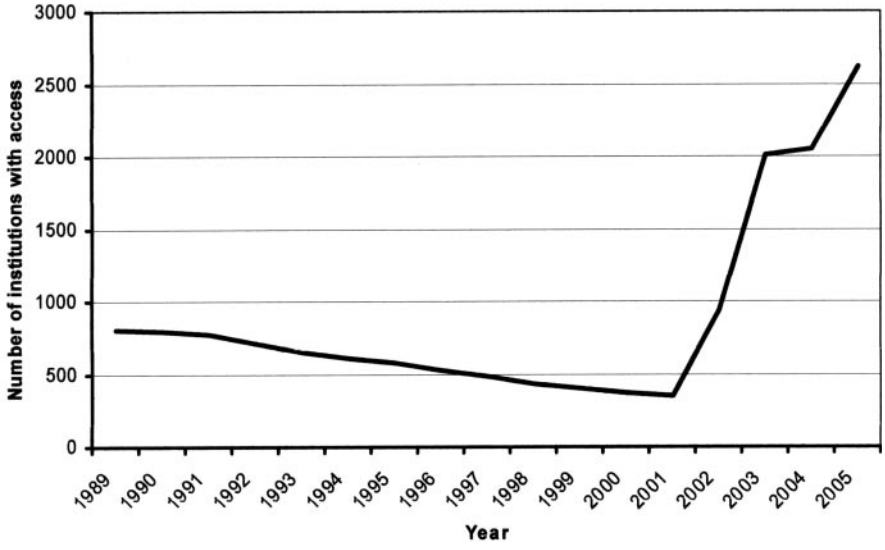

Fig. 1. Number of institutions with full-text access to *Annals of Occupational Hygiene*.

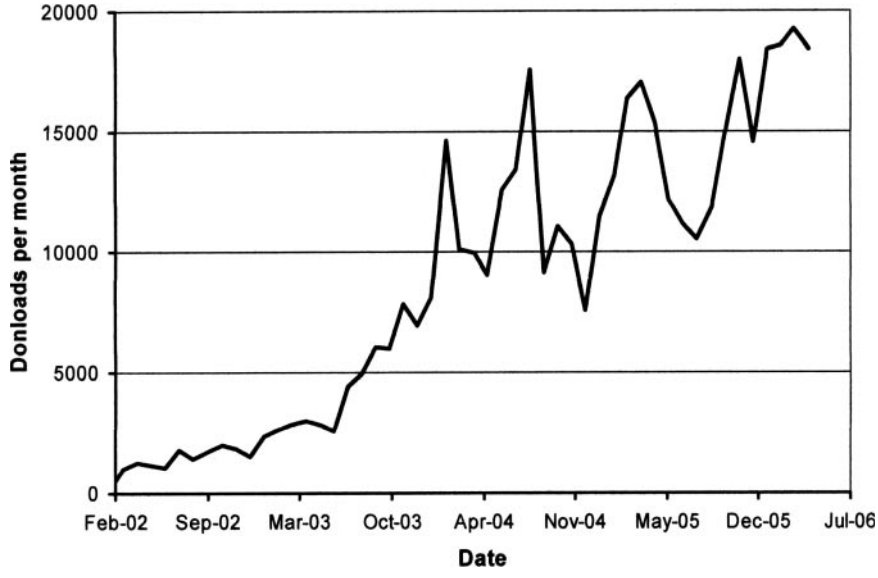

Fig. 2. Number of full-text articles downloaded from the on-line edition each month. This does not include downloads of papers from the advance access site, before they are allocated to an issue.

deeply discounted access under an Oxford University Press scheme, but there has been an increase everywhere. For example, the number of institutions with access in North America has doubled since 2003.

Figure 2 illustrates another aspect of this. Every month the full texts of nearly 20 000 papers are downloaded from the on-line edition; in a sample week in mid-2006, the journal was accessed from over 30 countries. This dwarfs the print circulation. We have no plans to discontinue the print edition, and BOHS members continue to get it as well as on-line access as a membership benefit, but it is clearly increasingly irrelevant for the readership as a whole.

For every 20 hits on Annals full-text papers or abstracts, 5 come through Google (www.google.com) or Google Scholar (www.scholar.google.com), and one through PubMed at the US National Library of Medicine, which holds the Medline database (www.ncbi.nlm.nih.gov/PubMed/). The other 14 hits come via other search engines, library or publisher sites, from other journals, or simply from the publicized table of contents. Those of us who use PubMed every day will be surprised at the low proportion of hits coming by that route, but perhaps people do not realize that it has an excellent coverage of hygiene as well as medicine.

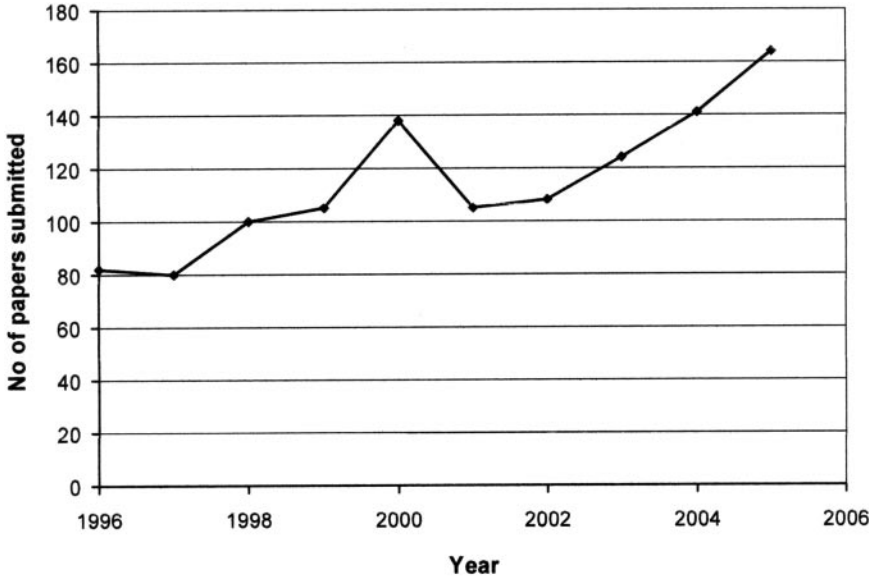

Fig. 3. The number of papers and similar items submitted to the Annals in recent years. At the time of writing, the 2006 rate is ~20% above the 2005 rate.

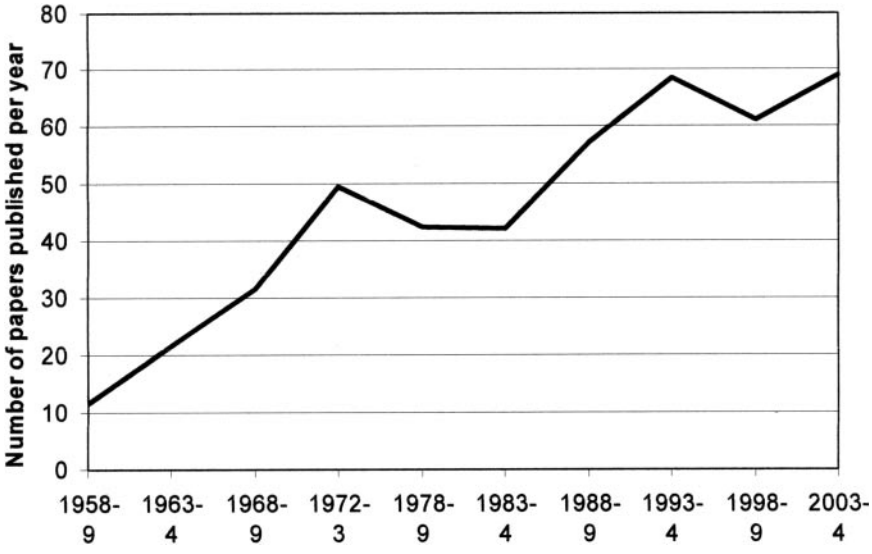

Fig. 4. Number of papers published per year, averaged in 2 year periods. 81 papers were published in 2005.

The number of papers submitted is also increasing rapidly, as can be seen in Fig. 3, and is more than double what it was 10 years ago. We have to adapt our editorial procedures rapidly to cope with this. We appointed a North American Editor in 1997, and the Editor in Chief is now helped by five assistant editors in covering material from the rest of the world. We are keen not to allow this to increase the time it takes to give authors a decision. The rejection rate has increased, and also the journal size (Fig. 4). We can also now put supplementary files without size limit in the on-line edition, and we are encouraging authors to use this. Many biomed journals are experiencing similar pressure. There must be a limit to the number of papers that researchers can write, but it does not seem to be in sight yet. In a recent survey, 49% of researchers felt that too much was published, but only 13% felt that they published too much themselves (Rowlands and Nicholas, 2005).

The on-line edition can also carry audio and video files and colour pictures free of charge. On-line publishing also means that we can publish papers on the web a short time after the proofs have been cleared, and they can be cited in a form which remains valid after their migration to their issue (see http://annhyg.oxfordjournals.org/misc/papfaq.dtl). This means that delay to appearance in print is much less important than it used to be, but we are still keen to minimize it.

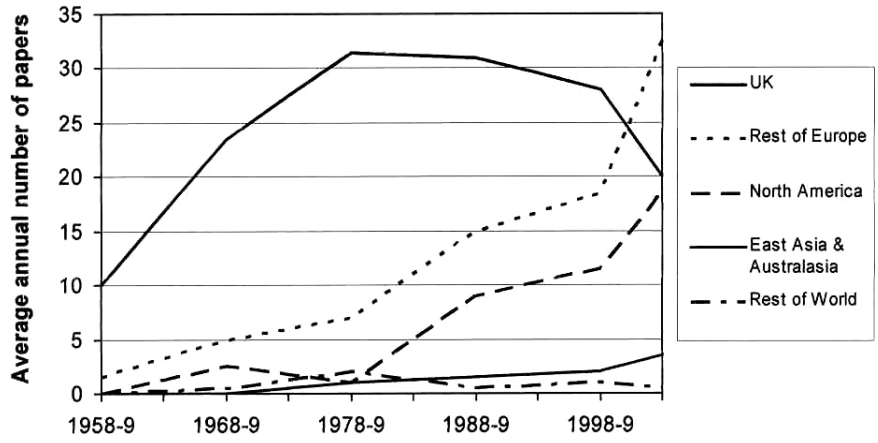

Fig. 5. Numbers of papers published from different regions (by address of first author).

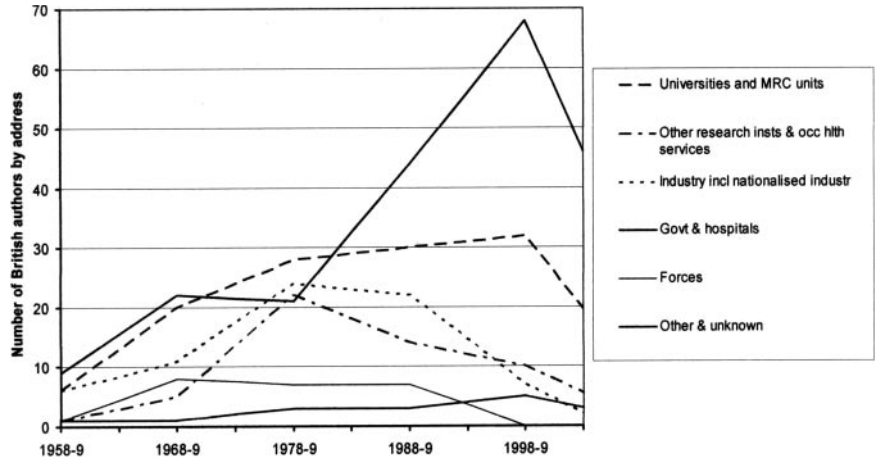

Fig. 6. Number of British authors in different types of organizations.

LONGER-TERM TRENDS

Figure 4 shows how the number of papers published has grown, and Fig. 5 shows the distribution by address of first-named author. British papers dominated the Annals for the first 20 years, but in recent years they have been less important than contributions from the rest of Europe, and comparable with those from North America. The decline in British papers is clarified by Fig. 6, which shows the affiliations of British authors (not just first authors). The most striking features are the decline in the number of industrial authors, and the growth of the number of government authors, almost all from the Health and Safety Executive. Large manufacturers and extractive industries used to be big employers in Britain, with a corresponding interest in occupational hygiene, but this is no longer the case.

Figure 7 gives a breakdown of the 'Rest of Europe' figure in Fig. 5, for 2003–2004. The most prolific single country from continental Europe each year is usually Sweden or The Netherlands, providing 6–12 papers each in recent years. However, European Union finance tends to go to multi-centre projects, and this means that a paper can have authors from half a dozen countries.

CONTENT

Volume 1 of the Annals carried a foreword by Henry Walton (1960), who was at the time President of BOHS, and was later the journal's longest-serving editor, from 1972 to 1987. He said that the Annals would be mainly 'original articles of a high standard concerned with occupational hygiene and its underlying sciences'. This remains the aim. Walton later wrote a chapter on the Annals to BOHS's history (Walton, 1993), in which he detailed his own and others' attempts to achieve it.

Figure 8 shows a rough breakdown of papers by subject for the 5 years 1997–2001. The distribution will not have changed much since.

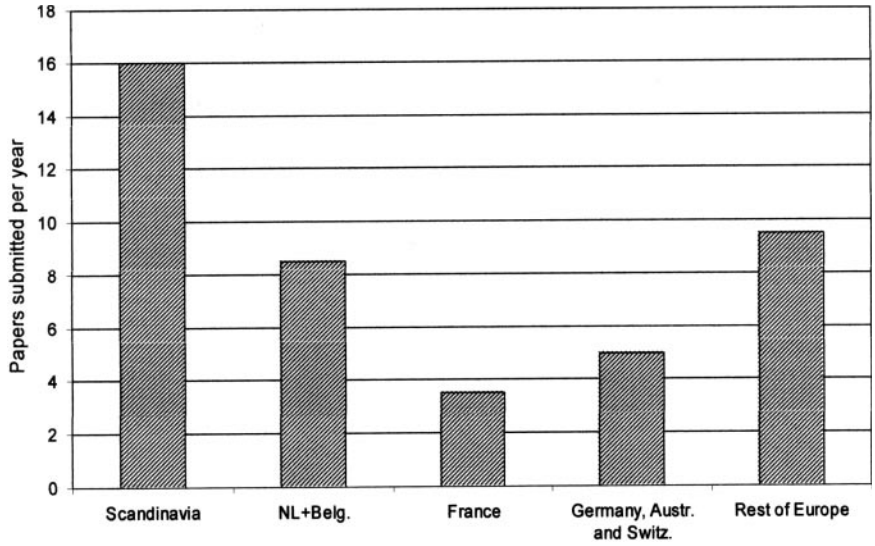

Fig. 7. Average number of papers submitted from different parts of Europe, by address of first author.

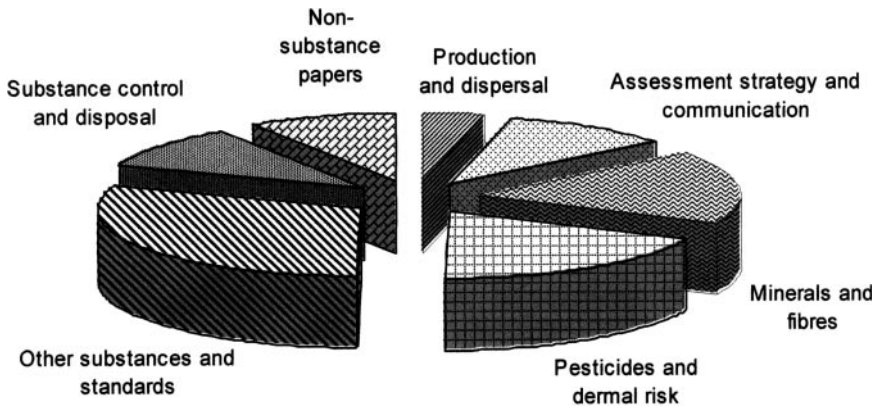

Fig. 8. Rough breakdown of Annals papers by subject, 1997–2001. About two-thirds of the papers were concerned with specific substances or classes of substance, and risk measurement and standards. Ten per cent were non-substance papers, mainly on physical hazards; ~15% were on substance generation, dispersal, control and disposal; and ~10% were on assessment strategy and communication.

Any more detailed selection of topics from the 3000 or so items that we have published must be personal, subjective and very incomplete, but here are some personal comments. A number of the papers cited were discussed in more detail in our celebration of BOHS's 50th anniversary in 2003, when we reproduced in the on-line edition some of the classic papers from the past, accompanied in both editions by commentaries aiming to assess their context and importance. I have not attempted to list all the important papers on the topics mentioned below: more can be found by a search on http://annhyg.oxfordjournals.org/search.dtl. Papers back to 1972 are available on-line, and the complete archive back to 1958 should be available on-line by the end of 2006. Where I have mentioned the contents of an issue, I have given the URL of the contents page.

Standards and exposure limits

In the 1960s and 1970s, BOHS committees published standards for control of various hazards. Two which were especially influential were for chrysotile asbestos (BOHS, 1968) and for wide-band noise (BOHS, 1971). The one for chrysotile asbestos had a number of serious shortcomings, but it also contained innovative proposals for sampling strategy (Ogden, 2003), and was the origin of the 2 fibre ml^{-1} standard which was very widely applied internationally through the 1970s. Lawton (2003) described the wide-band noise standard as 'the first modern noise standard', and the ancestor of those used today. The BOHS standards were an honest attempt to give hygienists and industry benchmarks of satisfactory control, at a time when no one else was much interested, but the asbestos case showed the

difficulty of avoiding industry influence on conclusions when industry held all the data (Greenberg, 2006), and in any case the approach of a paternalistic independent expert committee was largely superseded in Britain by the tripartite system of the Health and Safety Commission.

However, effective standards must be evidence based, and the journal is in the business of publishing evidence, so we continue to influence standards for exposure and control. Papers from the past 5 years specifically aimed at exposure limits or substance classification have included those on sensitizers (Heederik and Houba, 2001), silver (Drake and Hazelwood, 2005), ceramic fibres (Brown *et al*., 2005), titanium dioxide (Hext *et al*., 2005), cold (Malchaire *et al*., 2002; Geng *et al*., 2006) and, as ever, crystalline silica (Borm and Tran, 2002). More fundamentally, Heederik *et al*. (2002) discussed the principles on which exposure limits for sensitizers should be set.

Measurement methods and criteria

Perhaps the single most influential paper ever published in the Annals was the description in volume 2 of a portable pump and its use for personal sampling (Sherwood and Greenhalgh, 1960; Cherrie, 2003). There had been earlier attempts at this, for example, by hanging a thermal precipitator head round the neck of a worker, but use of Sherwood and Greenhalgh's device rapidly showed that in many workplaces a static sampler gave a poor measure of exposure, and personal sampling soon became the standard approach.

For about 30 years from 1960, there were two different approaches to respirable dust used in different parts of the world, and there seemed little chance of reconciliation, and there was no practical agreement on how dust in larger particles should be measured. Soderholm (1989) proposed a compromise on respirable dust at the right time for it to be adopted in the European and International standards and by the ACGIH in the US for use with their threshold limit values. Soderholm's proposal also incorporated the approach to inhalable dust measurement which was proposed in the Annals by Ogden and Birkett (1978) and Vincent and Armbruster (1981), and is now universally adopted through International and European standards. Probably the commonest way of measuring it is to use the IOM sampler of Mark and Vincent (1986), which was reviewed by Kenny (2003). The problem of specifying and testing samplers in relation to these standards was discussed in various Annals papers, for example, Kenny and Lidén (1989), and, following one of the European collaborative projects referred to above, Kenny *et al*. (1997) reported the extent to which various samplers complied with the standard. More recently, Esmen *et al*. (2002) and Johnson and Esmen (2004) have illustrated pitfalls in measuring against the criteria; more positively, Paik and Vincent (2004) have shown that inhalable sampler testing may not need large wind tunnels, and this may turn out to be an important discovery.

One of the earliest papers in the Annals concerned the principles and practice of a two-stage size-selective sampler for microbiological aerosols (May, 1960). A review in the same area is currently

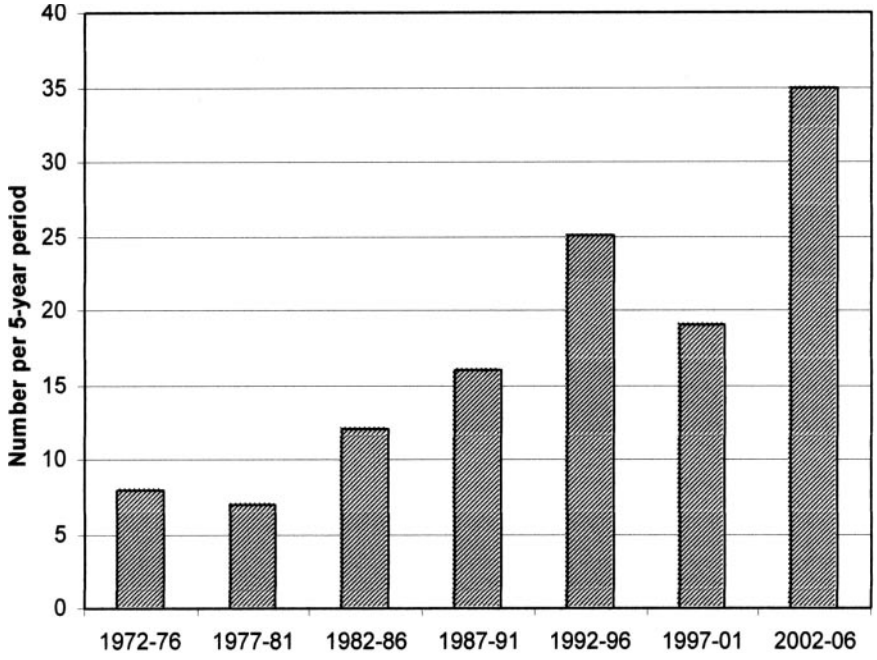

Fig. 9. Five year totals of papers on measurement in blood, urine or breath.

our most downloaded paper (Douwes *et al*., 2003), but the biggest growth area is probably ultrafines (nanoparticles)—their production (Zimmer and Maynard, 2002; Peters *et al*., 2006), measurement (Maynard, 2003; Brouwer *et al*., 2004) and effects (Hext *et al*., 2005). A review of nanotechnology is in press (Maynard, 2006).

There has also been a big growth in papers on biological monitoring techniques over the past 35 years (Fig. 9). Just as the ability to take personal samples rapidly demonstrated that static sampling was inadequate, so biological monitoring has shown that for many substances simply measuring what is inhaled does not give an adequate measure of exposure. Many publications have demonstrated features such as: relative importance of dermal absorption (e.g. McClean *et al*., 2004); the importance of long-term dose where elimination is slow (e.g. Kontsas *et al*., 2004); and the effect of respiratory protection on absorption (e.g. Unwin *et al*., 2006). Other work on dermal exposure is mentioned below. Biological monitoring guidance values of various sorts have followed the availability of techniques, first in Germany, then in the US from ACGIH, and also in Britain and other countries. The practical and ethical problems of taking samples of biological fluids used to be an objection, but in Britain HSE guidance on biological monitoring did much to address these issues (Gompertz, 1994; HSE, 1997).

References to papers on other new and improved methods could be multiplied, together with the questions of what should be measured (e.g. Seixas *et al*., 2005), and the problems of modelling exposure in the absence of adequate data (e.g. Northage, 2005). Such papers will remain a staple as long as measurement remains fundamental to occupational hygiene.

Sampling strategy and statistics

The classic approach to measuring exposure is to divide the workers into groups expected to have more-or-less the same exposure and to take one or more samples from each in a rather unsystematic manner. This approach was made obsolete by the early 1990s, notably by Rappaport (1991), and by Kromhout *et al*. (1993), who accumulated a large database and used it to demonstrate the variability within and between groups. Burdorf (1993) wrote an editorial tracing the history of sampling strategy and discussing the implications of the growing use of these statistical methods, concluding with the prophetic comment, 'The occupational hygiene professionals will be challenged to convert these novel methods into a powerful tool in their daily practice.'

Rappaport *et al*. (1995) then applied the new techniques to design a compliance-testing strategy, and Preller *et al*. (1995) demonstrated how statistical design and analysis of surveys could be used to prioritize control methods. The effect of Kromhout *et al*.'s work and these subsequent developments were briefly but lucidly reviewed by Burdorf and van Tongeren (2003), along with more recent approaches such as those of Peretz *et al*. (2002) and Wild *et al*. (2002). Burstyn (2004) provided a tutorial on principal component analysis, which the download numbers show to be reassuringly popular.

I say 'reassuringly' because many sampling surveys submitted for publication still use something like the classic approach, despite Preller *et al*.'s demonstration of the power of more modern statistical techniques for choosing control methods, and the journal has been criticized for continuing to publish papers using the old ad hoc approach to sampling strategy. The Editorial Board is considering its policy on this. A problem is that the surveys may still contain useful information. This is not the only example of persistence of obsolete methods: the Annals still gets submissions of surveys based on static sampling, 40 years after this was shown to be a very limited value. Perhaps the persistence of the old methods reflects the neglect of occupational hygiene as a university topic in many countries (Vincent, 2005).

Nevertheless, the modern statistical techniques are powerful, and surveys which neglect them are bound to lose information, and it is a moot point as to whether the journal should continue to tolerate submissions using the classic approach to sampling strategy. A recent example of the power of the more modern techniques is given by Meijster *et al*. (2004), who used principal component analysis to identify sources of exposure in a new process. Since the foundation of BOHS, hygienists have argued for incorporating hygiene into design and commissioning, and this paper illustrates how modern techniques facilitate this.

This is a very active field, with a lot of interest recently in the application of Bayesian statistics (e.g. Ramachandran, 2001, 2002; Burstyn and Kromhout, 2002; Wild *et al*., 2002; Lavoué *et al*., 2006). One of the applications of this is reconstruction of old exposures for epidemiological purposes, but this has also been studied using other models and structured approaches (e.g. Cherrie and Schneider, 1999).

Fibres

The Annals' first paper on control of asbestos was Bamblin (1959). By the 1970s we carried on average a paper per issue on asbestos. The rate doubled in the 1980s, but since 1990 has decreased somewhat. Glass and ceramic fibres have also been a continuing interest, and the disaster of asbestos disease has made researchers alert to other durable fibres,

recently illustrated by the paper by Skogstad *et al.* (2006) on silicon carbide fibres. We carried in a special issue the proceedings of the 1986 WHO symposium on man-made fibres in the working environment (see http://annhyg.oxfordjournals.org/content/vol31/issue4B/index.dtl), and in 1995 the proceedings of a workshop on the assessment of toxicity of man-made fibres, at a time when this was an important issue in classification in the European Union (http://annhyg.oxfordjournals.org/content/vol39/issue5/index.dtl). Between these two, we published a workshop on chrysotile, organized by the International Commission on Occupational Health and the International Programme on Chemical Safety (http://annhyg.oxfordjournals.org/content/vol38/issue4/index.dtl).

With several hundred Annals papers on these topics, an adequate survey is impossible within the scope of this commentary.

Many of the 1970s papers were concerned with measurement and came out of the work at the Institute of Occupational Medicine for the asbestos industry. IOM staff had experience with the quality control problems of counting coal dust on thermal precipitator slides (Holdsworth *et al.*, 1954). Trials showed that asbestos counts on membrane filters had similar variability (e.g. Beckett and Attfield, 1974; Walton *et al.*, 1976). This led to two devices which have become almost universal in fibre-counting methods, the Walton–Beckett graticule (Walton and Beckett, 1977) and the HSE/NPL test slide for checking microscope resolution (Le Guen *et al.*, 1984), but even more important was the establishment of the RICE interlaboratory sample exchange scheme (Crawford and Cowie, 1984; Crawford *et al.*, 1992; Brown *et al.*, 2002). This has influenced various international schemes (e.g. Arroyo and Rojo, 2001; Jones *et al.*, 2005). A 1986 compilation of techniques for within-laboratory quality control (Ogden *et al.*, 1986) is still used by the United Kingdom Accreditation Service in guidance for laboratories.

In 1982 Henry Walton wrote an extensive review of asbestos and its problems, which at the suggestion of BOHS Council was allowed to occupy a whole issue of the Annals (Walton, 1982). In many ways it was more complete and incisive than the report of the UK government's Advisory Committee on Asbestos which came out the previous year.

The Annals has been central to the problems of asbestos measurement, but it has been less important as a source on fibre toxicology and epidemiology. It has however carried major work on the determinants of fibre toxicity (e.g. Miller *et al.*, 1999a,b; Searl *et al.*, 1999). Some important papers on asbestos epidemiology have been those on the Quebec asbestos miners and millers (e.g. Liddell *et al.*, 1997, 1998; McDonald, 1998), and more recently a meta-analysis of the risks to motor vehicle mechanics (Goodman *et al.*, 2004). The influence of smoking on asbestos disease has always been seen as important, and Liddell (2001) showed that common assumptions about this were oversimplified (see also Berry and Liddell, 2004). Perhaps our most influential recent paper in this field has been a survey by HSE staff of the risks of asbestos (Hodgson and Darnton, 2000), although it led to some strongly dissenting correspondence. Much of the study of asbestos-related disease is now concerned with the compensation of victims (Burdorf and Swuste, 1999; Burdorf *et al.*, 2003).

Control banding

Topping *et al.* (1998) reported some market research for HSE which showed that the British system of exposure limits, although theoretically well-designed, was not understood even by large chemical users. Five other papers in the same issue described an alternative approach, called control banding, by which chemical users would use the R phrases on a substance label, and details of the use of the substance, to pick a method of control (see http://annhyg.oxfordjournals.org/content/vol42/issue6/index.dtl). It would not be necessary for the substance to have an exposure limit, although exposure limits were used in the system's validation. There had been earlier attempts at this sort of thing. Gardner and Oldershaw (1991) explored moving from R phrases to exposure limits; an approach based on toxicity had been proposed for the design of controls (Money, 1992); the British chemical and pharmaceutical industries had issued related guidelines (Guest, 1998); and Regnier *et al.* (1996) quote French guidance from 1990 which combined toxicity and quantity to specify controls. However, following the 1998 series of papers there was rapid development internationally and in Britain, where the approach is now called COSHH Essentials. Issue 47(7) included an editorial and six papers from an international workshop (see http://annhyg.oxfordjournals.org/content/vol47/issue7/index.dtl for details), and we have recently published two papers relating level of control to exposure (Jones and Nicas, 2006a,b). These have attracted critical correspondence (Evans and Garrod, 2006; Jones and Nicas, 2006c; Money *et al.*, 2006).

Dermal exposure

We published no items with the phrases *dermal exposure* or *skin exposure* in the title before 1992, 11 between 1992 and 1999, and 40 since 2000. Certainly there was awareness of the relevance of skin exposure before 1992, and the ACGIH TLVs and other exposure limit lists marked substances for which it might be important, but these numbers of papers show how systematic study of the subject has grown. Several factors have contributed to this.

Measurement techniques have been improved and have become more readily available (Fenske, 1993), and there has been a deeper consideration of what should be measured and the conceptual model in terms of which results can be interpreted (Cherrie and Robertson, 1995; Schneider *et al*., 1999, 2000). In 2003 and 2004 we devoted parts of two issues to a European Union collaborative study, RISKOFDERM, which gathered a great deal of data and attempted to analyse them in a way which could be generally applied [see http://annhyg.oxfordjournals.org/content/vol47/issue8/index.dtl and http://annhyg.oxfordjournals.org/content/vol48/issue3/index.dtl, summarized by van Hemmen (2004) and Rajan-Sithamparanadarajah *et al*. (2004); see also Warren *et al*. (2006) and Marquart *et al*. (2006)].

Before these studies, the usual approach to skin exposure was to avoid it by personal protection. The growth in interest in dermal exposure has been paralleled by a growth in study of gloves over the past 15 years. Like other forms of protection they turn out to be less protective than generally assumed unless they are used properly, and to be less effective in the workplace than in laboratory tests (Cherrie *et al*., 2004; Rawson *et al*., 2005; Packham, 2006).

Research on dermal exposure cannot be isolated from work on pesticides and biocides, for which absorption through the skin is often the major route. As well as many individual papers over the years, we had a 24-paper special issue in 2001 on the risk assessment of pesticides, kindly paid for by TNO (http://annhyg.oxfordjournals.org/content/vol45/suppl_1/index.dtl). With so much agricultural and horticultural produce now coming into Europe and North America from the tropics, it has been encouraging to be able to publish papers from developing countries on the problems of pesticides (Ohayo-Mitoko, 1999; Aragón *et al*., 2004, 2006; Blanco *et al*., 2005). A new area of concern for us is bystander exposure to pesticides (van Hemmen, 2006).

These topics are also bound to grow.

Control evaluation: A neglected topic?

A member of the Editorial Board commented on a draft of this paper that there were relatively few papers on control, and even fewer on evaluation of controls, in contrast to research on interventions in medicine and ergonomics.

There have been quite a few studies of individual techniques of dust control. Examples are the long series from HSE laboratories on local exhaust ventilation (Fletcher, 1977, 1978, 1995; Fletcher and Johnson, 1982; Saunders and Fletcher, 1993) and individual control devices (Wake *et al*., 1991, 1992; Thorpe and Brown 1994, 1995; Johnson and Brown, 1998); and Jones and James' (1987) interesting theoretical and experimental study of the performance of spray nozzles used on mining machinery. A Taiwan group is now producing some valuable studies of ventilation control, including some innovative work on fume cupboards (Huang *et al*., 2005, 2006; Tseng *et al*., 2006), and of course there have been many studies of respiratory protection.

However, there are relatively few studies which evaluate the practical effect of the introduction of control in a workplace. In recent years Croteau *et al*. (2004) looked at the effect of LEV on respirable silica exposure on a construction site, and for the same endpoint Thorpe *et al*. (1999) looked at the effect of various controls with cut-off saws, and Beamer *et al*. (2005) at misting controls in brick cutting (using an experimental chamber). Breum *et al*. (1989) compared dilution and displacement ventilation in an electroplating plant. There have been a couple of attempts to evaluate modification of the source of hazard. Bartlett *et al*. (1999) looked at the overall effect of substituting vegetable oils for conventional organic cleaning solvents in lithographic printing, considering factors such as effectiveness, training, spillages and slip hazard; and Lavoué *et al*. (2003) reviewed the likely effects of substituting aqueous solvents in metal degreasing. Uter *et al*. (2004) looked for an effect on dermatitis risk on the introduction of ferrous sulphate in cement. Finally, Veillette *et al*. (2004) looked at the effectiveness of system cleaning for control of the microbiological hazard of metalworking fluids.

There is growing interest in the evaluation of systems of approach to control. Topping *et al*.'s (1998) evaluation of knowledge of exposure limits might be put in this class, and Jones and Nicas' (2006a,b) attempts to evaluate control banding give another example. There is clearly a lot more to do on this.

Despite these examples, studies that compare workplaces before and after introduction of recommended controls are relatively rare, and such a subject is clearly central to occupational hygiene. The modern statistical approaches referred to above should be ideal for this, and we await the papers.

And the rest...

Of the hundreds of papers not mentioned here, many were significant in their field, but I will mention five others from my personal choice. Although cooling tower plumes are frequently blamed for *Legionella* outbreaks, this has usually been inferred from the presence of organisms in the water supply. Apparently, Ishimatsu *et al*. (2001) were the first actually to measure the airborne organisms in a plume. Interest in this paper began slowly, but citations and downloads show that interest has been

growing. The second paper was the major study of the Seveso accident by Homberger *et al*. (1979). This was by any account an incident with far-reaching consequences for the regulation and operation of large chemical plants. Although the paper was awarded the Bedford Prize by BOHS, it is generally little known. It is clearly speculative to pick out recent papers which may turn out to be very influential. Nieuwenhuijsen *et al*. (2005) conducted an interesting study in which they examined the reliability of answers given in household questionnaires on pesticide exposure, and found that 90% of the 94 respondents who did not report the use of pesticides in the questionnaire reported the use of pesticides during a follow-up interview, and that the likelihood of reporting was related to perception of risk. This must surely turn out to be important for studies which use questionnaires. Another landmark may be Cherrie *et al*. (2006), who give a conceptual framework for the ingestion route. The papers by some of these authors proposing a framework for dermal assessment provided a stimulus to the study of that route (Schneider *et al*., 1999, 2000); it will be interesting to see if the same applies to the ingestion paper. Finally, and much further back, I will mention the classic and influential paper by May and Clifford (1967), which provided information on impaction efficiency, supported by May's virtuoso experimental studies in aerosol science. It was the first Annals paper that I remember using, when I was trying to collect particles from clouds in Australia in the late 1960s. I did wonder how it came to be in a journal with such a peculiar title.

WHERE DO WE GO FROM HERE?

Ten years ago our Instructions to Authors were still saying that charts should be carefully drawn in black ink on Bristol board or tracing linen, although even then the publisher's production department was not very sure what Bristol board was. We certainly could not have foreseen how things would change in such a short time, so it is futile to expect that we can predict what the next 10 years will bring, let alone 50. The growth of use of the on-line edition and its versatility, and the changing patterns of searching for and accessing information, mean rapid change. We can expect a shift in paying for publication from the reader to the author through open access. Universities and some research funders are pushing for this, and Annals authors can choose it at present after a paper is accepted; free-access papers seem to get significantly more downloads. We cannot predict how all this will work out, but we must position the journal to be flexible enough to accommodate and exploit the changes. Our purpose will remain to publish 'original articles of a high standard concerned with occupational hygiene and its underlying sciences', as Walton (1960) put it, and to be as helpful to authors as the pressures will permit.

However, bigger changes may come from the changing sources of papers. Five years ago we would get half a dozen submissions a year from developing countries. Recently, we have been getting about 30 a year, and the hygiene problems they report are sometimes severe. We have been used to getting good material from sources in east Asia such as Japan and Taiwan, but we are now seeing a growth in submissions from the Chinese People's Republic. It is widely predicted that before the Annals gets to Volume 100 China's gross domestic product will have passed that of the US, and perhaps its per capita GDP will as well. Focusing on how this will affect the Annals in the medium term, in 2005 China had 16 million students enrolled in higher education, about half a million of them postgraduate, and about 130 000 on doctoral courses. In 2005, China spent £60 billion on higher education, and government spending on research is doubling every 4 years. In 1998 President Jiang Zemin had announced that China must have 'a number of first-rate universities at international advanced level'. That number was later stated to be 9, but it was announced in 2004 that a further 29 universities would be funded to raise them up to internationally competitive standards. Currently, China has 720 universities and 313 research institutes able to offer postgraduate course. In 2004, the 600 universities represented by the China Academic Library Information Service spent £35.7 million on paper-based journals and £17.6 million on databases.

With its huge manufacturing and extractive industries, we know that China has many occupational hygiene problems. Last January, China Labour Bulletin quoted the General Administration of Work Safety, the responsible government body, as saying there were 700 million cases of occupational disease in China—more than half the population! More credibly, in July, China Daily reported that China has 10 000 new cases of pneumoconiosis a year. Li Tao, head of the Occupational Health and Poisons Control Institute in the China Centre for Disease Control was quoted as saying that the direct and indirect cost of occupational disease and injury could exceed $US 25 billion a year. However, the China Daily report says that, despite the above figures on university expansion, scientific research and education in occupational health in universities was weakening, with fewer people interested in the subject. Moreover, the emphasis of the report is on provision of occupational health services and medical information, rather than preventive work through hygiene and safety. This sounds a familiar story!

(Information in the previous two paragraphs was taken from Wilson and Purushothaman, 2003; China.com, 2004; Li, 2004; Normile, 2005; China

Daily, 2006; China Labour Bulletin, 2006; and Martin Richardson, Oxford University Press, 2006, personal communication.)

Something else may follow anyway. We have got used to the idea, during the Annals' lifetime, that the journals we want to read are in English. As an example, the great German journal *Naturwissenschaften*, which last century published papers by Einstein, Heisenberg, Max von Laue, von Frisch, Eigen and Konrad Lorenz, now only accepts papers in English. In its early days, the Annals would accept papers in French and German, but I think that the last time it published one was in about 1966. Oxford University Press has established an 'English polishing service' to help Chinese applicants to its journals. But there is no particular reason why this linguistic state of affairs will continue. The English poet Edmund Waller, born only 400 years ago, was sure that

Poets that lasting marble seek
Must carve in Latin or in Greek,

but he turned out to be wrong. Maybe the same is true of English as the language of scientific publishing.

Even if the language does not change, an eastward shift in the source of papers will have other influences. Rowlands and Nicholson (2005) did a detailed survey of the attitudes of 5500 corresponding authors. Asian authors put much less value on peer review than authors in the West. They were the most likely to think that a shift from journals being financed by payment by readers to an author-pays open-access system would undermine scholarly journals, and the most likely to think that this was a good thing! This may have reflected bad experience with Western-based journals, but it was not due to ignorance. Rowland and Nicholson found that there was much more awareness of open access among authors from Eastern Europe, Asia and Africa, than Western Europe and North America, with the lowest awareness in Australasia. How authorship will shift, and what effect this will have, remains to be seen, but changes are certain.

The future is unclear, and may be in Chinese, but we can be certain that any review by my successor of the first hundred volumes of the Annals will look very different.

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