

SPECIAL ARTICLE

Where next in basic asthma research?*

T. H. Lee and J. Barnes

National Asthma Campaign, London, UK

Introduction

Asthma is a significant health problem. Prevalence of the condition continues to grow, and in the UK an estimated 8 million people are diagnosed as having asthma, with 5 million people receiving treatment. The cost of asthma to the national health service is more than £850 million a year, and yet there are many people with asthma for whom available care and medication are not relieving symptoms [1].

In recent years there have been major advances in our understanding of the mechanisms and genetics of asthma. Some findings have already led to the development of new therapeutic agents, and others might be the basis for further new drug entities. The National Asthma Campaign is dedicated to conquering asthma, and has contributed to the seed-corn funding of research, some of which has paved the way for important discoveries. However, while much has been achieved, many unmet needs remain.

In the light of the recent rapid expansion of knowledge the National Asthma Campaign felt it timely to review progress. The charity decided to consult widely with experts on the priorities for asthma research over the next five years, to ensure that the full range of research needed to conquer asthma is undertaken. The findings of the National Asthma Campaign's national consultation on basic asthma research strategy are outlined in this summary. The summary encompasses consensus views on the state-of-the-art and makes recommendations for future work.

Aims of the consultation

The aims of the National Asthma Campaign's national consultation on basic asthma research strategy are set out in Table 1.

Setting up the consultation

The National Asthma Campaign convened an executive group of asthma scientists and representatives from the major funding agencies. A representative from the Netherlands Asthma Foundation provided an international perspective.

The executive group identified seven major areas for basic asthma research (Table 2) to receive detailed consideration by a

working group. These topics included laboratory based research and research that translates laboratory findings into clinical settings. A clinical and a non-clinical investigator of international repute were invited to co-chair each of six working groups, the seventh being chaired by an investigator who combines both roles. The chairmen were asked to invite six to eight experts to discuss the area in depth and write a report. Chairmen were encouraged to recruit individuals from different disciplines and participants included, for instance, vascular biologists, rheumatologists and genetic epidemiologists in addition to asthma scientists (appendix 1). Each working group was advised that its discussions and recommendations should not be constrained by considerations of financial affordability, but should be driven by science and vision. Once the strategic issues were identified, the National Asthma Campaign could prioritize its research portfolio and develop imaginative ways to fund the necessary body of work.

The National Asthma Campaign's current portfolio

For more than a decade the National Asthma Campaign has provided grant support for asthma research. By the mid-1990s funding levels had grown to over £2 million a year and the portfolio has maintained its value since then. To date, the charity has spent £18 million on research. Most of the research funded is laboratory work or work that translates laboratory findings into clinical settings. The portfolio has supported both people and research projects:

- about 20% of annual research grant expenditure is devoted to relatively long-term support for individuals, in the form of 5-year fellowships and support for two university professorships;
- the remaining grant expenditure provides support for projects (Fig. 1), typically in the form of 2-year grants each averaging £45 000 a year. Project grants are awarded on the recommendations of a research committee that invites an annual round of applications; each competing submission is assessed for relevance to asthma, scientific merit and likely value for money.

Although the charity publishes a list of topics in asthma that it would particularly like to see investigated, the list is a guide only and priority is given to supporting the best ideas coming forward from the asthma research community.

Research training is not supported directly but it is recognized that many project grants provide opportunities for young researchers to undertake work for higher degrees. It is recognized that any project, in addition to its intrinsic merit, might provide leads for continuing investigation or development and thus pave the way for possibly larger scale, more definitive studies.

Correspondence: Professor Tak H. Lee, Department of Allergy, Guy's Hospital, London SE1 9RT, UK. E-mail: tak.lee@kcl.ac.uk

*On behalf of participants in the National Asthma Campaign's consultation on basic asthma research strategy

Table 1. Aims of the National Asthma Campaign's consultation exercise

To identify the important questions in basic asthma research that should be addressed in the next 5 years
To assess the extent to which these questions are being addressed and, if a question is not being addressed, to identify the reasons (e.g. research capacity, problem formulation, scale and mode of funding or organization)
To inform the National Asthma Campaign's strategy for basic asthma research priorities over the next five years, and determine the most appropriate means of pursuing the charity's mission to "Conquer Asthma"

Table 2. Areas of basic asthma research identified for detailed evaluation

Genetics
Early life events
Environmental impact
Immunology and immunotherapy
Inflammation and anti-inflammation
Airway remodelling
Interface between academia and industry

National Asthma Campaign grant holders are encouraged to publish results from their research. Each year an average of 80–90 original research papers in which the National Asthma Campaign is acknowledged as a funding body are published in international peer-reviewed journals. The impact of these publications, as assessed by the citation scores of the journals in which they appear, rose steadily over the 1990s. Today most papers that acknowledge the National Asthma Campaign as a funding agency appear in the top 30% of journals publishing respiratory research. The charity's research budget is relatively small but the funded research results in a large volume of scientific publications, of which the potential impact is increasing year by year.

Key issues and recommendations

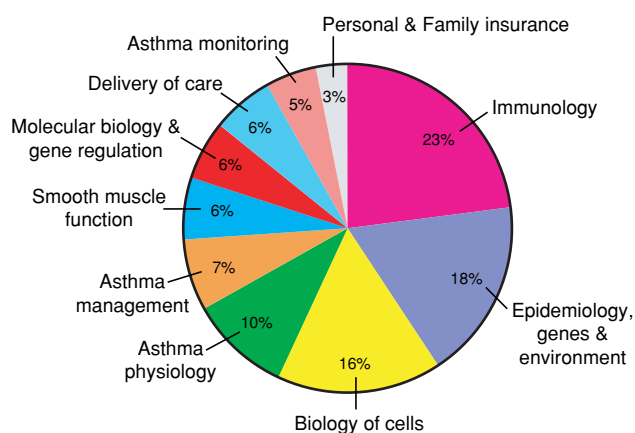
We summarize here the main points emerging from the seven workshops on different areas of basic asthma research. General points are presented first, and then specific issues discussed in more detail.

General points

Definition of phenotypes Asthma is a heterogeneous disorder and future work needs to devote greater attention to the different phenotypes of the disease.

Longitudinal studies Greater emphasis should be given to longitudinal studies rather than single 'snapshots' in time. This raises issues of funding, as such studies might run for up to 10 years.

Hypotheses Existing hypotheses on the causation of asthma urgently require testing to provide clarity and to bring current theorizing to a conclusion.

Distribution of projects by subject area (1993–2000)**Fig. 1.** Asthma research funded by the National Asthma Campaign, 1993–2000: distribution of projects by subject area.

Human research Research should be considered in the context of a continuum from bench to patient. Clinical research in the UK is particularly strong and translational research in asthma has been successful in providing many insights. Future expeditious progress will depend on continued support for experimental medicine in asthma.

Tissue collections Collections of DNA, RNA and lung tissue could be coordinated centrally (possibly by the National Asthma Campaign in partnership with other funding agencies) to maximize research opportunities.

Networks Co-operative multidisciplinary networks should be established; this will require standardization of methodologies. Greater use could be made of existing databases, which should be collated across centres both nationally and internationally. Partnerships between academia and industry can be productive and should be encouraged. Patients recruited for short-term drug trials are carefully characterized, and it was suggested that there could be enormous research opportunities if the pharmaceutical industry could facilitate long-term follow-up of cohorts of trial participants.

Funding It was felt important that support for asthma research should be gained from Government agencies, charities, industry and universities. The National Asthma Campaign could discuss with the Medical Research Council, the Wellcome Trust, the Department of Health, private donors,

industrial partners and even venture capitalists whether there are opportunities for collaborative funding of major research projects. Opportunities for international exchange and collaboration with related charities in Europe could be explored. With respect to large-scale, lengthy, multicentre longitudinal studies, it will be imperative to have clear objectives, robust design, transparent milestones and a well-defined exit point at which the study will be concluded. While funding mechanisms should reward collaboration, there is an absolute necessity for transparency on process. It is recognized that while some types of research are best conducted through a commissioning process, creativity must not be stifled and reactive mode funding should be retained.

Fellowships To ensure a steady supply of asthma researchers coming through the career structure and to provide greater job security, the National Asthma Campaign could both support more clinical and non-clinical scientists and training fellows and also provide funding over longer periods (e.g. fund posts offering 5-year tenure). This could be an area in which it would be fruitful to explore possibilities for joint initiatives with other funding bodies and with industry.

The major questions for asthma research Areas for asthma research can be divided pragmatically into those relating to initiation, resolution and perpetuation of the condition. 'Initiation' encompasses genetics, early life events and certain aspects of the impact of environmental factors, and high priority was assigned to establishing whether allergy and asthma can be prevented in infancy (primary prevention). It was also considered important to understand the mechanisms for remission of asthma in adolescence. Questions highlighted in relation to the perpetuation of asthma included how and whether inflammation and immunology contribute to chronicity of disease, what is the precise role of airway remodelling and whether it is reversible or progressive. Occupational asthma was proposed as a useful model to investigate mechanisms of initiation, perpetuation and resolution of the condition.

Communication It is imperative that significant scientific advances and the mission of the National Asthma Campaign's research portfolio are brought into the public domain, not only to keep patients informed and for public accountability, but also for future fund raising purposes. Similarly, people with asthma and their advocates have a role in advising scientists on research directions.

Specific points

Asthma genetics

Phenotypes Doctor-diagnosed asthma is a robust phenotype for studying the onset of the disease, but there are few robust phenotypes for the study of disease progression. Study of the genetics of asthma in preschool children is confounded by the presence in this age group of several distinct disease phenotypes. Genetic influences on the development of asthma in later life are obscured by the effects of other conditions such as chronic obstructive pulmonary disease (COPD). Longitudinal monitoring of people with asthma will be a critical element in generating the most accurate phenotype.

Age-specific effects Most studies of asthma genetics are based on a 'snapshot' of a particular population. As genetic influences on asthma are likely to have age-specific effects, it would be advantageous for longitudinal cohort studies to include genetic analyses.

Human Genome Project The Human Genome Project has created the potential for major advances in genetics, but there are significant methodological problems in applying any information gained to complex conditions such as asthma. Positional cloning has been less informative than was anticipated. Combining genomic and proteomic approaches might provide a way forward. The likely advances in the postgenome era need urgent attention; for example, we should be planning how to evaluate the functional consequences of newly discovered genes. Work of this type is expensive and might be best achieved in collaboration with industrial partners. Studies of polymorphisms/mutations could also be useful but would require large sample sizes.

Pharmacogenetics of asthma Studies of relationships between genetic polymorphisms within drug targets and response to treatment, as observed for example with β_2 -agonists, could yield useful information.

Neglected approaches Approaches that have been fruitful in clarifying the genetics of other complex diseases such as rheumatoid arthritis could be applied to asthma genetics; for example, twin studies, migrant studies, identification of subphenotypes, studies of large extended families and studies in isolated populations (e.g. Amish, Hutterites).

Cohorts The National Asthma Campaign could make a major contribution in the field of cohort studies by documenting and organizing the large amounts of information already available. This role could also extend to include co-ordination of any future studies in the available cohorts. It was suggested that a workshop to discuss how best to handle the substantial volume of data relating to this complex area would be productive. Issues for debate would include cohorts, database accuracy, study size and use of bioinformatics.

Links with industry The genetics group saw close collaboration with industry as an obvious way forward in this research area; for example, genome screens and expression profiling are best conducted with industrial partners. However, to avoid potential problems surrounding intellectual property rights, confidentiality agreements and resulting delays in publication, it is necessary to draw up conceptual and contractual agreements with industrial partners.

Early life events and the development of asthma

Asthma phenotypes The term 'asthma' embraces several distinct disease phenotypes. This is particularly apparent in preschool children, a group in which it is necessary to distinguish between acute viral episodic wheezing and wheezing with underlying atopy. Establishing better characterization of the different types of asthma is a priority, so that research can be directed at the different phenotypes within the spectrum of disease.

Causal factors No single study has been identified that, if conducted, would lead directly to an answer to the question of what causes asthma. Instead, it is necessary to examine the possible roles of a range of agents, including allergen exposure, microbial exposure, nutrients/diet and pollutants. It would seem that fundamental steps towards understanding the cause of asthma are:

- elucidation of the mechanisms for development and activation of Th1, Th2 and regulatory T cells and of resident structural cells in target organs;
- an understanding of how environmental agents influence these mechanisms.

Intervention studies Specific interventions to assess the importance of causative factors in the development of asthma require careful design. It seems timely to establish a task force to design multicentre studies aimed at resolving current hypotheses of asthma causation and ascertaining whether allergy or asthma or both can be prevented. Intervention studies on allergen exposure in early life are already underway and it was recommended that the results from these studies should be evaluated before more resources are committed to this specific question.

Timings and dosage of exposure to possible causative factors When planning studies of ante- and postnatal exposure to possible causative factors, dosage levels, and the frequency and timing of exposure are crucial considerations. More preparatory work is required on this aspect of such studies.

Environmental influences on asthma

Epidemiology Migrants who move in early life to 'high income' countries are at the greatest risk of acquiring asthma or atopy, and the rapid rise in the prevalence of asthma and atopy in such countries points to the importance of environmental determinants. Epidemiological data have provided the basis for two major hypotheses to explain this rise of asthma:

- changing patterns of microbial exposure in early life might influence the development of immune tolerance or restraint;
- changes in diet might influence primary immune functions or resolution of inflammatory changes or both.

Trial work There is a pressing need for good trials to test the above hypotheses. Agents that require testing include microbial exposure, diet, allergens, occupational substances and paracetamol. The studies will be difficult to design and it was recommended that a working party be established to plan a logical programme of work. Clearly there is substantial overlap of this work with early life studies.

Microbes Results from large epidemiological studies have suggested an inverse relationship between mycobacterial exposure and atopic disorders. Probiotics may be an important area of research, with studies using whole microbes, parts of microbes or whole organisms (e.g. a trial of the effects of BCG vaccination on the development of atopy). Such studies should investigate the effect of interventions in early life.

Diet Dietary influences on the development of asthma and atopy might include the anti-inflammatory actions of many micronutrients that tend to be lacking in the diets of people in

'high income' countries, where there is a low intake of fresh vegetables. A pregnant woman's diet might have important effects on the developing immune system of the fetus. Randomised controlled trials are needed to clarify this hypothesis. The National Asthma Campaign is funding studies on vitamin E supplementation and the influence of maternal diet.

Allergens The dose-response relationship is likely to be a critical determinant of the role of allergens in the development of atopy, induction of asthma and asthma severity. There are some important considerations:

- How should allergen exposure be measured?;
- How important are allergen interactions?;
- What is the cost-effectiveness of expensive interventions to avoid or reduce allergen exposure?;
- How do allergens work? For example, could disruption of tight junctions between epithelial cells that allows allergen transfer be a key initial step in allergic sensitization?;
- How does one evaluate allergen-allergen-endotoxin-pollutant interactions?;
- Is the increase in asthma prevalence driven by an increase in allergy?.

Current trials on allergen avoidance should report before further large-scale trials are started in this area of research.

Occupational agents Occupational asthma might represent an important model for the investigation of asthma onset, particularly in older people, and also for mechanisms of resolution. For example, fundamental studies into isocyanate-related airways disease could provide important insights into the initiation and persistence of asthma.

Paracetamol In adults there is positive association between frequent paracetamol use and asthma, asthma severity and rhinitis. Prospective studies are still needed to confirm such an association and address reverse causation.

Pollution There is little evidence that pollution initiates asthma, although there is some experimental evidence and circumstantial epidemiological evidence that particulate carbons and ozone might promote sensitization to allergens. This 'adjuvant' effect might occur at low concentrations and deserves further investigation. The link between exposure to cigarette smoke and asthma in both adults and children is so compelling that this should now be a campaigning issue rather than a research priority.

Inflammation and anti-inflammation in asthma

Methodologies and approaches More consideration could be devoted to technology development, in the context of how it can affect both *in vitro* analysis and the development of *in vivo* models. For instance, new approaches to tissue engineering, in which the milieu of the airway microenvironment is created *ex vivo* to study cellular interactions, could be explored as a way forward in this complex area. Most studies of airway inflammation have taken place in people with relatively mild asthma. More research needs to be conducted in people with more symptomatic asthma and the mechanism of chronicity should be investigated. It is also becoming clear that severe inflammatory changes might be taking place in the distal

airways in people with asthma. In view of ethical considerations with regard to tissue sampling in patients with severe disease, development of less invasive investigative techniques is a priority.

Populations Several phenotypes/cohorts were identified as being potentially useful to this research area, including: occupational asthma; steroid dependent/resistant asthma; aspirin sensitive asthma; adolescent asthma; and groups that have grown out of the disease. More attention should be given to relating inflammatory changes to physiological changes and to subtypes of asthma, including asthma in children.

Cell recruitment and activation Much progress has been made in elucidating the mechanisms of leucocyte recruitment and activation. Although research in this area has been centred on the generation of hypotheses, it is becoming increasingly evident that translational research should now be encouraged – for example, the use of anti-IL-5 antibodies in human subjects to test the IL-5/eosinophil hypothesis.

Airway smooth muscle Recent evidence has suggested that airway smooth muscle is not only the contractile cell of the airways but also is secretory, proliferates and produces matrix proteins. The airway smooth muscle cell should therefore be considered as a pro-inflammatory cell, in addition to the important part it plays in airway remodelling. The new concept of perturbed myosin binding within airway smooth muscle needs further characterization to assess its relevance to asthma.

Neural mechanisms The role of neural mechanisms in the chronicity of asthma is a neglected area of research. The major questions are:

- does 'sensitization' of sensory nerves occur in the airways of people with asthma?;
- if it does, how does it occur?;
- what is the effect of inflammation on nerves?.

Impaired mechanisms of resolution Defects in mechanisms of resolution in inflammation could be a key factor in the chronicity of asthma; such mechanisms should therefore be a prime area of investigation.

Environmental influences The manner in which the inflammatory processes of asthma interact with environmental influences remains unknown.

Animal models Animal models are still useful in inflammation research, but are not helping to clarify any aspects of the chronicity of the process. More representative models need to be developed.

Immunology and immunotherapy in asthma

T cells Allergen-specific T cells might play an important part in asthma by recognizing allergens and subsequently initiating inflammatory responses. T cells are an important source of pro-inflammatory cytokines; these include IL-4, which causes immunoglobulin subtype switching to IgE; IL-5, which has an important role in eosinophil biology; IL-13, which induces many common features of allergic asthma, such as airway

hyper-responsiveness, eosinophilic inflammation, IgE production, mucus hypersecretion and subepithelial fibrosis; and IL-3 and IL-9, which are implicated in mast cell growth and development. Other cell types also produce these inflammatory cytokines, but their relative roles and the interactions between the T cell and these cells are unresolved. Future work needs to help us understand the regulation of inflammatory and anti-inflammatory T cells, including antigen-presenting cell-derived signals upon which T cell activation is critically dependent. The role of T cells, if any, in the chronicity of asthma needs to be assessed. Development of methods to enhance the *in vivo* differentiation of inhibitory and regulatory T cell populations could be of therapeutic benefit.

Atopy IgE is important in the maintenance of asthma in some individuals, but in others its role is unclear. The recent development of humanized non-anaphylactic monoclonal IgE antibodies will allow a logical assessment of the role of IgE, especially in more severe disease.

Innate immunity The role of innate immunity vs. that of adaptive immunity is topical with the identification of polymorphisms in the T cell receptor associated with asthma. Understanding the implication of this observation requires further work.

Non-atopic asthma It is not clear whether the inflammatory response of the airways is exclusively antigen driven or whether, once triggered by antigen, the process becomes self-sustaining. The mechanisms of nonatopic asthma need clarification.

Rhinitis The immunology of asthma is not necessarily the immunology of allergy, and mechanisms causing rhinitis might be different from those in asthma.

Immunotherapy Immunotherapy can be classified as specific and nonspecific. Specific immunotherapy (SIT) targets individual allergens that cause an individual's disease and the aim is to achieve a satisfactory immunological outcome without putting the patient at excessive risk of adverse reactions. Experience suggests that SIT works best in people whose allergic disease has a single principle trigger.

Disease modification Specific immunotherapy might have disease-modifying effects by preventing the onset of asthma in people with allergic rhinitis. Similarly, SIT might also modify disease by accelerating the remission of asthma in children with allergic disease. There is some evidence from the 1960s for these effects, but the hypothesis requires detailed re-appraisal. There is a need to compare the influence of SIT on the long-term evolution of established asthma in adults with that of drug therapy.

Non-specific immunotherapy Non-specific immunotherapy targets the immune system in an allergen-independent manner. It could be effective in patients with multiple sensitivities. Novel forms of immunomodulation that require testing include:

- bacterial-type DNA that is intended to switch on Th1 and suppress Th2 responses;
- agents directed against individual cytokines; and;

- use of probiotic bacteria designed to modify the intestinal microflora.

Probiotic intervention could be useful in early life, as modification of the gut microflora is known to be an important determinant of an infant's immune system and T cell repertoire. However, such intervention would have to be shown to be very safe before it could be recommended for use in healthy children. Studies to investigate novel immunomodulatory strategies are clearly important, but clear and careful choice of end-point/outputs is essential.

Airway remodelling in asthma

Anatomy Several studies have linked the process of airway remodelling to physiological changes (such as bronchial hyper-responsiveness). However, more and larger studies of airway anatomy and function are required to provide a clear link, including studies in children.

Matrix Matrix biology is clearly an important area of knowledge that could be developed in relation to asthma research; expertise should be sought from outside the asthma field. The development and validation of non-invasive markers of matrix turnover is especially important.

Animal models Airway remodelling is difficult to study *in vivo* in humans. The use of animal models is vitally important for this area of work and should be continued.

Imaging Non-invasive methods of analysing morphological changes in the airway are already used in the study of chronic obstructive pulmonary disease (COPD), including emphysema, and are likely to become increasingly important in the study of asthma. These methods include imaging techniques such as high-resolution computed tomography and magnetic resonance imaging. These techniques are expensive and if they are to be applied in the study of asthma it will be essential to encourage experts in these fields to take an interest in asthma research.

Tissue banks Research on airway remodelling would benefit greatly from coordination of existing tissue collections and tissue banks, with an audit of what is already 'out there' and encouragement of collaboration.

Interactions between academia and industry in asthma research

Drivers for collaborations Collaborations between pharmaceutical companies and academia are driven by technology, basic science or novel compounds. Industry can be constrained by process, whereas academic institutions might have greater flexibility to be more creative.

Academia's role Academic centres can provide help with identifying surrogate markers for disease, patient stratification and phenotyping, imaging technology, proof of concept studies, target validation and disease monitoring.

Technology Some state-of-the-art technology, such as genomic screens and proteomics, is too expensive for academic centres, making links with industrial partners a critical element of research into asthma genetics.

Partnerships Interactions between research groups, clinicians and industry can help to establish dialogue on unmet clinical needs, identify key discovery targets and debate drug development strategies. The National Asthma Campaign could establish workshops for this purpose and such consultations could involve several companies. One important area to discuss as soon as possible is how to define clinical outcome measures for new disease-modifying drugs that will be predictive of the long-term outcome of the disease.

What strategies best ensure that resources will be used to attract, train and retain scientists to conduct asthma research?

Fellowships A key issue is the need to attract more top medical and science graduates into asthma research. More clinical and non-clinical fellowships are required and the length of fellowships should be extended. It was strongly recommended that the National Asthma Campaign considers establishing a few competitive Junior Research Fellowships, each ideally of 3-year tenure, together with consumable support. It was also proposed that there should be a special focus on postdoctoral intermediate/advanced fellowships and support for clinician scientists. Funding postdoctoral fellowships of 5-year tenure was identified as an important strategy. It was suggested that such fellowships should be linked to a university that undertook to sustain the employment of the individual for a reasonable period after the end of the fellowship.

Programme grants It would be helpful to establish longer-term funding streams to support larger-scale pieces of research directed towards a specific goal. Programme grant research support would be a way forward.

Joint funding It was felt that much could be achieved if the National Asthma Campaign was to collaborate more closely with other funding agencies in the support of fellowships.

How does academic asthma research interface with pharmaceutical industry research and what is the distinctive role of academia?

Training The high level of asthma expertise in the UK provides pharmaceutical companies with not only many opportunities for partnerships and collaborations, but also a superb environment for the training of future pharmaceutical scientists and managers.

Hypothesis-led work Academic institutions should continue to perform the hypothesis-led research that has proved so successful in elucidating new targets in the treatment of disease.

Phenotyping Academic clinical institutions clearly have a vital role in characterizing the phenotype of people with asthma when asthma drugs are being tested.

Immunomodulation Several pharmacotherapeutic interventions might have a value in primary and secondary prevention of asthma. In the medium to long-term, immunomodulatory interventions with a significant role are likely to be developed.

Animal research A pharmaceutical company often has far more opportunity than an academic institution to devote significant resource to animal studies. It is suggested that jointly sponsored studentships might be particularly valuable in this area.

Scope of interactions Interactions with industry will extend well beyond those with pharmaceutical companies. The use of probiotics, allergen avoidance techniques and other environmental modifications, for example, will necessitate interactions with the food industry, electronics companies and building establishments.

Longer-term follow-up Many large pharmaceutical trials have investigated single interventions in the management of young children with wheezing illnesses. The pharmaceutical industry could be encouraged to support longer-term follow-up of such patients beyond the initial study period. Of particular value would be follow-up covering the watershed area from 10 to 15 years, where there is a gap in observational cohort studies at a time when asthma remission is moderately frequent.

Genetics Extensive collaborations exist between academic and industrial groups in the area of genetics research and are enormously beneficial. Many of the current expression profiling projects and some of the large linkage studies could not be undertaken without logistic and financial support from industrial partners.

Confidentiality Major problems can arise in relation to confidentiality agreements and delay in publication when academics work in partnership with the pharmaceutical industry. To avoid these a standard research agreement could be designed, which protected the right to publish results within a reasonable time, while allowing industrial partners adequate time to develop intellectual property rights.

Conclusions

Following the individual workshops, which were both stimulating and instructive, the executive group and all chairmen of working parties met in July 2001 to discuss recommendations. Traditional concepts were challenged and new ideas were debated. The National Asthma Campaign will publish the final reports from each workshop [2], encompassing consensus views on the state of the art in each research area and recommendations for future projects and strategies.

The consultation achieved its aim of providing novel and reasoned insights on the way forward for basic asthma research in the short and medium term, to the benefit of people with asthma. Although the National Asthma Campaign sought information to inform its own decisions on research funding, we believe that the consultation also has a wider relevance to all those taking part in funding and carrying out research in the asthma field.

Acknowledgements

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Appendix 1

EXECUTIVE GROUP

Mr Jack Barnes	(National Asthma Campaign)
Prof. Peter J. Barnes	
Dr Mark Britton	(British Lung Foundation)
Prof. Stephen T. Holgate	
Prof. Julian Hopkin	(Medical Research Council)
Prof. A. Barry Kay	
Prof. Tak H. Lee	(Chairman)
Dr Howard Scarffe	(Wellcome Trust)
Prof. Peter J Sterk	(Netherlands Asthma Foundation)
Prof. Tim J. Williams	

PARTICIPANTS

Dr Ian Adcock	
Prof. Jon Ayres	
Mr Frank Anderson	
Mr John Berriman	
Prof. John Britton	
Dr Sherwood Burge	
Prof. Edwin Chilvers	
Prof. Fan Chung	Co-chair Inflammation and Anti-Inflammation
Prof. William Cookson	
Dr Christopher Corrigan	
Dr Adnan Custovic	
Dr Graham Devereux	
Dr Jane Dewar	
Prof. Stephen Durham	
Dr Martyn Foster	
Prof. Anthony Frew	Co-chair Immunology and Immunotherapy
Prof. Hannah Gould	
Prof. Ian Hall	Co-chair Genetics of Asthma
Dr Catherine Hawrylowicz	
Prof. Peter Helms	
Dr Gerry Higgs	Co-chair Industrial/Academic Interface and Wealth Creation
Dr Stuart Hirst	
Prof. Julian Hopkin	Co-chair Environmental Impact
Dr Peter Howarth	
Dr Dale Jackson	
Dr Malcolm Johnson	
Prof. Noor Kalsheker	
Dr Ian Kimber	
Prof. Jonathan Lamb	Co-chair Immunology and Immunotherapy
Dr Mark Larché	
Prof. Geoffrey Laurent	Co-chair Airway Remodelling
Prof. David Lomas	
Dr Robin McNulty	
Dr Rodger McMillan	
Prof. Gillian Murphy	Co-chair Airway Remodelling
Dr Brian O'Connor	

Dr Bill Oldfield	
Prof. William Ollier	Co-chair Genetics of Asthma
Dr Andrew Peacock	
Dr Alistair Reinhardt	
Dr Douglas Robinson	
Prof. Anthony Seaton	
Dr Seif Shaheen	
Prof. Michael Silverman	
Dr John Sime	Co-chair Industrial/Academic Interface & Wealth Creation
Prof. David Strachan	
Dr Peter Strong	
Prof. Andrew Wardlaw	
Prof. John Warner	Chair Early Life Events
Prof. John Westwick	Co-chair Inflammation and Anti-Inflammation
Dr Matthias Wjst	
Prof. Ashley Woodcock	Co-chair Environmental Impact

OBSERVERS

Dr Robin Buckle	(Medical Research Council)
Dr Matthew Hallsworth	(National Asthma Campaign)
Dr Philippa Major	(National Asthma Campaign)
