OVERVIEW OF THE INDIGENOUS ALLERGENS OF SOUTH AFRICA

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This issue of *Current Allergy & Clinical Immunology* focuses on studies of the major allergens indigenous to Southern Africa which have been conducted in recent years, mainly by South African investigators. In addition to the common allergens which are found in westernised societies worldwide, Southern Africa has a unique geographical location with its own climate, aerobiology, microflora, and biodiversity in the field of entomology and seafood species, all of which contribute to differences in allergenicity observed in the region. These have important implications for the development of appropriate allergen-specific diagnostic tests and specific vaccines.

In addition to the wealth of allergological biodiversity there is the diversity of its peoples. South Africans are a rainbow nation of peoples with European, Oriental, African, Asian and mixed-race ancestry. There is diversity in exposure to allergens, from the rural context where some indigenous people still live in mud huts, to affluent opulence in some of our bigger cities. Added to this has been the rapid migration of millions of South Africans to peri-urban informal settlements within a period of 10 years which has led to dramatic changes in lifestyle and allergen exposure.

It is against this background that allergy research has been conducted in the region to document the important allergies, to identify new allergens, to sharpen allergy testing and to recommend appropriate avoidance or immunotherapy.

In this issue Charlie Obihara who recently completed his PhD thesis on the interaction between atopy, tuberculosis and parasites on the expression of allergic diseases in the Western Cape, discusses published findings on the studies of the relationship between mycobacterial and parasitic exposure and atopic disease in different populations in Africa. His recent studies conducted in South Africa suggest that *Mycobacterium tuberculosis* infection modifies the expression of atopy in populations who have high burdens of active disease, compared with high levels of immunisation.

It was found that in children with a negative tuberculin skin test (TST) (158) more than 70% had atopic symptoms compared with only 13% in 179 children with a positive TST.

Aerobiology is an important area for allergy sufferers in South Africa (Fig. 1). South Africa is fortunate to have had continuous aerobiological monitoring in the Cape Town area and of the metropolitan areas for over 20 years.

An overview of aerobiology of Southern Africa including botanical and clinical aspects was published in *Clinical Experimental Allergy* in 1997.[1] In this issue Dilys Berman highlights and illustrates ongoing and new developments in aerobiology in the region.

Fig. 1. Compositae species at Kirstenbosch, Western Cape.

In addition to the importance of aerobiological monitoring to plan immunotherapy, antihistamine and avoidance therapy in allergy sufferers, it has been important to identify and characterise the indigenous grass pollen allergens of South Africa.

Although the first grass pollen to be characterised in South Africa by Ann Orren was not an indigenous one (Bermuda grass, *Cynodon dactylon*), it turned out to be one of the most important, in view of the uniqueness of its allergens (lack of cross-reactivity) and its importance in vaccines currently used in the region for grass-pollen immunotherapy (50% rye, 50% Bermuda grass). Characterisation of the first indigenous pollens of Africa (kikuyu grass) by Potter *et al*.[2] was followed shortly by the identification of buffalo grass[3] and *Eragrostis* as being important and highly allergenic grass pollens with some cross-reactivity to other indigenous and alien grasses. A review of these studies is presented by Ruth Prescott in this issue of the journal.

Although not addressed specifically in this issue, but reported previously,[4] it is important to mention that among the indoor allergens in South Africa cockroach sensitivity is present in about 40% of allergic individuals whether they live inland or at the coast. Cockroach allergy tends to be rare as a monosensitive allergy and is invariably noted in polysensitised patients, especially those sensitive to house-dust mites. All three cockroaches are present: *Blatella germanica, Periplaneta americanis* and *Blatella orientalis*. Locust hypersensitivity has been reported by Lopata and Fenemore in laboratory workers at the University of Cape Town (Fig. 2).

House-dust mites remain probably the most important of all the perennial/persistent allergens affecting allergic patients with asthma and rhinitis in South Africa and they too have been studied in detail in the Cape Town area, Gauteng and KwaZulu-Natal regions. A comprehensive review of the house-dust mites in South Africa was published in 1996,[5] emphasising their variability, distribution, antigenic levels and relevant species. They have been shown to accumulate in mattress covers, persisting throughout the winter months in the Cape[6]

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Fig. 2. Locusta migratoria: a cause of reported occupational allergies in laboratory workers in Cape Town.

and also on the Highveld[7] where patients appeared to be sensitised at lower levels than is observed in the coastal areas.

Recently it has been found by Calvert (personal communication) that *Blomia tropicalis* is also an important sensitising house-dust mite species in South Africa (accounting for up to 40% of subjects being positive in some areas); further studies by Levin *et al*. in the Western Cape are currently under way.

The interactions between urbanisation, migration and the changes induced by not only direct immunological exposure to allergen, but the context of exposure, have been studied in an excellent unique study by Steinman *et al*.[8] This is the only study in the region ever to have compared allergenicity and bronchial hyperreactivity (BHR) using histamine challenges in 2 157 children, 10-14 years old, living in different areas, from the Libode district in rural Eastern Cape (Transkei), Marconi Beam (an informal settlement area in the Western Cape) and Kirstenhof, an established city suburb in Cape Town. There are numerous important findings from this study: 17% of rural and 34.4% of recently urbanised black children now show increased BHR (by histamine challenge) compared with 0.03% and 3.1% shown 30 years ago. This compares with the current prevalence of increased bronchial reactivity in white urban children of 33%.

Even more striking has been the acquisition of sensitisation to one or more aeroallergens as indicated by CAP RAST tests which was present in 36% of the children with normal BHR and in 62% of the children with increased BHR. Overall atopic sensitisation to one or more aeroallergens by skin-prick test was found in 42% of the recently urbanised Xhosa children and 45% of urbanised white children. *Ascaris* infestation played no modifying role in the development of BHR in the rural or urban children. These studies suggest that BHR increases earlier than and independently of the acquisition of specific IgE responses to environmental allergens and have important implications for our understanding of the development of diseases such as asthma in Southern Africa.

Seafood allergy has been another area in which the Southern African region has demonstrated some unique findings. A highlight was the discovery of the major allergen in abalone resulting from patients with severe clinical allergic reactions to *Haliotis midae* (abalone) in a survey of seafood allergens in the Western Cape. The major 45 kDa binding allergen was identified by Lopata[9] as Hal m 1. In this issue Lopata and Jeebhay further discuss immunological and clinical implications of the proteins in molluscs and crustaceans in the region, particularly in relation to tropomyosins.

In addition to the effect of seafood allergens in the domestic environment, important studies of occupational exposure to seafood allergens in the West Coast seafood industry have been reported by Jeebhay and colleagues, which have significant implications for health care workers. Other occupational allergens studied by Jeebhay include the effects of exposure to grain allergens, storage mites and to the red spidermite in the fruit industry in the Elgin area of the Western Cape.

Addressing a new crisis in occupational allergy in the 1990s, a recent large body of work has identified and defined the problem of latex allergy in Southern Africa. Large studies have been conducted at the major teaching hospitals (Groote Schuur – over 2 000 workers, Tygerberg, Red Cross Children's Hospital and in Gauteng).[11,12] These studies have led to major changes in latex avoidance strategies in hospitals throughout South Africa, national latex policy guidelines, compensation for affected health care workers, the establishment of specialised clinics for the diagnosis, medical management and placement of employees affected by latex allergy and the production of practical information sheets for affected individuals and booklets on alternative latex safe products by the industry.

In addition an important contrasting study was conducted by Johar (while in South Africa as a visiting fellow from Malaysia) *et al*.,[12] which found the prevalence of latex allergy in spina bifida subjects at Red Cross Children's Hospital to be considerably lower than reported in Europe and in the USA.

In addition to the studies on common and major indigenous allergens highlighted above, several 'exotic' allergens have also been identified in the region. These include immediate contact hypersensitivity reported to *Verbena hybrida*,[13] contact hypersensitivity to *Gloriosa superba* (Fig. 3), occupational allergy to imbuia wood dust[14] and sensitisation to the venom of the spitting cobra[15] (Figs 4 and 5) in a snakepark handler who developed asthma when exposed to the venom of the rinkhals (spitting cobra) during public demonstrations.

An overview of the indigenous allergens of Southern Africa would be incomplete if current studies looking at the immune responses to indigenous allergens such as house-dust mites are not mentioned. Important laboratory work studying in depth the lymphocyte cytokine responses to house-dust mite proteins has been conducted by Nurse and co-workers[16] and has provided not only new information on T-cell responses to aller-

Fig. 3. Gloriosa superba: *an important allergen inducing immediate contact hypersensitivity. The leaves, flowers and bulbs are irritant.*

Fig. 4. The rinkhals (spitting cobra) produces allergenic phospholipases in its venom to which snake handlers in South Africa have become sensitised and developed occupational asthma.

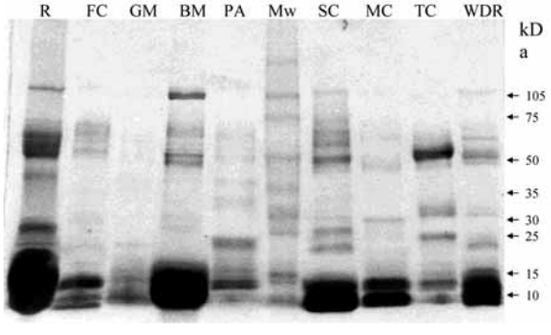

Fig. 5. IgE binding to a range of venom proteins on western blots, in a snake handler.[15] R – rinkhals, FC - forest cobra, GM – green mamba, BM – black mamba, PA - puff adder, MW – molecular weight markers, SC – snouted cobra, MC – Mozambique spitting cobra, TC – Thai cobra, WDR – Western diamond blacked rattlesnake.

gens, but critical new information on markers of immune responsiveness and tolerance for current ongoing studies on the mechanisms of sublingual immunotherapy in subjects with asthma and allergic rhinitis.

Finally this issue of *Current Allergy & Clinical Immunology* highlights the frequency and management of C6 deficiency, an immune deficiency disease, which could almost qualify for classification as an 'indigenous' immune disease of Southern Africa. Southern Africa and in particular the Western Cape has the highest frequency of the expression of total C6 deficiency, presenting with recurrent meningitis, in the world.

The clinical international studies published on this disease have been conducted in South Africa and the genetic studies have been conducted on DNA from the South African subjects in Cambridge, Cardiff and at the University of Cape Town.[17-19] In this issue Ann Orren, who has been the main driving force behind these important studies, discusses current aspects of C6 deficiency in the light of ongoing follow-up studies of the affected patients and their families.

It can be seen from the above overview that a lot has been elucidated regarding both common and exotic allergens in Southern Africa during the past 20 years, both relating to prevalence of disease, clinical importance, refinements for specific allergy testing and relating to specific therapy (e.g. immunotherapy).

The cumulative body of knowledge of the regional allergens which has resulted from the many research studies into allergens published from the region, would form essential core knowledge for allergists who wish to conduct intelligent and appropriate allergy practice in the Southern African region.

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Declaration of conflict of interest

The author declares no conflict of interest.