Discussion
DISCUSSION

Increasing attention is being directed to the indoor environment as a focus of exposure to air pollution. Rather than a refuge from air pollution, as has generally been believed, specific pollutants may be more concentrated indoors than outdoors. Inhalation of certain types of airborne spores and other constituents of the airspora within the buildings is now widely accepted as one of the important causes of some respiratory disorders.

Various studies carried out in different parts of the world have emphasised the need for monitoring indoor air for effective management of allergic disorders (Kang et al., 1989; Burge, 1990; Dales et al., 1991; Agashe et al., 1992). Such studies supplement outdoor monitoring, which have been used to prepare pollen and spore calendars, helpful in diagnosis and management of allergic disorders (Levetin and Horowitz, 1978; Burge, 1992; Agashe and Abraham, 1988; Agashe and Abraham, 1990-91).

Although extensive work has been done on the qualitative and quantitative incidence of pollen and fungal spores in outdoor environments, scant attention has been paid to the biopollutants in indoor environment of non-industrial areas.
Hence the present investigation was undertaken to find out the qualitative and quantitative variation in the airspora of different environs such as air-conditioned environment, residential environment, hospital and library and to correlate the trapped airspora with allergic manifestations of the patients. The present intramural aerobiological study also aims at characterizing the airspora of each site, which will help clinicians in understanding the offending aeroallergens responsible for aggravating allergic symptoms.

Monitoring of indoor airspora was carried out using Boehm's personal sampler, Rotorod sampler and culture plate technique.

Boehm's personal sampler was used since this device gives an accurate picture of the personal exposure of the patients and also because of its low cost and easy availability. This sampler was employed by workers like Leuschner and Boehm, 1979, Tilak et al., 1981, and Boehm and Leuschner, 1987.

Rotorod sampler was also employed in this study in order to obtain a volumetric picture of the indoor airspora. This sampler was employed by many aerobiologists such as Tilak and Vishwe, 1975; Solomon et al., 1980; Tilak et al., 1981; Vittal and Glory, 1985; Tripathi, 1987; Gallup et al., 1987.
Thus, in the present investigation, a combination of slide exposure and petriplate technique have been used to get a fairly complete picture of the indoor airspora. Indeed, such a combination for sampling indoors has been suggested and emphasised by earlier workers (Burge et al., 1977; Tilak, 1982).

The observations made from above investigations on airspora from different non-industrial indoor environments are discussed in the light of the current literature in the following pages.

AIR-CONDITIONED ENVIRONMENT

A basic principle in treating allergic disorders is that of avoidance of the offending allergens. Although aeroallergens originating in nature are difficult to avoid, exposure to these agents may be reduced, often substantially, within man-made structures. Thus, the effectiveness of air-conditioning and air-filtering devices have been intermittently studied in an attempt to diminish hay fever symptoms to inhalant allergens in allergic individuals. There are numerous reports available which have described clinical benefits (Mansmann, 1978) as well as reduced particle levels (Hirsch et al., 1978) within air conditioned homes.
On the other hand, inadequate maintenance of the air-conditioning plant of buildings increases the symptoms in allergic individuals. Human respiratory diseases in homes using humidifying devices have been clearly established. Hypersensitive pneumonitis has been linked to contamination of an air-conditioner (Banaszek et al., 1970). Solomon et al., 1980, suggest that humidifying devices may serve as dispersion sources in addition to their permissive role in facilitating fungal growth. The air-conditioned environments are therefore of great interest and concern to aerobiologists and medical practitioners.

Thus, in view of the facts mentioned above and the fact that studies conducted on this aspect in India are almost negligible, a comparative study was taken up in air-conditioned and non-airconditioned office environment, the results of which are discussed here.

The present study has clearly demonstrated that the total spore and pollen counts in air-conditioned offices were significantly lower than in the non-airconditioned office environment. This was substantiated statistically by performing ANOVA test. This is in conformity with the studies carried out by all the other workers (Spiegelman et al., 1961; Hirsch et al., 1987; Kooistra et al., 1978; Solomon et al., 1980; Kodama and M.C.Gee, 1986; Sneller and Pinnas, 1987; Nelson et al., 1988).
The major reasons for the decreased total spore and pollen count in air-conditioned offices may be the closed windows, which result in a reduced influx of outdoor spores, lower relative humidity and filtration. (Hirsch et al., 1978).

During the course of aerobiological investigation in air-conditioned office, totally 53 types of both culturable and non-culturable fungal spores and 17 types of pollen grains were identified from the samples. In non-airconditioned office, 59 fungal types and 30 pollen types were identified. From the culture plate analysis, 14 fungal types of AC office 1, 23 fungal types in AC office 2 and 21 fungal types in non-AC office were recovered. The total mold types recorded by other workers in their study are as follows: 27 (Hirsch et al., 1978) and 16 (Kodama and MC Gee, 1986).

*Cladosporium* spores have been found to be the major fungi in both AC and non-AC office environment. This was followed by *Aspergillus*. Same spore types were predominant even in the petriplate exposures. This finding contrasts with the findings of Kodama and MC Gee (1986) who have found that *Aspergillus* was the most predominant fungal spore in AC residences which was followed by *Cladosporium*. Sneller and Pinnas, (1987) have also reported high counts of *Aspergillus* in AC homes in their study. Hirsch et al., (1978) have
reported a significant reduction of *Cladosporium* in air-conditioned rooms.

The spores of *Alternaria* are important fungi in AC and non-AC environs. They were present throughout the year, but in low concentrations. The concentration of *Alternaria* spores in air-conditioned and naturally ventilated interiors was also studied by Solomon *et al.*, (1980).

Pollen trapped was chiefly restricted to grasses and weeds. Tree pollen were minimal, chiefly represented by *Eucalyptus*, *Casuarina*, *Cassia*, and *Dodonaea*. This is in conformity with other indoor studies like those of Ravindran *et al.*, (1991) and Agashe *et al.*, (1992). The main source of pollen in AC buildings could be the constant opening and closing of the doors leading to intermixing of inside and outside air.

**RESIDENTIAL ENVIRONMENT**

Environmental factors such as allergens and non-specific irritants are known to play an important role in inducing asthmatic symptoms in perennial bronchial asthmatics.

Extensive studies of the indoor environment, the air quality, especially home environmental allergens such as house dust, dust mites and danders demonstrate that indoor
home environment has a greater impact on asthmatic population than outdoor or occupational environment (Booij-Noord et al., 1971; Solomon and Burge, 1984; Spengler, 1986). This is most probably due to the longer hours spent in the home and the more concentrated allergen exposures than outdoor pollutants (Spengler, 1986).

Thus, an intramural study is more important at the residence of a patient with intractable allergy symptoms whose treatment cannot be started with general immunotherapy. The systematic study of this nature will help in pinpointing the exact source of the patient's problem.

In view of these facts, a detailed aerobiological sampling was carried out in the residential environment, the results of which are discussed here.

During the course of aerobiological investigation at the residences of patients with nasal and nasobronchial allergy, totally 53 spore types and 24 types of pollen grains were identified from the samples. In the control house, 55 fungal types and 32 pollen types were identified. Cladosporium was the most predominant fungal spore in the residential environment followed by Aspergillus - Penicillium. The overall dominance of Cladosporium is probably explained by its saprophytic habit and ability to grow in a variety of substrates together with the capacity
to produce a number of spores which are adapted to passive dispersal (Ingold, 1971). Tilak and Patil (1981) studied the airspora of dwelling houses at Aurangabad. They identified 30 fungal types, of which *Cladosporium* formed the highest concentration followed by *Curvularia*, *Aspergillus*, *Alternaria* and *Periconia*. The results of the present study are also in conformity with the findings of Agashe et al., (1992) who observed that Aspergillus/penicillium group and *Cladosporium* accounted for the maximum catch in the indoor environment. According to Patil and Mane (1985), *Aspergillus* was the most dominant form.

In the present investigation, culture plate technique was also employed to study the indoor airspora. From the culture plate analysis, 20 fungal types in patient's house 1, 21 fungal types in patient's house 2 and 25 fungal types in the control house were recovered. The total mold types recorded by other workers in their study are as follows:- 44 (Levetin and Hurewitz, 1978); 58 (Bunnag et al., 1982); 24 (Sorensen et al., 1985).

The most predominant fungal spores in patient's house 1 were *Cladosporium*, *Aspergillus* and *Mucor*. In patient's house 2, it was *Cladosporium*, *Penicillium* and *Aspergillus*. In the control house, the most predominant spores were *Cladosporium*, *Aspergillus*, *Alternaria* and *Fusarium*. Swaebly and Christensen (1952) found that *Penicillium* and
Aspergillus were predominant indoors, while Alternaria and Cladosporium were most frequently found outdoors. Richards (1954) reported that Cladosporium was the most frequently found genus, both indoors and outdoors, similar to our findings. Hirsh and Sosman (1976) in a 12-dwelling study found that Cladosporium was the most abundant of all fungi encountered indoors followed by Alternaria, Penicillium and Aspergillus.

Kozak et al., (1979) in their study in 68 homes of allergic patients found that Cladosporium, Penicillium, Alternaria and Mycelia Sterilia were most abundant.

According to Levetin and Hurewitz, (1978), the predominant genera in Tulsa homes were Alternaria, Hormodendrum, Pullularia, Penicillium and Epicoccum. Calvo et al., (1980) have reported Cladosporium and Penicillium as the most frequently found genera in Barcelona dwellings. Calvo et al., (1982) have found that the dominant fungi in the homes of asthmatics were Penicillium, Yeast, Cladosporium, Aspergillus, Rhizopus and Mucor. In the homes of healthy controls they found Penicillium, Aspergillus and Cladosporium in higher frequency. Bunnag et al., (1982) have showed the prevalence of Yeasts, Aspergillus, Cladosporium and non-sporulating fungi. Rogers (1984) found Yeasts, Mycelia sterilia, Cladosporium and Penicillium as the most
predominant forms. Sorensen et al., (1985) have reported *Aspergillus* as the most frequently encountered fungal type.

The fungal concentration showed a seasonal predominance from July - October. *Aspergillus - Penicillium* concentration was high in August - October. *Alternaria* showed a seasonal predominance during April - June. *Cladosporium* was high during May and July - August. Seasonal fluctuation in fungal concentration is also reported from studies conducted by workers like Levetin and Hurewitz (1978); Tilak and Patil (1981); Bunnag et al., (1982); Rogers (1984); Agashe et al., (1992).

Among the airborne pollen types, *Parthenium* was the most predominant pollen grain in this study in the patient's house 1 and the control house. It was followed by grass and Cheno-amaranth. In patient's house 2, Cheno-amaranth was most predominant followed by *Parthenium* and grass. In the indoor environment the pollen catch is thus restricted to grasses and weeds (10 - 90%). Tree pollen is poorly represented. This is in conformity with other indoor studies like those of Agashe et al., (1992) Sorensen et al., (1985) and Ravindran et al., (1991) who have reported the predominance of grass pollen in their studies.

High pollen count encountered in the residential environment could be accounted for by the facts that the
houses were surrounded by sprawling garden and also vacant lands invaded by weeds like *Parthenium* and Cheno-amaranth.

**HOSPITAL**

The ambient air contains different types of biopollutants of which fungal spores constitute a major portion. These aerial fungal spores play an important role in the etiology of allergic manifestations. They are ubiquitous in nature. Being small and buoyant they have easy access to indoor environment through cracks, open doors and windows.

The increasing importance in recent years of opportunistic fungal infections in immunocompromised patients (Rose and Varkey, 1975) has led to the search for sources of fungal contamination within the hospital environment (Vidotto *et al.*, 1988). Important sources of infection include Catheterization in the case of yeast infections and inhalation of airborne spores and conidia in the case of infections caused by mold fungi. The potted plants inside the hospital are also a very good source of pathogenic fungi which can cause serious mycotic hazard to the immunosuppressed patients (Summerbell *et al.*, 1989). They can also produce upper and lower respiratory tract symptoms in sensitized hospital workers and patients (Kurup and Kumar, 1991).
Besides fungal spores, pollen are also one of the most important allergens as they affect the respiratory tract inducing allergic symptoms. Thus, in view of the significance of the fungal spores and pollen grains in the hospital environment, a detailed aerobiological sampling was carried out, the results of which are discussed here.

56 fungal forms and 17 pollen types were isolated and identified during the course of investigation. Among the 56 spore types, 41 belonged to Deuteromycetes, 8 belonged to Ascomycetes, 4 to Basidiomycetes and 3 to Zygomycetes.

The total mold and pollen types recorded by other workers in their study are as follows: Babu and Tilak (1984) recorded 62 spore types of which 42 belonged to Deuteromycetes, 12 to Ascomycetes, 4 to Basidiomycetes and 2 to Phycomycetes. Tilak et al., (1981) carried out the estimation of potentially allergenic pollen grains inside the hospital ward in Aurangabad. They have recorded 28 pollen grains, of which 19 types were known to be potentially allergenic. Singh (1985) recorded 29 pollen types and 15 fungal types inside the hospital ward at Shillong. Singh and Singh (1991) isolated 143 fungal forms from the hospital campus in Delhi.

*Cladosporium* was found to be the major fungus in hospital ward of Bangalore, constituting 1/3rd of total
fungal load. This was followed by Aspergillus and Alternaria. This finding is in conformity with the studies carried out by the other workers like Babu and Tilak 1984; Srivastava et al., 1990 and Singh and Singh 1991. In an aerobiological survey from Imphal, Aspergilli, Mucor, Cladosporium and Penicillium are reported to be predominant (Singh, 1985).

During the present investigation, 22 fungal types were isolated by culture plate method. The most predominant fungal spores encountered were Cladosporium, Aspergillus, Penicillium and Mucor. Culture plate studies were also conducted by Singh (1985) who isolated 24 different fungal colonies in which Aspergillus, Cladosporium and Mucor were most common.

Yasmeen and Saxena (1991) have isolated 24 fungal types from the indoor environment of the hospital.

Noble and Clayton (1963) observed high concentration of Aspergillus fumigatus, while Solomon et al., 1978, recorded low concentration of the same.

Many of the species belonging to Aspergillus, Penicillium, Fusarium, Trichoderma, Rhizopus isolated from hospitals have been reported to be potential pathogens (Schwartz et al., 1984). Fusarium can cause skin lesions similar to Aspergillus species (Bodey, 1988).
Some of the types, which may not be found in high concentrations, but are still important by virtue of their frequent occurrence are: Periconia, Smut spore, Nigrospora, Basidiospores, Ascospores, Helminthosporium and Curvularia.

The total fungal concentration showed a seasonal predominance from May - June and August - September. Aspergillus - Penicillium were predominant in October. Alternaria showed a seasonal predominance during April - May. Cladosporium was high in September 1991-92 and May 1992-93. Seasonal periodicity in fungal concentration is also studied by workers like Singh, 1985; Singh and Singh, 1991; Yasmeen and Sexena, 1991.

The spores of Aspergilli are the major pathogens in hospital environment as is evident from reports of different workers (Mahoney et al., 1979; Sarubbi et al., 1982; Peterson et al., 1983; Bodey, 1988; Mayer et al., 1992). The high concentration of Aspergillus - Penicillium spores in operation theatre could cause infection while the operation is going on or in an intensive care unit when the patient is recovering (Hummel et al., 1992). Patients with organ transplants often suffer from Mycoses and the most frequent cause is aspergillosis. The soil of indoor plant pots causes serious mycotic hazard to the immunosuppressed patient (Summerbell et al., 1989).
Among the airborne pollen types, Parthenium was the most predominant pollen grain in this study. It was followed by grass and Cheno-amaranth. Predominant tree pollen were Dodonaea Casuarina, Cassia etc. This finding contrasts with the results of Tilak et al., 1981; Singh, 1985; and Ravindran et al., 1991, who have found that grass pollen was the major component in the hospital ward.

**LIBRARY**

The occurrence of rhinitis or asthma provoked by exposure to libraries and other book collections has been well documented (Aas, 1972). Among enclosed spaces libraries offer unique substrate characteristics such as bindery glue and paper which support active fungal growth. Airborne microorganisms such as fungi, bacteria and actinomycetes are also responsible for biodeterioration of storage materials, equipment, library materials and archives (Tilak, 1982).

The deterioration of paper by the activity of microorganisms is known by the works of Kathapalia (1960) and Mukherjee (1973).

The studies on the air mycoflora of libraries are very few (Tilak and Vishwe, 1975; Burge et al., 1978; Vittal and Glory, 1985; Tripathi, 1987; Tilak and Pillai, 1988 and
Singh et al., 1990). Information on airborne pollen grains in libraries is almost negligible. In view of these facts, a detailed aerobiological sampling was carried out in the Bangalore University Library, the results of which are discussed here.

The two year aerobiological survey in the library yielded 54 fungal genera. Most of the types belong to Deuteromycotina and accounted for 85.3% in 1991-92 and 92.9% in 1992-93. The total mold types recorded by other workers in their study are: 80 (Paradkar and Munshi, 1980); 60 (Tilak et al., 1981); 19 (Vittal and Glory, 1985); 26 (Verma and Khare, 1987); 19 (Tripathi, 1987); 60 (Tilak and Pillai, 1988).

**Cladosporium** was the most predominant fungal spore in the library followed by **Aspergillus** – **Penicillium**, **Periconia**, Smut spore and **Alternaria**. The results are in agreement with the findings of Paradkar and Munshi, 1980; Tilak et al., 1981; Verma and Khare, 1987; Tilak and Pillai, 1988.

However, high prevalence of **Alternaria** followed by **Aspergillus** and **Cladosporium** is reported by Tilak and Vishwe, 1975.

Vittal and Glory (1985) and Tripathi (1987) found **Aspergillus** Sp. to be the most predominant fungal spore in the library atmosphere which was followed by **Cladosporium**.
In the present investigation 23 fungal types were isolated by culture plate method. The most predominant fungal spores encountered were Cladosporium and Asperillus. Culture plate studies were also conducted by Vittal and Glory (1985), who isolated 43 species belonging to 23 genera in which Aspergillus was the most predominant fungal spore followed by Curvularia and Penicillium. Singh et al., (1990) isolated 39 fungal types among which Cladosporium ranked first, followed by Aspergillus sp., Penicillium and Alternaria. Verma and Khare (1987) also reported the predominance of Cladosporium in the library environment. The predominance of Aspergillus sp. in libraries has been reported by Burge et al., (1978) who made an aerometric survey of fungi in eleven libraries at the University of Michigan to ascertain the role of fungi as allergic contaminants in book collections, with Andersen sampler.

In the present investigation, cellulose degrading fungi such as Chaetomium, Rhizopus, Torula and Trichoderma have been recorded, which were reported to be common on books.

Seasonal fluctuations in the concentration of total and individual types were observed in different months during the course of investigation. Generally, total spore count showed an increase in concentration from April - May and October - November. The total colony count showed an
increase in concentration from February to March. Seasonal fluctuation in fungal concentration is also reported from studies conducted by workers like Paradkar and Munshi (1980); Tripathi (1987); Singh et al., (1990).

Airborne pollen grains in the library environment were also studied in the present investigation. Totally 23 pollen types were sampled during 1991-92 and 16 types during 1992-93. The most predominant pollen grains encountered during the course of the investigation are grass, Parthenium, Casuarina and Cheno-amaranth. Information on the airborne pollen grains in libraries from other parts of the country is negligible.

The study of airspora in the library is thus of great importance since the library environment was found to be loaded with biopollutants that can be very harmful to the health of the library users besides reducing the life of books. Thus the damage to the library system is two fold: it affects both the human health (User and library worker) and the books and paper comprising the library collections.

In addition to fungal spores and pollen grains, the importance of house dust mites, cannot be ignored in indoor environments. Small catches of these were obtained on the personal sampler slides during August and November. Studies on house dust mites were conducted by workers like
CLINICAL STUDIES

The results of the questionnaire survey and skin testing carried out in the air-conditioned environment and on allergic patient's, whose residences were taken up for a detailed aerobiological survey, for the incidence of various respiratory disorders pertaining to their environmental conditions, are discussed here.

Responses to the questionnaire survey undertaken as a part of the present study regarding different symptoms of respiratory/allergic disorders have revealed that 44.3% workers suffered from one or the other respiratory problem. Out of these workers, 28% felt better with almost no symptoms in the AC office. 19% complained of increase in symptoms like nose block inside the AC room and the rest experienced no change in symptoms. Abbritti et al., (1992) assessed the prevalence of sick building syndrome in a new air-conditioned building in Italy by a questionnaire survey. They found that 69% of the employees reported work related symptoms in airconditioned building, compared to 27% in naturally ventilated buildings.
A preliminary health status survey conducted by Kodama and MC Gee (1986) suggested that persons residing in air-conditioned homes may have a higher frequency of respiratory complaints than those living in naturally ventilated homes.

Skin prick tests were performed on 20 workers who had reported respiratory disorders during the questionnaire survey and volunteered for the test in air-conditioned office.

Among the 16 pollen, 12 fungal and 2 dust mite antigens tested on atopic workers, house dust mite extract had produced marked skin reactivity (70% and 50% of cases). *Parthenium*, *Chenopodium* and *Cynodon* showed significantly positive reactions in 65%, 35% and 25% of the workers. *Curvularia* showed a positive reaction in 25% of the workers.

Skin prick test results of patients (from residential environment) showed positive reactions to house dust mites and pollen like *Parthenium*, *chenopodium*, *Cynodon* and *Ricinus*.

Mitchell et al. (1969) observed that emanations of the common house mite, *D. farinae*, was the antigenic factor in the great majority of patients in central Ohio who were clinically sensitive to house dust.
3) As many as 68 fungal genera were isolated in the present investigation from all the sampling sites.

4) It was observed that indoor airspora differs quantitatively from the outdoor airspora. No significant differences in the mycoflora between outdoors and the air inside naturally ventilated residences were found.

5) The present study has clearly demonstrated that the total spore and pollen count in air-conditioned offices were significantly lower than in non-airconditioned office environment.

6) Thus it was observed that air-conditioning was one of the most efficient methods to reduce pollen and spore level in the indoor environment which will help the persons suffering from allergy to these aeroallergens.

7) Some of the predominant fungal spores encountered in the airconditioned environment were Cladosporium, Aspergillus - Penicilium, Smut spore, Periconia, Alternaria and Nigrospora. Alternaria, Cladosporium, Curvularia, Helminthosporium, Periconia and Nigrospora had significantly higher concentration (P < 0.001) in the non-AC office as compared to AC office. Aspergillus, Parthenium and Eucalyptus was also significantly high (P < 0.01) in the non-AC office.
11) Culture plate studies from all the centres have also revealed the predominance of Cladosporium colonies. The overall dominance of Cladosporium is probably explained by its saprophytic habit and ability to grow in a variety of substrates together with the capacity to produce a number of spores which are adapted to passive dispersal.

12) Seasonal fluctuations in the concentration of total and individual types were observed in different months during the course of investigation. Generally, total spore count showed an increase in concentration from July - November.

13) Pollen types are poorly represented. The pollen trapped are almost restricted to grasses and weeds. This study done at human height, indoors, has revealed minimal number of tree pollen in the indoor airspora.

14) In addition to fungal spores and pollen grains, the importance of house dust mites cannot be ignored in indoor environments. Small catches of these were obtained on the personal sampler slides during August to November.

15) The effect of various meteorological parameters on the indoor airspora was statistically analysed. In the residential environment; Aspergillus, Alternaria,
Ascospores and Basidiospores and Dodonaea and Chenopodium showed positive correlation to humidity, rainfall and different combinations of weather parameters. In hospital environment; Aspergillus, Ascospores, Basidiospores, Smut spores, Parthenium and Cheno-amaranth showed positive correlation. In the library; Basidiospores showed a positive correlation while Alternaria, Helminthosporium, Uredospores and Grass showed negative correlations.

16) Respiratory/allergic disorders have been recorded in 44.3% of the workers in AC environment, as surveyed by the medical questionnaire. Out of these workers 28% of them felt better with almost no symptoms in the AC office, which aggravated outside the office. 19% of them complained of an increase in symptoms like nose block, inside the AC room and the rest experienced no change in symptoms.

17) Based on the information obtained from a detailed medical questionnaire, 2 patients of nasobronchial and nasal allergy were selected for this study.

18) Predominant pollen and fungal types producing allergic reactions, based on skin prick test results, were Parthenium, Cynodon, Chenopodium, Amaranthus, Casuarina, Curvularia, Helminthosporium, Aspergillus, Mucor.
Rhizopus and Cladosporium. The prevalence of these types has also been reported from aerobiological studies. Patients showed maximum allergic reaction to house dust mites.
The results discussed in this study will provide a basis for further intramural studies on house dust mites and thermophlic actinomycetes in residential and hospital environments respectively, considering their importance in these environments. Studies on larger patient population can yield better results and can exactly pin point the offending indoor aeroallergens, which will be helpful in relieving the patient's symptoms. Characterization of pollen and fungal allergens responsible for the induction of seasonal allergic rhinitis and asthma will help in immunotherapeutic procedures.