

## Bronchial asthma, allergic rhinitis, and allergy skin tests among college students

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*Allergic conditions were evaluated for 2 successive years among 1,836 Brown University and Pembroke College freshmen (99.2 per cent). Students gave personal allergic histories and family histories of allergy, and information was supplemented by parents. Some type of allergy was present in 34.8 per cent of the population. A total of 25.0 per cent of students had a history of asthma, seasonal hay fever, or nonseasonal allergic rhinitis. The frequency of each of these conditions was 5.3 per cent for asthma, 21.1 per cent for seasonal hay fever, and 5.2 per cent for nonseasonal allergic rhinitis. Positive family histories of asthma and/or allergic rhinitis were found to localize among students who had these conditions. Skin scratch tests with 15 commercial allergens and a control were performed on 1,243 students (67.7 per cent); 30.9 per cent showed at least one positive reaction, with localization found among the allergic group. No association between scratch test reaction and family history was observed.*

**S**pecific types of allergies may vary within segments of the human population, dependent upon characteristics of the population, methods of collecting data, and definitions applied to determine allergic individuals. Previous population studies have not tried to repeat, in detail, sampling techniques to determine if frequencies vary from time to time and group to group.

The present study has focused on college freshmen who entered Brown University and Pembroke College in 1962 and 1963. A 2 year study was utilized to determine whether observations made on one class also pertained

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to the next class. Allergic histories were obtained from nearly all native Caucasian students of each freshman class. During their first semester in college, subsamples of these students were taken for allergy scratch tests.

It is significant to study a well-educated, well-informed group of young adults to evaluate most correctly the frequencies of allergic conditions. Students who participated in this study were very health conscious and frequently sought medical treatment for their complaints. Our conclusions, then, are limited to this segment of a Caucasian population which is in the 16 to 20 year age group.

In this report we consider in detail only frequencies of bronchial asthma and allergic rhinitis in this population. The latter category has been subdivided into seasonal allergic rhinitis, which we refer to as hay fever, and nonseasonal allergic rhinitis. We have also determined how these conditions differ by sex and by family history of allergy. We have a measure of the frequency in this population of positive scratch test reactions to specific allergens. It is then possible to determine whether students with positive scratch tests have positive family histories more frequently than students with negative scratch tests.

## **MATERIALS AND METHODS**

During the first week of college each freshman completed a questionnaire which documented any personal history of allergy. Students were assisted by allergy-trained medical personnel. Information recorded at this time included the specific type or types of allergy, onset age, duration, symptoms, time of year affected, and therapy. In addition the student reported the name, age, and allergic history of each of his sibs and the allergic history of each parent and grandparent as far as it was known to him.

With consent of the student, written permission of parents was then requested for the student to have allergy skin tests. Parents were also requested to give information about allergies occurring in members of the family.

Appointments were arranged with students during October and November. Each student was instructed not to take any antihistamines or related drugs for 24 hours prior to testing. During these appointments allergy questionnaires were reviewed with each student.

Medical personnel performed skin tests on the anterior forearm by the scratch technique with the use of fifteen commercial allergens and a control.\* The following glycerinated extracts were used: birch,  $\frac{1}{20}$ ; elm,  $\frac{1}{20}$ ; maple,  $\frac{1}{20}$ ; timothy,  $\frac{1}{20}$ ; June grass mixture,  $\frac{1}{20}$ ; short ragweed  $\frac{1}{20}$ ; giant ragweed,  $\frac{1}{20}$ ; feather mixture,  $\frac{1}{10}$ ; cat dander  $\frac{1}{10}$ ; dog dander  $\frac{1}{10}$ ; cow milk,  $\frac{1}{10}$ ; egg white,  $\frac{1}{10}$ ; wheat,  $\frac{1}{10}$ ; *Alternaria*,  $\frac{1}{10}$  (used only during the second year of study); and a saline control. Scratch test sites were read by an allergist 20 minutes after application of extracts and positive skin tests were interpreted as a wheal with erythema. Erythema, if any, in the control site was never as large as in a positive site.

An individual's diagnosis was established by evaluating the answers given on the original questionnaire, as well as answers given to specific questions at

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\*Products of Hollister-Stier Labs.

the time of skin testing and additional information supplied by parents. We also reviewed the results of the physical examination and chest roentgenogram which were given to each student during the first week of school. This information did not alter our diagnosis made by history. All students had essentially negative chest roentgenograms. Only 2 students were found to have wheezing on auscultation of their lungs, and both had known histories of asthma. Ear, nose, and throat examination revealed that 3 students had mechanical nasal obstruction due to polyps or marked nasal septal deviation. Two of these had a history of seasonal hay fever, while one had no allergic history. Only a few students had evidence of active rhinitis at the time of physical examination, and most of these had a history of seasonal hay fever.

The following criteria were used to classify specific allergies:

1. Bronchial asthma—a history of recurrent episodes of wheezing and dyspnea not due to any known organic condition. (All students in this group had been previously diagnosed as asthmatic by their family physician.)

2. Seasonal allergic rhinitis or hay fever—a history of watery, itchy eyes, rhinorrhea, and sneezing occurring during the same seasonal period for at least 2 consecutive years.

3. Nonseasonal allergic rhinitis—a history of similar symptoms as hay fever, but occurring nonseasonally and associated with exposure to particular antigens, e.g., animal danders.

The asthma and hay fever diagnoses were not difficult to determine from the students' histories, but some difficulty was encountered in classifying all cases of nonseasonal allergic rhinitis. In all instances conservatism was the rule of thumb, and doubtful cases were classified as nonallergic. The results of skin scratch tests were not utilized to classify individuals as affected with a given condition.

## RESULTS

The population is classified by year of study and by sex in Table I. Since only native Caucasian students were considered, 2.3 per cent of the total enrollment during the 2 year period was omitted. This gave a total population of 1,850 students for study. Allergic histories were not obtained from 14 students (0.8 per cent). Allergic questionnaires were completed by 1,836 students (99.2 per cent), and 1,243 of these (67.7 per cent) had scratch tests. The scratch test sample did not differ significantly by sex from the total population.

**Table I.** *The population by sex and by year of study*

| Information obtained                      | Year of study | Men  |      | Women |      | Total number |
|-------------------------------------------|---------------|------|------|-------|------|--------------|
|                                           |               | No.  | %    | No.   | %    |              |
| History of allergy                        | 1962          | 638  | 75.1 | 211   | 24.9 | 849          |
|                                           | 1963          | 641  | 64.9 | 346   | 35.1 | 987          |
| Total                                     |               | 1279 | 69.7 | 557   | 30.3 | 1836         |
| History of allergy and skin scratch tests | 1962          | 407  | 75.5 | 132   | 24.5 | 539          |
|                                           | 1963          | 470  | 66.8 | 234   | 33.2 | 704          |
| Total                                     |               | 877  | 70.6 | 366   | 29.4 | 1243         |

**Table II.** *Frequency of allergy reported by the population*

|                      |          | $A +$     | $A +$     | $A +$     |           | $HF +$    |           | Total |      | Other          | % Al-         |
|----------------------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-------|------|----------------|---------------|
| <i>Year of study</i> | <i>A</i> | <i>AR</i> | <i>HF</i> | <i>AR</i> | <i>HF</i> | <i>AR</i> | <i>AR</i> | No.   | %    | <i>allergy</i> | <i>lergic</i> |
| 1962                 |          |           |           |           |           |           |           |       |      |                |               |
| Men                  | 9        | 1         | 19        | 2         | 115       | 12        | 7         | 165   | 25.9 | 52             | 34.0          |
| Women                | 4        | 2         | 5         | 1         | 22        | 7         | 4         | 45    | 21.3 | 21             | 31.3          |
| Totals               |          |           |           |           |           |           |           | 210   | 24.7 |                | 33.3          |
| 1963                 |          |           |           |           |           |           |           |       |      |                |               |
| Men                  | 7        | 9         | 20        | 3         | 102       | 12        | 15        | 168   | 26.2 | 54             | 34.6          |
| Women                | 5        | 0         | 8         | 2         | 48        | 10        | 8         | 81    | 23.4 | 53             | 38.7          |
| Totals               |          |           |           |           |           |           |           | 249   | 25.2 |                | 36.1          |
| Both years           |          |           |           |           |           |           |           |       |      |                |               |
| Men                  | 16       | 10        | 39        | 5         | 217       | 24        | 22        | 333   | 26.0 | 106            | 34.3          |
| Women                | 9        | 2         | 13        | 3         | 70        | 17        | 12        | 126   | 22.6 | 74             | 35.9          |
| Totals               |          |           |           |           |           |           |           | 459   | 25.0 |                | 34.8          |

A = asthma, HF = hay fever, AR = nonseasonal allergic rhinitis. Other allergy = any type of allergy in the absence of asthma, hay fever, or nonseasonal allergic rhinitis (see text).

At least one type of allergy was present in 639 (34.8 per cent) of 1,836 students (Table II). Asthma, hay fever, and nonseasonal allergic rhinitis occurred either singly or in combination in 25.0 per cent of the population. Many students with these conditions also had other types of allergy. Students who did not have asthma, hay fever, or nonseasonal allergic rhinitis but who did have another type of allergy are listed under the "other allergy" column in Table II. This category includes atopic eczema, angioedema, urticaria, food allergy, drug allergy, and bee sting allergy. Migraine headache was not classified as an allergic condition.

A high frequency of allergies was observed in both years of study. Differences in total frequencies between males and females were not significant.

The total frequency of asthma was 5.3 per cent and that of nonseasonal allergic rhinitis was 5.2 per cent; no significant sex difference was present for these conditions. Hay fever, the most common allergy, occurred in 21.1 per cent of the total population. The difference in the first year of study between men and women who had hay fever (23.2 per cent of the men vs. 16.6 per cent of the women) was significant ( $P < 0.05$ ). However, this sex difference was not found in the second year of study (21.4 per cent of the men vs. 19.7 per cent of the women affected with hay fever) or for the 2 years combined. It is questionable, then, that there was real biological meaning in this observation for the first class of students.

The mean age of onset was 6.9 years for asthma, 9.1 years for nonseasonal allergic rhinitis, and 10.6 years for hay fever. Mean age of onset did not differ significantly by year of study or by sex affected.

Family histories of students were evaluated for the presence or absence of asthma, hay fever, and nonseasonal allergic rhinitis among parents and sibs. In many cases it was not possible to obtain reliable information about the students' grandparents; thus, data on grandparents were omitted. Histories were classi-

**Table III.** *Positive family histories of asthma, hay fever, and/or nonseasonal allergic rhinitis among 1,825 college freshmen*

|        | <i>Students' diagnoses</i>       |                   |              |                                   |                   |              |                                |                   |              |
|--------|----------------------------------|-------------------|--------------|-----------------------------------|-------------------|--------------|--------------------------------|-------------------|--------------|
|        | <i>Group 1,<br/>A/HF/AR</i>      |                   |              | <i>Group 2,<br/>other allergy</i> |                   |              | <i>Group 3,<br/>no allergy</i> |                   |              |
|        | <i>Family history of A/HF/AR</i> |                   |              |                                   |                   |              |                                |                   |              |
|        | <i>Pos.</i>                      | <i>%<br/>Pos.</i> | <i>Total</i> | <i>Pos.</i>                       | <i>%<br/>Pos.</i> | <i>Total</i> | <i>Pos.</i>                    | <i>%<br/>Pos.</i> | <i>Total</i> |
| Men    | 202                              | 61.0              | 331          | 37                                | 34.9              | 106          | 283                            | 33.9              | 835          |
| Women  | 89                               | 71.8              | 124          | 33                                | 45.8              | 72           | 132                            | 37.0              | 357          |
| Totals | 291                              | 64.0              | 455          | 70                                | 42.1              | 178          | 415                            | 34.8              | 1192         |

Eleven students with unknown family histories were omitted.

**Table IV.** *Frequency of at least one positive skin scratch test to selected allergens among 1,243 college freshmen*

|        | <i>Students' diagnoses</i>    |               |              |                                   |               |              |                                |               |              |
|--------|-------------------------------|---------------|--------------|-----------------------------------|---------------|--------------|--------------------------------|---------------|--------------|
|        | <i>Group 1,<br/>A/HF/AR</i>   |               |              | <i>Group 2,<br/>other allergy</i> |               |              | <i>Group 3,<br/>no allergy</i> |               |              |
|        | <i>Scratch test reactions</i> |               |              |                                   |               |              |                                |               |              |
|        | <i>Pos.</i>                   | <i>% Pos.</i> | <i>Total</i> | <i>Pos.</i>                       | <i>% Pos.</i> | <i>Total</i> | <i>Pos.</i>                    | <i>% Pos.</i> | <i>Total</i> |
| Men    | 164                           | 66.9          | 245          | 25                                | 28.7          | 87           | 101                            | 18.5          | 545          |
| Women  | 48                            | 55.2          | 87           | 14                                | 23.7          | 59           | 32                             | 14.5          | 220          |
| Totals | 212                           | 63.9          | 332          | 39                                | 26.7          | 146          | 133                            | 17.4          | 765          |

fied as positive if any parent or sib ever had asthma, hay fever, or nonseasonal allergic rhinitis.

Family histories are known for 1,825 students (Table III). These students were classified into one of the following: Group 1—those with asthma, hay fever, and/or nonseasonal allergic rhinitis; Group 2—those without asthma or allergic rhinitis but with any other type of allergy; and Group 3—those without any type of allergy. Asthma, hay fever, and nonseasonal allergic rhinitis concentrated in families of students who were also affected with these conditions. The frequency of positive family histories observed in Group 1 was significantly higher ( $P < 0.01$ ) than the frequency in either Group 2 or Group 3; however, Group 2 was not significantly different from Group 3. In each group women reported positive family histories more frequently than men. This sex difference was significant ( $P < 0.05$ ) only in Group 1. It may represent only a reporting difference; that is, women may be more aware of affected individuals in the family, or it may be due to other factors which will require more detailed analysis for interpretation.

The frequency of at least one positive scratch test reaction among the 1,243 students who were tested with the battery of selected allergens is given in Table IV. No significant sex differences were observed within groups, although more men were reactive to the scratch test than women in each group. Group 1

**Table V.** *Association of family histories with skin scratch test reactions*

| <i>Diagnosis<br/>of students</i> | <i>Scratch test<br/>reaction</i> |            |                        | <i>Family history of A/HF/AR</i> |          |                         |
|----------------------------------|----------------------------------|------------|------------------------|----------------------------------|----------|-------------------------|
|                                  | <i>Result</i>                    | <i>No.</i> | <i>% Pos.<br/>S.T.</i> | <i>Positive</i>                  |          | <i>Negative<br/>No.</i> |
|                                  |                                  |            |                        | <i>No.</i>                       | <i>%</i> |                         |
| A/HF/AR                          | Pos.                             | 210        | 63.8                   | 149                              | 71.0     | 61                      |
| (Group 1)                        | Neg.                             | 119        |                        | 75                               | 63.0     | 44                      |
| Total                            |                                  | 329        |                        | 224                              | 68.1     | 105                     |
| Other allergy                    | Pos.                             | 39         | 27.1                   | 16                               | 41.0     | 23                      |
| (Group 2)                        | Neg.                             | 105        |                        | 45                               | 42.9     | 60                      |
| Total                            |                                  | 144        |                        | 61                               | 42.4     | 83                      |
| No allergy                       | Pos.                             | 133        | 17.4                   | 61                               | 45.9     | 72                      |
| (Group 3)                        | Neg.                             | 630        |                        | 244                              | 38.7     | 386                     |
| Total                            |                                  | 763        |                        | 305                              | 40.0     | 458                     |

(asthma-allergic rhinitis), with 63.9 per cent reactors, was significantly higher than Group 2 or Group 3 ( $P < 0.01$ ). The frequency of positive skin test reactions in Group 2 (other allergy) was significantly greater ( $P < 0.05$ ) than the frequency observed in Group 3 (no allergy).

In Table V data are given on both family history and skin scratch test reaction to determine if these two variables are related. One thousand two hundred and thirty-six students had known family histories as well as known scratch test reactions. No association was found in any group for presence or absence of scratch test reaction with presence or absence of affected relatives in the family.

## DISCUSSION

Our study has been limited to a consideration of asthma and allergic rhinitis, since these conditions were easy to identify from the histories given by these college students. Infantile eczema was not considered in detail due to the difficulty of making a retrospective diagnosis and of differentiating by history atopic eczema from other childhood skin lesions such as seborrheic dermatitis. Urticaria was not included with the asthma-allergic rhinitis group because the frequency of this disease may be the same in atopic and nonatopic individuals.<sup>2</sup>

Gradually increasing incidence of allergy has been observed with successive studies of college students. Frequencies reported for asthma and/or allergic rhinitis vary as follows: 1924, Spain and Cooke,<sup>3</sup> 3.3 per cent; 1934, Jiminez,<sup>4</sup> 11.9 per cent; 1937, Rowe,<sup>5</sup> 13.0 per cent; 1954, Tips,<sup>6</sup> 20.2 per cent; 1959, Van Arsdel and Motulsky,<sup>7</sup> 16.7 per cent; 1962, Maternowski and Mathews,<sup>8</sup> 19.1 per cent. The geographical area in which the population study was done may have played an important role, since the quantity and quality of pollens and molds vary depending on the climate of the particular area. However, the studies of Jiminez and of Maternowski and Mathews were both done in Michigan, although they were 26 years apart. Also, the study of Van Arsdel and Motulsky was done in the state of Washington, which these investigators re-

**Table VI.** *Seasonal and nonseasonal allergic rhinitis and asthma in different populations of college students*

| <i>Investigators and population source</i>  | <i>Allergic rhinitis</i> |          | <i>Asthma</i> |          | <i>Both</i> |          | <i>Total allergic</i> |          | <i>Total No. of students</i> |
|---------------------------------------------|--------------------------|----------|---------------|----------|-------------|----------|-----------------------|----------|------------------------------|
|                                             | <i>No.</i>               | <i>%</i> | <i>No.</i>    | <i>%</i> | <i>No.</i>  | <i>%</i> | <i>No.</i>            | <i>%</i> |                              |
| Van Arsdel and Motulsky<br>Univ. Washington | 695                      | 12.0     | 118           | 2.0      | 158         | 2.7      | 971                   | 16.7     | 5,818                        |
| Maternowski and Mathews<br>Univ. Michigan   | 58                       | 13.4     | 11            | 2.5      | 14          | 3.2      | 83                    | 19.1     | 434                          |
| Present study<br>Brown Univ.                | 362                      | 19.7     | 25            | 1.4      | 72          | 3.9      | 459                   | 25.0     | 1,836                        |

port is a region where ragweed is nonexistent and airborne pollen and mold spore concentrations are usually low.

We observed an even higher frequency of asthma and allergic rhinitis, 25.0 per cent. One explanation of this increasing trend in the frequency of allergy is that greater awareness of allergies exists now among the population. Other considerations involve the thoroughness of study procedures which have been used. By repeating our study for a second year, we observed essentially the same frequencies of allergic conditions from one class of freshmen students to the next.

Frequencies of asthma and allergic rhinitis observed in the present study and 2 recent investigations<sup>7, 8</sup> are summarized in Table VI. The frequency of asthma among Brown University students compares reasonably with frequencies observed among University of Washington students and among University of Michigan students, perhaps as a result of the usually overt, readily distinguished symptoms characteristic of asthma. The frequency of allergic rhinitis is significantly lower in the other two studies than in our study. Ecological differences may account for some of the variation between our study and the University of Washington study. More similar ecological conditions probably occur between our population and the University of Michigan population. Maternowski and Mathews<sup>8</sup> point out that the Michigan students are exposed to relatively large amounts of tree, grass, and weed pollens and airborne fungus spores; this description is also characteristic of the southern New England region.

Sherry and Scott<sup>9</sup> studied the frequency of allergic diseases among native-born Negro college freshmen at Howard University and observed asthma among 4.0 per cent and hay fever among 13.9 per cent. The higher frequencies of these conditions which we observed among native-born Caucasian students suggests that Caucasians may express these allergic conditions more frequently than Negroes.

Our onset-age data are in agreement with Rackemann's<sup>10</sup> observation that asthma has an earlier age of onset than hay fever. Rackemann described in highly sensitive individuals an allergic triad of atopic eczema, asthma, and hay fever, occurring chronologically in this order.

Our study allowed an evaluation of the frequency of positive cutaneous scratch tests in the 16 to 20 year age group. In order to make comparisons, Curran and Goldman<sup>11</sup> point out the importance of keeping all relevant considerations constant, including type, concentration, and number of extracts, sex, age, and skin test method, and interpretation of results. We found that 31.2 per cent of the class studied in 1962 (168 of 539) reacted to at least one allergen, while 30.7 per cent of the class studied in 1963 (216 of 704) were reactors. Thus, 30.9 per cent of the population studied during both years had at least one positive skin test reaction. As expected, these positive reactions occurred most frequently among allergic students. If it had been possible to use intracutaneous tests, a higher frequency of individuals would be expected to have positive skin test reactions, since this method has been estimated to be about one hundred times as sensitive as the scratch method.<sup>12</sup>

Among the 1,243 students who were scratch tested, 277 (22.3 per cent) had seasonal hay fever; but only 68.6 per cent (190) of these had at least one positive scratch test, and 62.5 per cent (173) reacted to one or more of the pollen extracts used in the study. Therefore, the frequency of hay fever associated with a positive scratch test to pollen extracts is 13.9 per cent. However, only 138 students (11.1 per cent) had a positive pollen skin test corresponding to the season in which hay fever had been reported to occur. These comparisons place some question on the diagnosis of seasonal hay fever, but they would be more meaningful if the intracutaneous test had been used as well as a broader battery of test allergens.

In previous studies in which a direct comparison of skin test reactivity in an allergic and a nonallergic population was investigated, the allergic group was markedly more reactive than the nonallergic group.<sup>10-11, 13-19</sup> In the present study, 3.7 times more skin reactive individuals occurred in the group with asthma and/or allergic rhinitis than in the group with no allergy at all. Among students who did not have any allergy, 17 per cent did have a positive scratch test reaction. This may give an estimate of the frequency of cutaneous reaction to test allergens in the absence of clinical symptoms of allergy among this age group of the general Caucasian population. It may represent either the frequency of nonspecific false positive scratch tests or a proportion of this population which has subclinical symptoms that may become manifest in time. Follow-up studies are needed to interpret this observation.

Curran and Goldman<sup>11</sup> suggest that a positive family history of allergy is significant in relation to skin test reactivity. Our data do not support this supposition in relation to a family history of asthma and/or allergic rhinitis.

Previous genetic studies of allergic diseases have been reviewed by Schwartz<sup>2</sup> and by Ratner and Silberman.<sup>20</sup> Our observed frequency of 64 per cent positive family histories of asthma and allergic rhinitis in parents and sibs of students with asthma and allergic rhinitis agrees with the frequency observed by Maternowski and Mathews<sup>8</sup> but is considerably greater than the 43.9 per cent observed by Van Arsdel and Motulsky.<sup>7</sup> However, in each study differences between allergic and nonallergic groups were highly significant.

If family history is to be evaluated meaningfully for an assessment of the

genetic transmission of allergic conditions, it is important to document more than just positive and negative family histories of affected and nonaffected individuals (probands). Such data as family size, onset age, and known diagnoses in specific relatives are essential. Then questions, such as whether susceptibility for a specific allergy or a specific group of allergies is inherited, can be considered. Are single genes or are many genes involved in genetic transmission? Is there a genetic relationship between asthma and allergic rhinitis; does each condition represent a different genetic entity or a different expression of the same genetic entity? The observed localization of these conditions among relatives of afflicted students suggests that they are related genetically.

Our test battery of cutaneous allergens was selected for this study as representative of pollens found in the New England area and of other inhalant allergens and foods. *Alternaria* was added during the second year of study. However, only one man, classified in the "other allergy" group, reacted only to *Alternaria*. Extracts of house dust were not used for test purposes since observations of Efron and associates<sup>15</sup> and of Fontana and associates<sup>17</sup> indicate that many skin reactions to house dust extracts may be on an irritative basis rather than a true allergic response.

We observed the following frequencies of reaction to individual allergens by the students which we tested: less than 5 per cent—egg white, cow milk, wheat, kapok; 5.0 to 9.9 per cent—feather mixture, dog dander; 15.0 to 19.9 per cent—cat dander, elm, *Alternaria* (based only on 1963 sample); 25.0 to 29.9 per cent—maple; 30.0 to 34.9 per cent—birch; 40.0 to 44.9 per cent—giant ragweed; 50.0 to 54.9 per cent—short ragweed, June grass, timothy. Foods have previously been reported<sup>18</sup> to produce a low incidence of positive tests with the use of the scratch technique, while grasses and ragweed are known to have a high incidence.

Various workers<sup>11, 21, 22</sup> stress the importance of accurate allergic histories obtained on repeated occasions from the individual. In the present study both questionnaire and individual test methods have been used. Also, parental follow-up has been employed. The principal yield from parents was to verify data reported by students and to add additional information about allergic diseases which the student had earlier in life.

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