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PAST HISTORY AND SKINREACTIONS IN ALLERGIC CHILDREN

By

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The purpose of the present investigation was to find how great a conformity there is between the past history of hypersensitiveness in children and the positive reactions found in cutaneous tests.

SERIES OF CASES

The series consists of 600 children examined in the course of the period from April, 1948, to October, 1952. Most of the children have suffered from asthma, though all the common types of allergic diseases are represented. The cases were not selected for the purpose of the present study, but a few patients were left out either because they had been insufficiently examined, or because it appeared that they did not suffer from allergic diseases. A couple of patients with physical allergy (urticaria from cold) were also left out.

The distribution of the patients in age-groups is shown in Fig. I. The sex-incidence, 62 per cent of boys and 38 per cent of girls, is characteristic of allergic children and in close conformity with findings by other Scandinavian investigators: Brandberg and Wilander: 66 per cent of boys—34 per cent of girls (1); Eriksson-Lihr: 61 per cent of boys—39 per cent of girls (2); Winge Flensborg: 64 per cent of boys—36 per cent of girls (4); and Wilken-Jensen: 66 per cent of boys—34 per cent of girls (6).

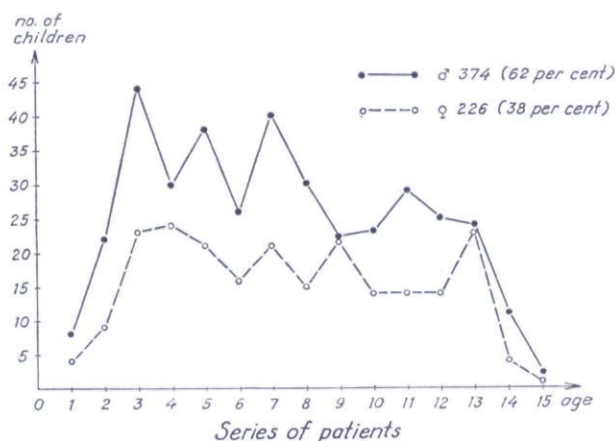


Fig. I.

INVESTIGATIONS¹

The past history was recorded in such great detail that it afforded any information with which to form an estimate of the allergens which might play a part in the disease of the individual child. Questions were asked about skin symptoms, rhino-laryngologic signs, the frequency of catarrhal affections, attacks of bronchitis and asthma, and about symptoms suggesting gastro-intestinal allergy. Furthermore, questions were asked about any change in the symptoms in relation to seasons and to the time of the day, or in the case of change of residence, and the dependence of the symptoms on climatic conditions. It was also attempted to obtain information concerning any releasing causes: Dust, feathers, domestic animals, pollen, special articles of food and drugs. The outfit and the quality of the home were elucidated, and detailed questions were asked about the child's sleeping accommodation, especially with regard to the outfit of the bed etc.

The physical examination of the patient comprised both

¹ I am indebted to Dr. Knud Wilken-Jensen for his kind permission to use the case records of the Clinic for Asthmatic Children and for advice and guidance during the preparation of this work.

an ordinary clinical examination (including radiography of lungs, heart and accessory sinuses of the nose, otologic special examination and the ordinary laboratory investigations) and an allergologic examination. Scratch tests were used as a routine method in the Clinic for Asthmatic Children (this has later been replaced by the prick test), and comprised about 80 standard extracts; when considered necessary, the examination can be extended to comprise about 120 allergens. (All allergens were supplied by "Allergologisk Laboratorium", Frihavnsapotheket, Copenhagen). Intracutaneous tests were used to a considerable extent to supplement the scratch tests.

TABLE 1
Total number of positive reactions classified according to intensity.

	♂ 0-7 years	♀ 0-7 years	♂ 8-15 years	♀ 8-15 years	Total
(+)	24	26	28	20	98
+	118	70	206	134	528
++	40	10	83	31	164
+++	16	5	22	14	57
++++	1	0	4	8	13
Total	199	111	343	207	860

Scratch tests.—Positive scratch tests were found in 194 (52 per cent) out of the 374 boys of the series; in the case of girls, 127 out of 266 (56 per cent) showed positive reactions. Table 1 shows that 860 positive reactions were found in a total of about 48,000 scratch tests. 98 out of these 860 reactions must be termed doubtfully positive (the (+)-reactions), and have therefore been left out in the following tables and calculations. Otherwise the great majority of reactions were of the intensity indicated by +. No small number of the most intense reactions occurred in very few children: 6 children thus had no less than 17 +++ and 7 ++++ reactions altogether!

Reactions to the allergen groups grass pollen, species of trees, species of fish, and various meats often showed group-

specific hypersensitiveness, as a child might react to all substances within a group—not infrequently with vigorous reactions and of the same intensity to all allergens of the group concerned. Each of these group reactions is listed in the table as only one reaction.

A similar survey of the intracutaneous tests cannot be made, as not all the children were thus tested, and as those who *were* were examined only with a comparatively small number of allergen extracts.

Findings with Skinreactions in Children aged 1, 2 and 3 Years.

The positive skinreactions decrease in frequently the younger the children are. It might therefore be thought that a positive reaction in the quite young children might be due to a pronounced allergy, and that the possibility of conformity between the past history and the skinreaction would be especially great here. This, however, was not the case: In the 1-year age-group (12 patients) a positive reaction (to Greenland feathers and to silk) was found in only 2 children, and nothing in the past history suggested hypersensitiveness to these two substances. In the 2-year age-group (31 children) there were 4 positive scratch tests in 3 children in all; nor did the past history in these cases lend support to the findings. Among the 3-year-old (67 patients) there were 15 positive skinreactions; in 6 cases the findings were in accord with a supposed allergy. This is undoubtedly due to the fact that the past history becomes more precise as the child grows older, as the parents will then have had a longer time in which to observe the disease and the conditions under which the attacks occur.

Non-reactors.—In the following this term means the children who showed no positive reaction in any of the tests, whether scratch tests, intracutaneous tests or nasal tests. Table 2 shows that of the 208 children of the youngest group of boys, 127 (61 per cent) were non-reactors, in the youngest group of girls there were 56 per cent of non-reactors; among the oldest

TABLE 2

	♂ 0-7 years	♀ 0-7 years	♂ 8-15 years	♀ 8-15 years
Total number of children ..	208	118	166	108
Non-reactors .	127	66	53	33
	(61 per cent)	(56 per cent)	(32 per cent)	(31 per cent)

boys 32 per cent, and among the oldest girls 31 per cent of non-reactors. The findings were thus the same in the groups of boys and girls, and the whole series has therefore been joined in Figg. II and III. Fig. II gives in absolute numbers the total of children in the separate age-groups (upper curve) and the number of non-reactors in the same age-groups (lower curve). A calculation of the number of non-reactors in per cent



Fig. II.

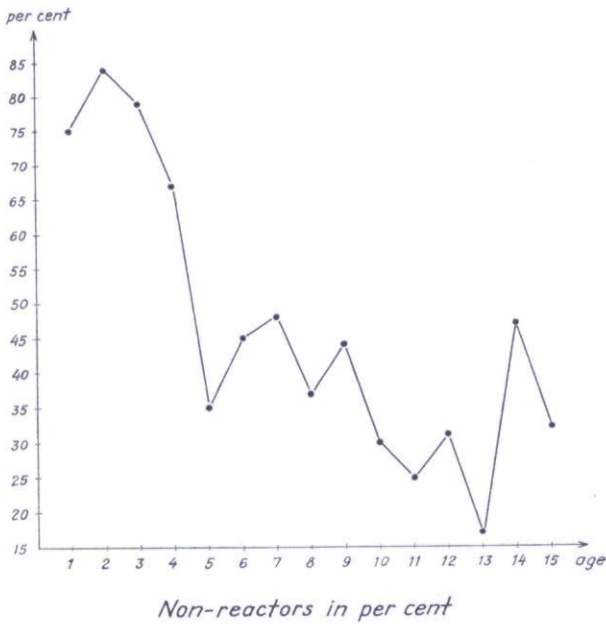


Fig. III.

of the total number of children in each age-group gave the results shown in Fig. III. It appears that in the youngest age-groups the non-reactors represented from 75 to 85 per cent of the children; but the relative number of non-reactors decreases for each year, so that over 50 per cent of the children from the age of 5 reacted to one or more of the allergen extracts. This is presumably due to the fact that bacterial allergy is gradually playing a less important part as the only releasing cause, as the children grow older. The curve shows an almost linear fall from 85 per cent at the age of 2 years to from 15 to 20 per cent at the age of 13. The apparent rise at ages from 14 to 15 years is due to the fact that the absolute number of children was very low here; a percentage calculation of non-reactors in these two age-groups would hardly be justifiable.

When the series is considered as a whole, the non-reactors represent 48 per cent in the case of boys and 44 per cent in the

case of girls. These rather high percentages are due to the fact that children up to 8 years constitute such a large proportion of the series.

BACTERIAL ALLERGY

In most of the allergic children who did not respond to the skin tests there was reason to suppose that their disease was due to bacterial allergy. Table 3 shows the series divided into a group of boys and one of girls, each being subdivided into a younger and an older age-group. The third column gives the number of children whose disease must be supposed to be either exclusively or chiefly due to bacterial allergy.

TABLE 3
Bacterial allergy.

Sex and age-group	No. of children	To be suspected of bacterial allergy	Per cent of children in this group	All skin-reactions negative	Per cent of children in this group
♂ 0-7 years	208	176	85 per cent	99	48 per cent
♀ 0-7 "	118	99	84 " "	56	48 " "
♂ 8-15 "	166	122	74 " "	25	15 " "
♀ 8-15 "	108	70	65 " "	19	18 " "

It should, however, be pointed out that the absence of response to cutaneous tests did *not eo ipso* cause the child to be included in the group "bacterial allergy". The child's attacks of allergy might also have been released by allergens other than those contained in the extracts used in cutaneous testing. Further, the attacks might be thought to be caused by psychic factors: Suspense, excitement, anger, anxiety states etc.

Necessary conditions for listing the children in the group of "purely bacterial allergy" in Table 3 (last column but one) were: (1) Absence of skinreactions *and* (2) a past history of the attacks setting on in conjunction with recurrent catarrhal affections, possibly complicated by bronchitis, and (3) possible

TABLE 4

<i>Danish series</i>				<i>Finnish series</i>		
<i>sex and age group</i>	<i>purely exogen.all.</i>	<i>exogen + bact.all.</i>	<i>purely bact.all.</i>	<i>purely exogen.all.</i>	<i>exogen + bact.all.</i>	<i>purely bact.all.</i>
♂ 0-7 years	15 per cent	37 per cent	48 per cent	17 per cent	76 per cent	7 per cent
♀ 0-7 years	16 " "	36 " "	48 " "	8 " "	74 " "	18 " "
♂ 8-15 years	26 " "	59 " "	15 " "	29 " "	69 " "	2 " "
♀ 8-15 years	35 " "	47 " "	18 " "	10 " "	67 " "	23 " "

objective findings at rhinolaryngologic examination or radio-scopy, suggesting the presence of infectious disease in the nasopharynx, the accessory sinuses of the nose, or in the lungs. When calculated in per cent (last column) the findings were identical in the groups of boys and of girls. Calculation on the whole group of boys gave 33 per cent, and on the whole group of girls 33 per cent. In other words, at least one-third of all children examined—boys as well as girls—presumably suffered from a purely bacterial allergy. This type plus combined bacterial-exogenous allergy was found in the present series in about 85 per cent in the youngest age-group (0-7 years) and in from 65 to 75 per cent in the oldest age-group (8-15 years), cf. the fourth column in Table 3. The percentage distribution of the children in the three groups: (1) Purely exogenous allergy, (2) the group of combined affection due to exogenous as well as bacterial allergens, and (3) purely bacterial allergy, is shown in Table 4. The classification into separate groups of boys and girls is used here, too, to make the table comparable with Eriksson-Lihr's series (2), even though the present one showed no difference between the two groups.

The most conspicuous difference from the Finnish series is seen in the group of "purely bacterial allergy", where Eriksson-Lihr has very low figures. It has been maintained (e.g. by Salén *et al.* (5)) that the part played by allergy caused exclusively by bacteria becomes greater with advancing age. In

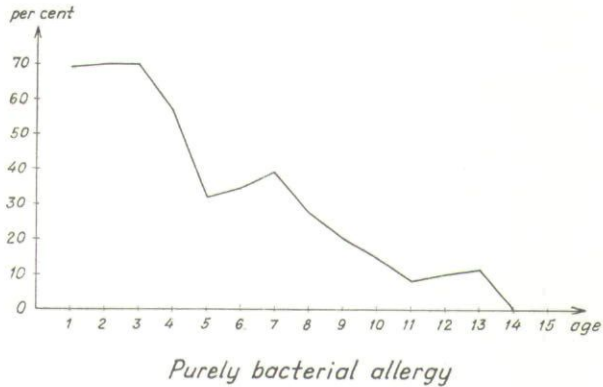


Fig. IV.

the Clinic for Asthmatic Children, University Hospital, Copenhagen, the findings were the reverse, as will appear distinctly from the curve in Fig. IV. The number of children with purely bacterial allergy is plotted along the ordinate in per cent of all children in the separate age-groups; the ages have been plotted along the abscissa. The curve shows an almost linear fall from about 70 per cent at the age of 3 years to 0 per cent at 14 or 15 years.

As previously mentioned, absence of response to cutaneous tests was found especially in the quite young children; the longer the child has been in contact with its surroundings and the numerous allergens present there, the more frequent will the positive skinreactions become. This is shown by Table 5 both in children with comparatively few (1-4) positive reactions and in such as had multiple responses. This survey is directly comparable with a table previously published by Winge Flensborg (3), as the two series of children originate from the same clinic. He found a similar, though still more pronounced rise in the number of reactors: from 2 to 4 years: 56 per cent; from 10 to 12 years: 90 per cent. He found a more pronounced rise, too, among the children who responded to more than four different allergens, as the maximum—reached by the age-group 10-12 years—was at 50 per cent.

TABLE 5
Number of children reacting.

Age in years	No. of children	With positive react.		1-4 positive react.		> 4 positive react.	
		No. of children	Per cent	No. of children	Per cent	No. of children	Per cent
0-2	44	6	14	6	14	0	0
3-4	125	30	24	23	18	7	6
5-6	100	47	47	43	43	4	4
7-8	106	44	41	36	34	8	7
9-10	80	55	69	44	55	11	14
11-12	82	57	70	48	59	9	11
13-15	63	45	71	34	54	11	17

FREQUENCY OF ACCORD BETWEEN PAST HISTORY AND SKINREACTIONS

The result obtained by investigating this question is essentially dependent on a very detailed past history recorded by the examiner. In spite of the special elaboration of the case records and despite prolonged questioning, the past histories of the children of the present series are often insufficient owing to inadequate information given by the relatives accompanying the children; however, it was only in 25 out of the 600 cases that any releasing causes could not be supposed. These cases were represented by 12 boys (i.e. about 3 per cent of all boys), 6 in the age-group 0-7 years and 6 in that of 8-15 years, and 13 girls (about 6 per cent) with 7 in the younger age-group and 6 in the older one.

Fourteen out of these 25 children did not respond to either scratch tests or intracutaneous tests; 4 showed doubtfully positive reactions, whereas 7—all of the older age-group—had definitely positive reactions to house-dust, 4 also to duck's feathers.

Table 6 shows the number of children who, according to their past histories, must be supposed to be hypersensitive to one of the allergens mentioned (the denominator) and the number of *these children* who responded to cutaneous tests or

TABLE 6

Ratio between number of children with past history of hypersensitiveness (denominator) and the number of these children reacting positively to the allergen concerned (numerator).

Allergen	♂ 0-7 years	♀ 0-7 years	♂ 8-15 years	♀ 8-15 years	Total	Per cent
House-dust	24/37	9/17	48/60	20/29	101/143	71
Feathers	25/79	10/60	29/75	18/43	82/257	32
Moulds	8/43	5/31	13/43	15/35	41/152	27
Grass pollen	3/5	0/0	8/15	7/16	18/36	50
Horse-scales	5/6	0/0	7/8	4/5	16/19	
Dog's hairs	1/3	0/1	3/6	7/12	11/22	
Cat's hairs	1/4	0/5	3/9	4/5	8/23	
Cow's hairs	0/0	1/1	3/4	1/2	5/7	
Threshing dust ...	0/0	0/0	3/14	2/7	5/21	

to nasal tests (the numerator). The table only comprises the nine allergens most frequently suspected to be the releasing cause of the childrens' allergy; each of all the other allergens were mentioned only in very few cases as a possible cause.

A past history of hypersensitiveness to cow's hairs, cat's hairs, dog's hairs, horse-scales and grass pollen requires no further comments; as a rule, the statements given by the parents in these cases were quite definite and unambiguous. In the case of allergy to feathers the children were suspected of this type when it was stated that they had feathers or downs in the pillow or in the quilt *and* if attacks occurred either exclusively or chiefly in the bed. Furthermore, the cases have of course been included in which it was stated directly that contact with fowl or birds might give rise to attacks.

With regard to allergy to house-dust, such cases are a little more difficult to diagnose, as the child's parents generally are not familiar with the idea of house-dust as releasing cause e.g. in asthma or allergic rhinitis. However, when the parents were questioned more closely, it was managed in quite a number of cases to obtain the information that the child's attacks had been released, for instance, by dusting, carpet-beating,

spring cleaning, or when the child was playing about in upholstered furniture—all things which are known to raise great quantities of dust. Further, when the children get up in the morning, house-dust (and feather allergens) are scattered all over. The present investigation showed that if the attacks often or exclusively occurred in the mornings, the possibility of allergy to house-dust should always be seriously considered—possibly also allergy to feathers—a combination which is very frequent, as will be mentioned in greater detail later. On the other hand, attacks occurring in the evenings are not characteristic of definite allergens to the same degree.

Threshing-dust as a special allergen extract has but recently been introduced into the routine examination; the figures in this group are therefore only small. Allergy to threshing-dust was supposed in the cases where it was noticed that the patient had his attacks when staying or playing in a barn or in a hay-loft, or when he lent a hand in threshing. Besides the possibility of pollen allergy, hypersensitiveness to moulds should also be considered under these conditions, as the child in contact with hay, straw, threshing-dust etc. will also contact (or inhale) moulds. Hypersensitiveness to these organisms was also supposed in cases where it was stated that the house was damp, possibly with mould on wall-paper, remains of food, or footwear.

The examination showed that of the inhalants house-dust was apparently the most important cause of allergic diseases in children. This type was supposed in a total of 143 children; 101 of these (71 per cent) gave positive reactions; this was the highest percentage of conformity found with all inhalants. The feather allergens constituted the second most important cause: In accordance with the criteria mentioned there was a possibility of feather allergy in 257 children; 82 (32 per cent) responded to the skin tests. This relatively low percentage is undoubtedly due to the fact that too wide limits had been fixed for children to be considered possible feather allergics.

It was striking to see that in the case of grass pollen only

TABLE 7

Ratio between number of children with past history of hypersensitiveness (denominator) and the number of these children (boys and girls) reacting positively to the allergen concerned (numerator).

Allergen	0-7 years	8-15 years
House-dust	33/54 (61 per cent)	68/89 (76 per cent)
Feathers	35/139 (25 " ")	47/118 (40 " ")
Moulds	13/74 (18 " ")	28/78 (36 " ")
Grass pollen	3/5	15/31 (48 " ")
Horse-scales	5/6	11/13
Dog's hairs	1/4	11/18
Cat's hairs	1/9	7/14
Cow's hairs	1/1	4/6

50 per cent showed accord between the past history and the testing; a much higher correlation would have been expected, especially as hay fever is such a characteristic and rather easily recognizable clinical entity. Horse-scales represented the allergen with the highest degree of accord: 16 out of 19 suspected children gave positive reactions.

With regard to all allergens not mentioned in Table 6, it applies that the possibility of hypersensitiveness has only been mentioned at rare intervals; in these rare cases the cutaneous reactions lent fairly good support to the past history.

Table 7 shows the groups of boys and girls considered as a whole but with the same division into age-groups 0-7 and 8-15 years. It appears that there is a greater conformity between the past history and the skinreactions in older than in younger children. It is uncertain whether this is due to a greater reaction capacity of the skin in the older children, or whether the cause is a more reliable past history. There is possibly an interaction of both factors.

When the skinreactions were counted, there appeared to be a striking connection between responses to house-dust extract and duck's feathers extract. The fact is, however, that these were the two extracts which most frequently produced positive reactions: Of the 600 children examined, 274 re-

TABLE 8

Total number of positive reactions to duck's feathers, duck's feathers + house-dust, and house-dust respectively.

Sex and age group	Positive react. to duck's feathers alone	Positive react. to duck's feathers and house-dust	Positive react. to house-dust alone
♂ 0-7 years	5	26	46
♀ 0-7 "	3	9	23
♂ 8-15 "	7	31	72
♀ 8-15 "	2	26	41
Total	17	92	182

sponded to house-dust and 109 to duck's feathers. In other words, almost half the children examined responded to purified house-dust extract. To speak of a "striking connection", there must therefore be a simultaneous response to house-dust and duck's feathers in considerably more than 50 per cent; this also appeared to be so. It appears from Table 8 that 92 out of the 109 children who responded to duck's feather-extract reacted simultaneously to the extract of house-dust. No mention of this fact has been found elsewhere in the literature, but in an examination of 36 children from the Home for Asthmatic Children in Stockholm, Salén *et al.* (1938) (5) mentioned the allergens to which these children responded. With regard to the ratio house-dust/duck's feathers, 29 children showed a positive reaction in tests with house-dust, while 17 responded to extract of feathers. *All* these 17 children also responded to house-dust.

A possible explanation of this fact is that the duck's-feather allergen constitutes rather a high proportion of the extract termed "purified house-dust". Or, the original material from which the duck's-feather extract is prepared may have been contaminated by house-dust.

CONCLUSIONS

The most important conclusions to be drawn from the present study are

(1) that a thorough and detailed recording of the past history is absolutely necessary in examination of allergic children—however time-consuming this may appear to begin with;

(2) that the great importance of allergy due to bacteria should always be borne in mind in dealing with allergic children. There are many things which suggest that bacterial allergens occur as the sole releasing factor in about 33 per cent of the children and as a complicating factor in about another 45 per cent.

Among the inhalants the sequence of importance as releasing factor seems to be: House-dust, feathers, moulds and grass pollen.

Finally it may be pointed out that the child's psychic condition also plays a great part in releasing the attacks; a detailed description of these complicated conditions would, however, be outside the scope of the present study.

SUMMARY

The results of an examination of the past histories and the skinreactions of 600 allergic children are reported.

The frequency of conformity between past history and skinreactions is detailed as far as the most important allergens are concerned.

Finally, the great importance of bacterial allergy, especially in the case of children of the youngest age-groups, is stressed.

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