# BREAST-FEEDING IN THE OXFORD CHILD HEALTH SURVEY

## PART II—COMPARISON OF BOTTLE- AND BREAST-FED BABIES

BY

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In a recent paper some of the social and biological factors which influenced the breast-feeding habits of mothers in the Oxford Child Health Survey were discussed (Westropp, 1953). It remains to discover what special advantages, if any, were enjoyed by the breast-fed babies.

In the following account the change-over from breast-feeding to artificial feeding is referred to as the weaning period. In a few cases complete breast-feeding was never established, but for most of the babies three distinct modes of feeding were represented in the first year: (1) Complete breast-feeding or pre-weaning period: during this phase the only additions to a diet of breast milk were vitamin concentrates. (2) Mixed feeding or weaning period: during this phase the babies were receiving breast milk and other liquid or solid foods. (3) "Other" feeding or post-weaning period: this phase began when the baby ceased to have any breast milk.

### Growth and Development

For 142 of the 580 babies who remained in the Survey for a year, weaning began during the first month (group 1), and for 235 it was postponed for at least five months (group 4). In addition, there were 84 babies who began to be weaned in the second or third month (group 2) and 119 in the fourth or fifth month (group 3). The composition of these four feeding groups in respect of sex, parity, birth-weight, and parents' weights is shown in Table I. These characteristics have been displayed because they are known to have influenced weight gain during the first year (Parfit, 1951; Hewitt and Stewart, 1952).

TABLE I.—*Sex, Parity, Birth Weight, and Parental Weights of Four Groups of Babies Defined by Duration of Complete Breast-feeding*

| Feeding Group | Age in Months at Onset of Weaning Period | No. of Babies | % Boys | % First-born | Average Birth Weight (lb.) | Average Weight (lb.) of | |
|---|---|---|---|---|---|---|---|
| | | | | | | Fathers* | Mothers† |
| 1 | 0– | 142 | 53·5 | 41·2 | 7·53 | 158·8 | 131·8 |
| 2 | 1– | 84 | 50·0 | 51·0 | 7·33 | 161·0 | 132·9 |
| 3 | 3– | 119 | 57·1 | 55·5 | 7·66 | 161·5 | 131·8 |
| 4 | 5+ | 235 | 47·8 | 41·6 | 7·54 | 156·3 | 132·1 |
| | Total | 580 | 51·2 | 46·0 | 7·52 | 158·6 | 132·1 |

* Based on 456 records.
† Based on 530 records.

*Body Weight.*—According to Table I there was so little difference between the four feeding groups for the factors mentioned that, had the rate of growth been the same for both breast- and bottle-fed babies, each should have gained approximately the same amount of weight. It is therefore significant that by the end of six months there was a definite weight gradient (see Table II); at this age the babies who had been bottle-fed longest were, on average, 12½ oz. (355 g.) heavier than the babies who were breast-fed longest. By the end of the year the average weights of the three groups weaned before the age of 5 months were roughly the same, but these babies were still appreciably heavier than the babies who continued to receive nothing but breast milk for longer periods.

TABLE II.—*Increase in Body Weight from 0 to 6 Months and from 6 to 12 Months. Comparison of Four Feeding Groups*

| Feeding Group | Average Increment (in lb.) | | Average Weight (in lb.) at 1 Year |
|---|---|---|---|
| | 0–6 Months | 6–12 Months | |
| 1 | 9·77 | 5·12 | 22·42 |
| 2 | 9·47 | 5·61 | 22·41 |
| 3 | 9·25 | 5·25 | 22·16 |
| 4 | 8·99 | 4·92 | 21·45 |
| Total | 9·29 | 5·14 | 21·95 |

*Development of Bones and Teeth.*—In Table III the bones and teeth of the babies in the four feeding groups are compared. The comparison, which was made at the age of 12 months, is in terms of the number of carpal and epiphysial bone centres visible in radiographs of the left wrist, the patency of the fontanelle, and the number of erupted teeth. It will be seen that the division of the babies by duration of complete breast-feeding cuts unevenly across the dates at which the fontanelle closed and the distal radial epiphysis appeared, and leaves the average number of bone centres in the carpus roughly the same for each group. There is, however, nothing to indicate a systematic difference between the breast- and bottle-fed babies in respect of these three characteristics. On the other hand, the analysis of teeth shows a slight but distinct feeding gradient, with the highest average number among the babies who were weaned earliest.

TABLE III.—*Development of Bones and Teeth. Comparison of Four Feeding Groups in respect of Skeletal Maturity, Patency of Fontanelle, and Number of Teeth at 12 Months*

| Feeding Group | No. of Babies | Radiological Data | | | Fontanelle Closed | No. of Teeth per Child |
|---|---|---|---|---|---|---|
| | | Distal Radial Epiphysis | No. of Carpal Bone Centres per Radiograph | No. of Babies Not Examined | | |
| 1 | 142 | 65·4% | 2·24 | 6 | 30·3% | 6·82 |
| 2 | 84 | 54·9% | 2·34 | 2 | 41·7% | 6·62 |
| 3 | 119 | 60·7% | 2·18 | 2 | 31·1% | 6·24 |
| 4 | 235 | 61·8% | 2·24 | 7 | 26·0% | 6·04 |
| Total | 580 | 61·4% | 2·25 | 17 | 30·3% | 6·35 |

*Other Milestones.*—Table IV summarizes the available data for the crawling and walking habits of the babies. In both respects the four feeding groups were very much alike, but the babies who dispensed with the crawling stage tended to be concentrated among those who were weaned earliest, and at 14 months the babies who were breast-fed longest were very slightly "less mobile" than the others.

To sum up, by the criteria chosen to demonstrate growth and development there were more resemblances than differences between the breast- and bottle-fed babies. Such differences as have appeared suggest that bottle-feeding, as practised by the mothers of healthy babies in the Oxford Child Health Survey, tended, very slightly, to accelerate growth.

TABLE IV.—*Other Milestones. Comparison of the Number of Babies (Expressed as a Percentage) who were Crawling at 10 Months and Walking at 14 Months in the Four Feeding Groups*

| Feeding Group | Crawling | | Walking at 14 Months |
|---|---|---|---|
| | At 10 Months | Never | |
| 1 | 61·8 | 13·1 | 67·7 |
| 2 | 69·6 | 6·0 | 71·3 |
| 3 | 71·7 | 5·0 | 66·7 |
| 4 | 60·2 | 6·5 | 63·9 |
| Total | 64·4 | 8·4 | 66·5 |

To discover whether this "acceleration" was attended by any increased risk of ill-health, the sickness dossiers of the babies were examined.

### Infections

Very few of the babies were under 2 months old when first seen, and the enrolment procedure effectively excluded babies who were seriously ill at or before this age (Thwaites, 1950; Stewart and Russell, 1952). For this reason all incidence rates in the following account will be for the period two to twelve months and not for the whole of the first year. In the case of head colds it was often impossible to identify the precise mode of feeding at the time of the illness, but the more serious infections have been studied in relation to the diet at the time of falling ill, to the total period of complete breast-feeding, and to one another.

To obtain a fair distribution of the illnesses in relation to the pre-weaning, weaning, and post-weaning periods the survey aggregates for three modes of feeding were calculated for each successive month of life (see Table V). This revealed that for 2,094 months, or 30% of the consolidated first year, the babies were exposed to breast milk only; for 3,669 months, or just over half the year, they had no breast milk, and for 1,197 months (17% of the period) they were exposed to mixed feeding.

TABLE V.—*Aggregate Months of Exposure to Three Modes of Feeding During the First Year of Life*

| Age in Months | Mode of Feeding: Exposure Time in Months | | | |
|---|---|---|---|---|
| | Breast | Mixed | Other | Total |
| 0–1 | 509 | 24 | 47 | 580 |
| 1– | 414 | 48 | 118 | 580 |
| 2– | 372 | 50 | 158 | 580 |
| 3 | 332 | 51 | 197 | 580 |
| 4– | 272 | 70 | 238 | 580 |
| 5– | 151 | 156 | 273 | 580 |
| 6– | 37 | 237 | 306 | 580 |
| 7– | 5 | 227 | 348 | 580 |
| 8– | 2 | 175 | 403 | 580 |
| 9– | 0 | 99 | 481 | 580 |
| 10– | 0 | 39 | 541 | 580 |
| 11– | 0 | 21 | 559 | 580 |
| Total .. | 2,094 | 1,197 | 3,669 | 6,960 |
| % of consolidated first year .. | 30·09 | 17·20 | 52·71 | 100 |

In Table VI the first two months of life have been excluded and the exposure periods for the rest of the year calculated for nine groups of babies defined by the duration of the pre-weaning period. Thus the 142 babies who were weaned in the first month were exposed to mixed feeding for 88½ months and to "other" feeding for 1,331½ months; while the 166 babies who were weaned in the sixth month were exposed to mixed feeding for 520½ months, to "other" feeding for 558½ months, and to breast milk only for 581 months. These overall "months of exposure" have been used to calculate the attack rates for the three groups of illness shown in Table VII.

TABLE VI.—*Aggregate Months of Exposure to Three Modes of Feeding Between the Ages of 2 Months and 1 Year for Nine Groups of Babies Defined by the Duration of Complete Breast-feeding*

| Period of Complete Breast Feeding | Mode of Feeding: Exposure Time in Months from 2nd to 12th Month of Life | | | |
|---|---|---|---|---|
| | Breast | Mixed | Other | Total |
| 0– | 0 | 88½ | 1,331½ | 1,420 |
| 1– | 0 | 49½ | 420½ | 470 |
| 2– | 18½ | 37 | 314½ | 370 |
| 3– | 63 | 63 | 294 | 420 |
| 4– | 192½ | 190½ | 387 | 770 |
| 5– | 581 | 520½ | 558½ | 1,660 |
| 6– | 270 | 155 | 175 | 600 |
| 7– | 33 | 14 | 13 | 60 |
| 8– | 19½ | 3 | 7½ | 30 |
| Total .. | 1,177½ | 1,121 | 3,501½ | 5,800 |
| % of consolidated age period 2–12 months .. | 20·30 | 19·33 | 60·37 | 100 |

### Gastro-Enteritis, Bronchitis, and Otitis Media

Between the ages of 2 months and 1 year 118 babies suffered from gastro-enteritis, 108 from bronchitis or bronchopneumonia, and 39 from otitis media or tonsillitis. One of the babies with gastro-enteritis had two distinct recurrences during this period and 20 others had one recurrence. Two babies had separate attacks of bronchitis and bronchopneumonia, and three, after recovery from tonsillitis, subsequently developed otitis media. In Table VII the age and sex incidence of the three disease groups are displayed, together with the attack rates for three categories of "current diet" and five periods of complete breast-feeding. The recurrences are not included in this table, but according to a separate analysis (based on the assumption that a first attack of a specific illness neither protects nor predisposes a baby to a second attack) the recurrence rate for gastro-enteritis doubled expectation while that for bronchitis and bronchopneumonia fell short of expectation. The analysis did not, of course, indicate whether these alterations of risk were determined by biological or social factors.

In Table VII one baby is represented in all three diagnostic groups, 26 in the first two (gastro-enteritis and bronchitis), 8 in the first and the last (gastro-enteritis and otitis

TABLE VII.—*Gastro-enteritis, Bronchitis and Bronchopneumonia, and Otitis Media and Tonsillitis. Age and Sex Incidence. Also Attack Rates by Duration of Complete Breast-feeding and Feeding at Time of Onset*

| Disease Group | | Sex | | Age in Months | | | | | Duration of Complete Breast-Feeding (in Months) | | | | | Mode of Feeding at Onset of Illness | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Aggregate Months of Exposure: | M | F | 2– | 4– | 6– | 8– | 10– | 0– | 1– | 4– | 5– | 6– | Breast | Mixed | Other | |
| | | 2,980 | 2,820 | 1,160 | 1,160 | 1,160 | 1,160 | 1,160 | 1,420 | 1,260 | 770 | 1,660 | 690 | 1,177½ | 1,121 | 3,501½ | 5,800 |
| Gastro-enteritis | No. of attacks .. | 61 | 57 | 15 | 32 | 20 | 24 | 27 | 30 | 11 | 14 | 48 | 15 | 11 | 31 | 76 | 118 |
| | Attack rate per 1,000 months .. .. | 20·5 | 20·2 | 12·9 | 27·6 | 17·2 | 20·7 | 23·3 | 21·1 | 8·7 | 18·1 | 28·9 | 21·7 | 9·3 | 27·7 | 21·7 | 20·3 |
| | Departure from even incidence .. .. | P > 0·90 | | 0·20 > P > 0·10 | | | | | P < 0·01 | | | | | P < 0·01 | | | |
| Bronchitis and broncho-pneumonia | No. of attacks .. | 62 | 46 | 29 | 26 | 19 | 16 | 18 | 29 | 33 | 15 | 23 | 8 | 16 | 18 | 74 | 108 |
| | Attack rate per 1,000 months .. .. | 20·8 | 16·3 | 25·0 | 22·4 | 16·3 | 13·8 | 15·5 | 20·4 | 26·2 | 19·4 | 13·9 | 11·6 | 13·6 | 16·1 | 21·1 | 18·6 |
| | Departure from even incidence .. .. | 0·30 > P > 0·20 | | 0·30 > P > 0·20 | | | | | 0·10 > P > 0·05 | | | | | 0·30 > P > 0·20 | | | |
| Otitis media and tonsillitis | No. of attacks .. | 19 | 20 | 6 | 8 | 4 | 7 | 14 | 10 | 7 | 4 | 14 | 4 | 5 | 4 | 30 | 39 |
| | Attack rate per 1,000 months .. .. | 6·4 | 7·1 | 5·2 | 6·9 | 3·5 | 6·0 | 12·1 | 7·0 | 5·6 | 5·2 | 8·4 | 5·8 | 4·2 | 3·6 | 8·6 | 6·7 |
| | Departure from even incidence .. .. | 0·80 > P > 0·70 | | 0·20 > P > 0·10 | | | | | 0·90 > P > 0·80 | | | | | 0·20 > P > 0·10 | | | |
| Total .. | Attack rate per 1,000 months .. .. | 47·7 | 43·6 | 43·1 | 56·9 | 37·0 | 40·5 | 50·9 | 48·5 | 40·5 | 42·7 | 51·2 | 39·1 | 27·1 | 47·4 | 51·4 | 45·6 |

TABLE VIII.—*Prevalence of Head Cold in Four Feeding Groups and Seven Groups Defined by Size and Composition of Household*

| | | No. of Attacks per Child |
|---|---|---|
| Feeding group | 1 | 1·69 |
| | 2 | 1·96 |
| | 3 | 1·43 |
| | 4 | 1·45 |
| | Total | 1·58 |
| Household size | 2–3 | 1·32 |
| | 4 | 1·56 |
| | 5–6 | 1·61 |
| | 7+ | 1·76 |
| Household: No. of schoolchildren | 0 | 1·25 |
| | 1–2 | 1·92 |
| | 3+ | 2·0 |

media), and 21 in the second and third (bronchitis and otitis media). The combinations for gastro-enteritis and bronchitis, and for gastro-enteritis and otitis media, are approximately what would be expected for chance associations, but those for bronchitis and otitis media are excessive and accord with the well-known tendency for these two conditions to be associated.

According to Table VII the most conspicuous findings for gastro-enteritis are: (1) that the pre-weaning and weaning attack rates were significantly lower and higher than average; and (2) that the highest recorded rate was for babies weaned in the sixth month and the lowest rate for babies weaned in the second, third, and fourth months. For bronchitis and bronchopneumonia the two lowest rates were for the pre-weaning period and for babies who were completely breast-fed for at least six months, but the differences between these and the rates for other groups are of doubtful significance. There was a slight tendency for the lung infections to affect boys more than girls, babies under 6 months more than those over 6 months, and babies who were breast-fed for less than four months more than those who were weaned later. Otitis media and tonsillitis occurred relatively often in the post-weaning period and after the age of 10 months. The attack rates for different periods of complete breast-feeding showed no signs of being influenced by duration of complete breast-feeding, but during the weaning and pre-weaning periods the incidence was below average.

In general, it is safe to conclude that while the Survey babies were taking nothing but breast milk the risk of intestinal infection was reduced. When finally removed from the breast, however, there was nothing to choose between the sickness experience of the early and late weaners.

### Head Colds

During the age period 2 to 12 months only 134 babies remained free from head colds. The remainder shared 916 incidents variously described as a cold, nasal catarrh, snuffles, or influenza. Though there was little or no difference in the cold attack rates for the four feeding groups, when the babies were arranged according to the size of the household to which they belonged, and then according to the number of schoolchildren in the house, a new gradient appeared which indicated a relatively low risk for babies in small households with no schoolchildren (see Table VIII). This finding confirms a suggestion put forward in an earlier paper—namely, that the relationship between "household amenities" and risk of illness in infancy is partly due to the more frequent introduction of infection into the homes with older children (Stewart and Russell, 1952).

## Discussion

The unique value of breast milk for small infants with a tenuous hold on life is so well established that failure to find any signs of the breast-fed babies having benefited more than bottle-fed babies may cause some surprise. The findings have, of course, been influenced by the absence of weakly infants in the present group and by the fact that all the babies were under continuous medical supervision. For the former must have reduced feeding problems to a minimum and the latter ensured that, whatever mode of feeding was adopted, there was every chance of it being carried out efficiently. Nevertheless this is not the only recent survey to suggest that under conditions which prevail to-day the dangers of bottle-feeding are more potential than real.

After analysing the first-year sickness records of 263 babies attending the Harvard Child Health Survey, Stevenson (1947) came to the conclusion that "artificially fed infants do not suffer more from diarrhoea than do nurslings when the feeding is carried out with proper techniques." He did in fact find that in the age group 6–12 months respiratory infections were less common among the babies who had been breast-fed, but the difference was slight, and for all other illness, including gastro-enteritis, the artificially fed babies compared favourably with the breast-fed babies. Norval and Kennedy (1949) also found that "the duration of breast-feeding did not influence the rate of illness." Their work was based on the records of 417 infants who regularly attended welfare clinics in Minnesota, and in this group the incidence of respiratory infections in the second half of the first year was actually higher among the breast-fed than the bottle-fed babies.

Even more convincing than these surveys, which like the present investigation are biased in favour of healthy babies, are the findings of Douglas (1950). He followed up a random sample of the babies born in Great Britain between March 3 and 9, 1946, and discovered that during the first two years of life the incidence was the same in four groups of babies defined by duration of breast-feeding. The only significant difference between the breast- and bottle-fed babies was that the former tended to have their first attack at a later age.

In the light of these earlier findings it should be considered whether the relatively high attack rates for gastro-enteritis among the Oxford babies who were completely breast-fed for five months is evidence of a "nursling risk" which has hitherto escaped attention. It is just possible that these babies had an exceptionally low immunity to infection or that they were more easily upset by the addition of solids to the diet (which frequently coincided with weaning) than the babies who had been bottle-fed. In view, however, of the relatively high prevalence of diarrhoea among all babies during the weaning period, the possibility that the mothers who had never had to prepare a bottle-feed were less skilful in producing "clean meals for spoon feeders" than the other mothers should not be overlooked.

The weight differences revealed in the present investigation also merit close attention. Once again the discovery that bottle-fed babies gain weight more rapidly than breast-fed babies is not unique. Over 20 years ago Glazier (1930) made a similar observation in Boston, Massachusetts, and on the basis of the national survey in this country Douglas (1950) calculated that a baby who is breast-fed to the tenth month may expect to be, at the age of 2 years, 11 oz. (312 g.) lighter than one who has not been breast-fed at all. Hitherto it has not been suggested that these findings amount to evidence of undernourishment among breast-fed babies, but, in view of Vining's (1952) opinion that underfeeding at the breast is "only too common," this possibility can no longer be ignored. Douglas himself suggested that the breast-fed babies may have weighed less because they were unusually vigorous. In support of this view, he estimated that the babies who were breast-fed for ten months walked on average ten days earlier than the babies who were bottle-fed. If, however, the age of walking is an indication of vigour then the breast-fed babies in the present investigation were no more vigorous than the bottle-fed babies.

Forty years ago, when it was fashionable to ascribe all manner of complaints to overfeeding, it might have been suggested that the greater weight of the bottle-fed babies was detrimental to their health. But it is now held that overfeeding in infancy is "a matter of opinion rather than a real disorder" and that it rarely, if ever, causes harm

(Wickes, 1952; Vining, 1952). In any case there was no more illness among the bottle-fed than among the breast-fed babies. We are therefore driven to the conclusion that, in spite of continuous medical supervision, minor degrees of underfeeding among the breast-fed babies had occurred and had been overlooked.

If there is any truth in the opinion that the high prevalence of diarrhoea among babies who were nursed until they were old enough to be spoon-fed is due to faulty technique, and if the weight records constitute evidence of "latent" underfeeding among the breast-fed babies, then the survey findings present a new challenge to the advocates of natural feeding. That breast-feeding has advantages to both mother and child which will never show on a weight chart no paediatrician will seriously deny, but artificial feeding is now so safe and easy that the slightest neglect of the special problems of nurslings could produce a sharp popular reaction against breast-feeding.


### Summary

The early progress of 580 babies in the Oxford Child Health Survey has been studied in relation to feeding habits.

At the age of 1 year the babies who were bottle-fed from the beginning were appreciably heavier than the babies who were completely breast-fed for five months or longer. They also showed signs of being slightly more mature. It is suggested that these differences are due to minor degrees of under-feeding among the breast-fed babies.

For three disease groups—gastro-enteritis, bronchitis and bronchopneumonia, and otitis media and tonsillitis—there was no evidence that the duration of complete breast-feeding influenced the overall infection rates. Gastro-enteritis was comparatively rare so long as the babies were receiving nothing but breast milk, but it reached its maximum incidence in the weaning period and was especially common among babies who began to be weaned in the sixth month.

Colds, which were most frequent in large households and households with several children of school age, were almost equally common among breast- and bottle-fed babies.


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The British Legion Village at Preston Hall, near Maidstone, for tuberculous ex-Service men and women has now been in existence for 28 years, and the record of its accomplishments during that period has recently been published in the form of a souvenir brochure. Its 50 beds in 1925 had grown to 926 by 1948, when they came under the authority of the regional hospital board. The village settlement and industrial training centre includes all the amenities necessary for a self-contained community. Over 11,000 men and women have taken advantage of the services offered. The brochure is a useful guide to the facilities available at Preston Hall for the rehabilitation of tuberculous ex-Service men and women, who during their stay are enabled to live normal family lives.

# FUTURE OF SURGERY IN SENILE OBLITERATIVE ARTERIAL DISEASE*


BY

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Senile obliterative arterial disease, often called arteriosclerosis, is one of the most important problems which the medical profession has to face, and as our population ages this problem is likely to increase in magnitude. All authorities agree that it is a very common disease, that it is much more frequently seen in middle and late life than in the young, that it often exists in a subclinical state before symptoms occur, and that the first clinical effect may be the patient's death from coronary or cerebral vascular occlusion.

When one thinks about the surgical treatment of senile obliterative arterial disease one fact must never be forgotten—that it is a general disease affecting the arteries of the whole body. In some patients the most abnormal vessels are in the lower limbs; they suffer from intermittent claudication or gangrene of the toes. In others the coronary arteries are affected and the patients develop either angina pectoris or coronary occlusion, while some suffer from the well-known symptoms of cerebrovascular disease or an aneurysm of the aorta. In all these patients the whole arterial system is abnormal, but one region is affected more than others, and it is against these local manifestations of a general disease that a surgeon's efforts can be directed.

An anatomical study of the changes in the arteries of these patients shows that the local manifestations are produced in a high proportion of patients by a relatively short thrombosis in a main vessel. Thus a patient with intermittent claudication usually has a thrombosis of a segment of his superficial femoral or popliteal arteries. Fig. 1 is an arteriogram from such a patient; this shows the local thrombosis and the general disease above and below the block, where plaques of atheroma can be seen in the vessel wall. Realization of this fact is changing the whole approach of surgeons to this disease, not only in the case of the superficial femoral and popliteal arteries, but also when the thrombosis is in the abdominal aorta, common or external iliac arteries, the carotid arteries, and even perhaps in the future in the coronary or cerebral vessels.

In the past, surgeons have used an indirect approach when treating the symptoms of senile obliterative arterial disease. They have employed methods designed to increase the collateral circulation such as sympathectomy (Ross, 1935), they have tried to increase the blood flow to the part by creating an arteriovenous fistula (San Martín, 1902), they have ligated the main vein in an attempt to increase the oxygen supply to the tissues by producing venous congestion (Makins, 1919), they have attempted to relieve pain due to ischaemia by interrupting the afferent nerve pathways (Jonnesco, 1920), and they have put the ischaemic muscle at rest by interrupting its motor nerve supply (Learmonth and Slessor, 1952) or by dividing its tendon (Boyd, 1950). In the case of coronary artery disease attempts have been made to increase the blood flow to

*Part of a postgraduate lecture given in New Zealand in September, 1952.