ment had marked decreasing effect on the α-amylase activities of taka-diastase extracts, and on the β-amylase activities of extracts from ungerminated wheat, barley, soybean, and sweet potatoes, and of solutions of purified β-amylase from sweet potato. This decreasing effect was dependent on the source of the enzyme as well as on the amount of enzyme protein in the treating mixture. Treatment of these enzyme solutions with 0.1% HCN (adjusted to pH 5.0) had no decreasing effect on either α- or β-amylase activities. Potassium carbonate in 0.1% concentration showed approximately the same degree of inhibition on these enzyme solutions as compared with 0.1% KCN. Moreover, these two reagents caused approximately the same degree of pH shift in the treated enzyme solutions.

These results support the view, in contrast to that of Roy and Underkofler, that cyanide has no inhibitory effect on either α- or β- (or saccharogenic) amylase activities of enzyme solutions used in this investigation. The apparent inhibitory effect of sodium cyanide, which Roy and Underkofler observed in their experiments, may be the result of the combined effects of pH and concentration of enzyme on the pH-heat stability properties of the enzyme solutions.

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Caloric Intake in Relation to Physique in Children[1, 2]

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It has become axiomatic today that obese children eat too much, and that linear children do not eat enough. Efforts have been made and much money has been spent by the parents of these children to change their physiques, but evidence that the results have not been satisfactory has been accumulated. On the contrary, these efforts have merely aggravated the problem and have made it even more difficult to treat. It seems pertinent, therefore, to determine to what extent the physique of the children is due to overeating and undereating, and to what extent it is due to genetic and/or other determining factors. The purpose of this study is to see whether there is a difference in caloric intake in children of different physiques. The children enrolled in the Child Growth Clinic of the Forsyth Dental Infirmary were used as subjects for this study.

Caloric intake and body build were determined for 86 subjects, selected from 350 enrolled in the aforementioned clinic, in order to obtain representatives of each physique, ranging from extremely lean to extremely fat children. Physiques were determined according to Sheldon's method. He classifies physique into three categories: (*a*) endomorphy, the stocky or obese; (*b*) mesomorphy, the muscular; and (*c*) ectomorphy, the linear or "skinny." Sheldon's contention is that all individuals have a measure of all three components, but that in the vast majority there is a degree of dominance of one of these three components which determines in which of the three categories the individual belongs (*1*). The group of 86 subjects studied consisted of 28 endomorphs, 21 mesomorphs, and 37 ectomorphs.

For each child the following was done: (*a*) height and weight were recorded; (*b*) dietary data for one week were obtained; and (*c*) the pediatrician examined each child.

The ages of these children ranged from 6 to 14 years, the mean of the group falling into the ten- to twelve-year category. Both sexes were included, although the majority were female. The physical examination of these children in the clinic revealed no evidence of pathosis.

The dietary data of these subjects for a period of one week were recorded by their mothers. The calories and amounts of proteins ingested were then calculated, and a 1-day average was computed from the 7-day data for each child.[4] The 1-day averages for each child were compared with the National Research Council standards (*2*) for a child in the appropriate age group. The results for each child were expressed as a percentage of National Research Council standards and the 1-day averages.

The mean and standard deviations of the dietary intake of each group were computed, and statistical tests for the significance of difference (*t*) between the endomorphs, mesomorphs, and ectomorphs were made.

As shown in Table 1, there are distinct differences in the ranges of caloric intake (expressed as a percentage of National Research Council requirements) of the three physique groups. The mean and standard deviations of each group are shown in Table 2.

Tests of the significance of difference (*t*) between the three groups were made, and the results are shown in Table 3. The *t* for the endomorphs versus the mesomorphs is probably significant, and the *t* for the endo-

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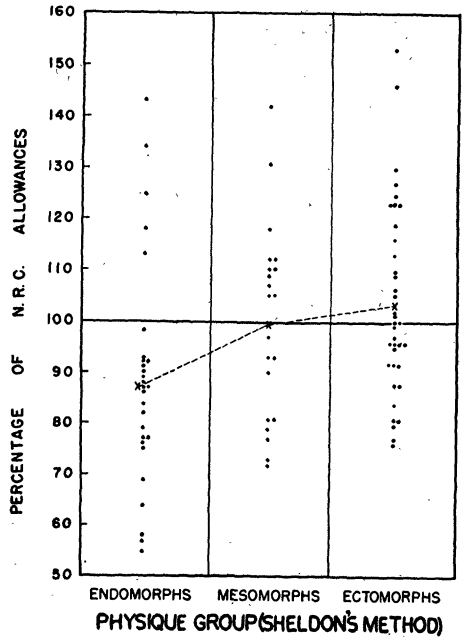
[4] Seasonal variations in the dietary intake were accounted for by the fact that all these children were seen either in the spring *and* fall, or in the winter *and* summer. Dietary data were obtained at each of these visits to the clinic.

TABLE 1

DISTRIBUTION OF CALORIC INTAKE ACCORDING TO PHYSIQUE



morphs versus the ectomorphs is highly significant.

In considering these findings it must be recognized that the dietary questionnaire may have introduced sources of error. Since household measures were used, corrections for loss of nutrients in preparation were not made. Parental or subject reporting is generally far from perfect; however, it was found that (*a*) no completely implausible results were obtained, (*b*) the results obtained could not be explained by random error, and (*c*) retests showed a high degree of reliability.[5] Hence it was felt that the questionnaire method was satisfactory and did not influence the findings unduly (*3, 4*). Another question was whether the parents consciously understated the caloric intake of the stocky children and exaggerated that of the linear ones. This is unlikely for the following reasons: (*a*) all these children and their parents had been coming to our clinic for many years (3–5 yr) and were known to be extremely truthful, and furthermore any deliberate change in the dietary would have been noted; and (*b*) the unexpected pattern exhibited by the data would not have occurred had fabrication been the rule.

For most of the subjects the protein intake was adequate.

In spite of the possible weaknesses in the questionnaire method, the relation indicated by the results is so definite that it cannot be ignored. It is obvious that "obesity" or "leanness" is not accounted for by the same common factor in all children (*5*). The author suggests the operation of the following determining factors: (*a*) inherent, genetically determined differences in food utilization and tendency to deposition of fat (*6*); (*b*) different activity rates, including resting activity and involuntary motion; and (*c*) differences in heat loss relative to body mass, with heat conservation most efficient in individuals with lowest mass/surface area ratio (*7*).

[5] Retests were done on 15 of the children used for this study, and the variations in caloric intake did not exceed 1–6% of the initial caloric averages.

TABLE 2

	N	Mean ± S.E.	Standard deviation
Endormorphs	28	87.6 ± 4.7	24.9
Mesomorphs	21	99.8 ± 4.1	18.7
Ectomorphs	37	103.5 ± 3.1	18.8

TABLE 3

TESTS OF SIGNIFICANCE

	(*t*)	Degrees of freedom	Probability
Endomorphs vs. mesomorphs	1.96	47	0.05 (probably significant)
Endomorphs vs. ectomorphs	3.00	63	0.01 (significant)
Ectomorphs vs. mesomorphs	0.74	56	0.40 (not significant)

There is other evidence that, on an individual basis, obesity can be caused by overeating, and leanness by the reverse. On a group basis this explanation is not sufficient. The observed caloric intake of each of these groups relative to body build is actually in the opposite direction from the expected pattern. What is important is that differences of body build in children are not a function of caloric intake alone.

Of the child population at large it is already known that differences in energy expenditure occur within a surprisingly large range, such as those expressed by differences in sleeping habits and marked differences in heat exchange. The stout, or more endomorphic, children can be expected to expend fewer calories because of less surface area exposed, and, if they also sleep more than the linear, more active children, several hundred calories per day are conserved (*8, 9*).

This study indicates that the observed caloric intake of each of these groups relative to body build is actually in the opposite direction from the expected pattern.

Although these findings throw important additional light on the problem of weight control, they also tend to intensify it. In other words, the standard reducing diet of 1000–1500 calories/day given to an endomorph would not reduce his weight. In order for him to reduce he would have to resort, at least initially, to a caloric intake of only 700–900 calories/day, in which case he would not be meeting the National Research Council requirements for specific nutrients.

This dilemma becomes even more obvious when applied to children. Of necessity, a child's diet is higher in calories than an adult's because the requirements for specific nutrients are higher, and decreasing the dietary even to 1200–1500 calories/day would mean going below the National Research Council requirements. Children cannot afford a drastic reduction in calories because of their need of these foods for growth and development.

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Protection Against X-rays and Therapy of Radiation Sickness with β-Mercaptoethylamine[1]

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Many substances *in vitro* partially inhibit the action of ionizing radiations on substances in aqueous solution. This fact has been correlated with the theory of indirect action through free radicals (*1–3*). The substances that were first shown to have a protective action against x-rays in animals, were toxic or had too weak an action; such is the case with thiourea, cyanide, malononitrile and azide (*4, 5*), nitrite (*6*), estradiol (*7*), cysteine and glutathione (*8*), and pyruvate (*9, 10*).

During a systematic search for a substance suitable for use in human beings, we encountered many protective substances in the amine group. Very active, but also toxic, are tryptamine, 5-hydroxytryptamine (= serotonine), para- and meta-tyramine, and dopamine (*10, 11*). The amino acids have, in general, a weak protective action in mice, a confirmation of the results of Hollaender and his group with microorganisms (*12*); the corresponding amines are generally better protectors (*10, 11*). Cysteamine $HS—CH_2—CH_2—NH_2$ (= β-mercaptoethylamine = 1573 L. = Becaptan R.N.) and the corresponding disulfide (= cystinamine), are in our opinion, the most interesting substances so far discovered, because of the power of their action and their low toxicity.

Cysteamine is a fragment of coenzyme A. Cystinamine, $\begin{matrix} S—CH_2—CH_2—NH_2 \\ | \\ S—CH_2—CH_2—NH_2 \end{matrix}$, like many diamines, is a liberator of histamine (*13*) and for this reason cannot be advocated for internal use in man. Thus our attention had been focused on cysteamine.

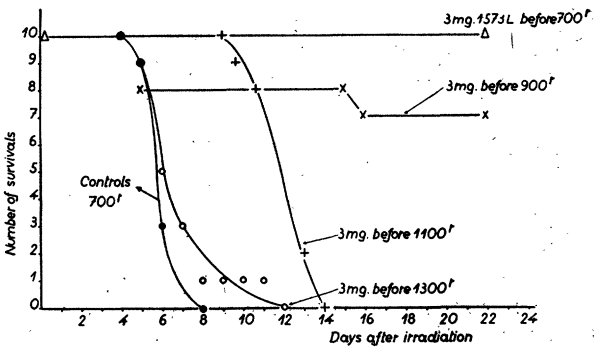

FIG. 1. Ordinates, number of mice (out of groups of 10) surviving after irradiation at day 0. Abscissae, days after irradiation. Various doses of x-rays (700 r–1300 r) are given to mice injected with 3 mg cysteamine, and the mortality compared with that of controls which receive 700 r.

Protection of mice against x-radiation. Mice of pure breed (C 57 black), about 4 months old, weighing 19 to 21 g, are irradiated by groups of 10 in a pasteboard box: 250 kv, Cu 2.5 mm, focal distance 50 cm, field 100 cm^2, 90 r per min. A single dose of 700 r kills practically all our controls in 5–15 days. Out of 38 series of 10 control mice, only 7 animals were alive 25 days after irradiation.

If a dose of 3 mg of cysteamine (base, neutralized with HCl to pH 6.5) is injected intraperitoneally 1–3 min before irradiation (700 r), a permanent survival of 97% is observed; it is necessary to give about 1300 r in order to obtain, in mice protected by cysteamine, the same mortality curve (Fig. 1). If it is injected 0.5–3 min after the end of irradiation, it does not affect the mortality. Cysteamine is rapidly metabolized; the mice irradiated 1 hr after the injection of cysteamine behave about like the controls. Cysteine (HCl) injected in doses equimolecular to 3 mg of cysteamine allows only 3 animals out of 10 to survive a dose of 700 r. The white cell count of irradiated mice protected with cysteamine drops just like those of the controls during the 2 or 3 days following irradiation, but recovery starts earlier in the injected animals. Similarly, the weight of protected mice, like that of the controls, decreases for 2 days after irradiation, but on the third or fourth day, the weight of the injected animals begins to increase (Fig. 2), whereas the weight of the controls drops until death.

The protective action of cysteamine against x-rays

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