# THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

## AFFILIATED ACADEMIES OF SCIENCE

THE American Association for the Advancement of Science fulfills its function as an integrating agency in science to a large extent through its affiliated and associated societies. At present there are 179 of these societies, the total membership of which, including duplicates, is nearly 1,000,000. Such organizations as the American Medical Association and the National Education Association have very large numbers of members.

Among the affiliated societies, the academies of science constitute a special class. As a rule their interests include all the natural sciences, and consequently they serve also as integrating agencies in their respective territories, which are usually states. For this reason the association extends to the affiliated academies every possible assistance, including allowances for the aid of research, the amounts depending on the numbers of their members who are also members of the association. In many cases the association can more effectively advance science through its affiliated academies than directly.

The membership of an academy of science is at least a rough measure of the scientific activity in its territory, for it draws its members from the colleges, secondary schools, industrial laboratories and amateurs. In turn the academy not only affects the science in the educational institutions in its territory, but it influences the scientific activities of state and local governments, and often plays important rôles in problems of utilization and conservation of natural resources and in problems of public health.

Certain statistics for the 33 academies affiliated with the association will now be presented. These statistics should not be given undue weight because the conditions under which the academies operate vary to an appreciable degree; yet they are indicative of the scientific activities in the territories to which they pertain. Another item of significance is the percentage of the members of an academy who are members of the association. Naturally the membership of an academy depends upon the total population of the territory from which it is drawn. In order to reduce the membership figures to a comparable basis in respect to population, the number of members per 100,000 of total population are presented. It will be seen from Table 1 that the variations in the numbers

TABLE I

MEMBERSHIP OF AFFILIATED ACADEMIES

| Academy | (a) | (b) | (c) | (d) | (e) |
|---|---|---|---|---|---|
| Alabama | 133 | 293 | 120.3 | 10.4 | 20.1 |
| American Institute | ... | 510 | ... | ... | 24.0 |
| British Columbia | ... | 97 | ... | ... | 15.5 |
| Colorado-Wyoming | 238 | 290 | 21.8 | 21.1 | 30.5 |
| Florida | 220 | 346 | 57.3 | 18.2 | 23.1 |
| Georgia | 106 | 122 | 15.1 | 3.9 | 41.8 |
| Illinois | 1,094 | 1,151 | 5.2 | 14.6 | 31.5 |
| Indiana | 888 | 1,051 | 18.4 | 30.7 | 26.1 |
| Iowa | 624 | 614 | − 1.6 | 24.2 | 39.4 |
| Kansas | 334 | 611 | 83.5 | 34.0 | 23.5 |
| Kentucky | 237 | 333 | 40.5 | 11.7 | 26.1 |
| Louisiana | 186 | 192 | 8.1 | 8.1 | 20.8 |
| New Orleans | 249 | 297 | 19.3 | 60.0 | 26.3 |
| La. and New Orl. | 435 | 489 | 12.4 | 20.7 | 23.9 |
| Maryland | ... | 38 | ... | 2.1 | 71.1 |
| Michigan | 1,055 | 1,034 | − 2.0 | 19.7 | 27.0 |
| Minnesota | 409 | 681 | 66.5 | 24.4 | 32.3 |
| Mississippi | ... | 113 | ... | 5.2 | 10.6 |
| Missouri | 820 | 752 | − 8.3 | 19.9 | 22.3 |
| St. Louis | 118 | 409 | 246.6 | 50.1 | 25.2 |
| Mo. and St. L. | 938 | 1,161 | 23.8 | 25.2 | 23.3 |
| Nebraska | 198 | 287 | 44.9 | 21.8 | 31.4 |
| New Hampshire | 145 | 212 | 46.2 | 43.1 | 25.0 |
| North Carolina | 223 | 335 | 50.2 | 9.4 | 41.2 |
| North Dakota | ... | ... | ... | ... | ... |
| N. W. Sci. Assn. | ... | 528 | ... | ... | 15.7 |
| Ohio | 462 | 678 | 46.7 | 9.8 | 51.2 |
| Oklahoma | 365 | 313 | −14.2 | 13.4 | 25.9 |
| Pennsylvania | 452 | 424 | − 6.2 | 42.8 | 39.9 |
| South Carolina | 225 | 187 | −16.9 | 9.8 | 27.3 |
| Tennessee | 349 | 418 | 19.8 | 14.3 | 26.3 |
| Texas | 475 | 651 | 37.1 | 10.1 | 30.9 |
| Virginia | 686 | 855 | 24.6 | 31.9 | 25.4 |
| West Virginia | 254 | 305 | 20.1 | 16.0 | 23.0 |
| Wisconsin | 375 | 322 | −14.1 | 10.3 | 55.7 |

(a) Number of members in 1936 as reported by the secretaries of the academies.
(b) Number of members in 1940 as reported by the secretaries of the academies.
(c) Percentage change.
(d) Members in 1940 per 100,000 population of state or area.
(e) Percentage of members in 1940 who are members of the Association.

of members relative to populations are very large. Likewise the rates at which the memberships of the academies changed in the interval 1936–1940 have varied widely.

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# SPECIAL ARTICLES

## A CASEIN DIGEST BY VEIN UTILIZED TO FORM BLOOD PLASMA PROTEIN[1]

To be able to feed an individual by other than the oral route has been the desire of investigators and medical men for many years. Many patients could be benefited and many experiments could be performed if such a technique were available. One difficulty has been the parenteral administration of the protein requirements. Henriques and Anderson[2] achieved first success with an enzymatic digest of meat. Holman, Mahoney and Whipple[3] found that the protein of

[1] From the Department of Pathology, the University of Rochester School of Medicine and Dentistry, Rochester, N. Y.

[2] V. Henriques and A. C. Anderson, *Zeit. f. Physiol. Chem.*, 88: 357, 1913.

[3] R. L. Holman, E. B. Mahoney and G. H. Whipple, *Jour. Exp. Med.*, 59: 269, 1934.

whole plasma can supply the body protein needs. Plasma is now widely used for the treatment of shock, but its use for nutritional purposes is restricted by its relatively limited supply. Protein digests should fill this need and supplement all plasma protein treatment. Casein digests intravenously have been used with some success by Elman[4] as well as by others. Digests have been effective subcutaneously.[5]

By established technique[6] for the measurement of plasma protein production in hypoproteinemic dogs, we have determined that an enzymatic (papain) digest of commercial casein[7] given parenterally is as effective in plasma protein production as whole liver by mouth. This digest provides materials needed to correct the hypoproteinemia as well as nitrogen for other body protein requirements.

TABLE 1

CASEIN DIGEST BY VEIN PROMOTES PLASMA PROTEIN PRODUCTION

| | Diet per period* | Plasma protein removed, total | Plasma protein level, average | Urine N, total |
|---|---|---|---|---|
| Dog 39–223 | | gm. | gm. per cent. | gm. |
| | Initial | ... | 5.92 | ... |
| 1 | Fasting | 25.4 | 5.44 | 12.6 |
| 2 | Low protein | 14.9 | 3.95 | 4.9 |
| 3 | Liver | 20.9 | 4.12 | 8.8 |
| 4 | Liver | 21.9 | 3.95 | 8.3 |
| 5 | Liver | 21.0 | 4.07 | 7.8 |
| 6 | Liver | 21.0 | 4.12 | 7.4 |
| 7 | Digest | 19.4 | 4.04 | 10.2 |
| 8 | Digest | 17.4 | 3.93 | 10.4 |
| 9 | Digest | 22.8 | 4.27 | 11.1 |
| 10 | Digest | 18.6 | 3.98 | 9.9 |
| 11 | Digest | 3.4 | 4.54 | 9.4 |
| 12 | Digest | 3.3 | 5.08 | 9.5 |
| 13 | Digest | 1.6 | 5.18 | 9.6 |
| 14 | Digest | 1.7 | 5.29 | 10.1 |
| 15 | Digest | 3.3 | 5.56 | 9.9 |
| 16 | Digest | 1.8 | 5.59 | 9.4 |
| 17 | Digest | 23.5 | 4.54 | 9.7 |
| 18 | Digest | 17.6 | 4.07 | 10.0 |
| 19 | Digest | 12.9 | 4.04 | 9.2 |
| Dog 39–316 | | | | |
| 6 | Digest | 15.6 | 4.04 | 13.0 |
| 7 | Low protein | 1.5 | 4.36 | 7.1 |
| 8 | Digest† | 1.5 | 4.59 | 12.8 |
| 9 | Digest† | 2.9 | 5.42 | 18.1 |

* Data are for consecutive 7-day periods.
† Given subcutaneously.

The dried digest is a golden yellow granular material containing 12.5 per cent. nitrogen. In a 5 per cent. solution, sterilized by Seitz (EK) filtration, it is well tolerated when given either intravenously or subcutaneously. While salivation is common during injection and vomiting sometimes occurs with the relatively rapid rate of injection used, no reaction even mildly serious has ever appeared. In fact, during all but the last two weeks of the 13-week interval in which dog 39–223 (Table 1) received daily 12 gm of the digest by vein, the dog also ate completely a diet containing carbohydrate and fat (80 calories per kilogram), minerals and vitamins, free of protein except for that present in the yeast, and liver vitamin supplements (2.2 gm daily). During periods 18 and 19, Table 1, the diet was 70 per cent. consumed.

A portion of the data obtained from our experiments is given in Table 1. The protein removed by plasmapheresis during the first 2 periods (40.3 gm) comes partly from reduction of the plasma protein level but largely from surplus extravascular tissue protein present in the body at the start of the experiment. The constancy of the plasma protein output (21 gm) and of the plasma protein level (4 ± gm per cent.) of periods 3 through 6 indicates a direct relationship between the protein consumed (70 gm per week, in liver) and that produced. A similar relationship obtains during periods 7 through 10 when the casein digest equivalent to 66 gm protein replaced the liver, with an average plasma protein production of 19 + gm per week. Cysteine and tryptophane added during period 7 apparently do not improve this digest.

With discontinuance of plasmapheresis during periods 11 through 16 a prompt rise in plasma protein concentration occurred and then progressed more slowly to a peak of 5.70 in period 16. Redepletion was accomplished in period 17. Despite some lack of appetite for the oral low protein diet in periods 18 and 19 the plasma protein production is similar to that of the earlier periods. The dog was in positive nitrogen balance while receiving the digest and gained in weight from 8.5 to 9.3 kg. The 20 per cent. increase in urinary nitrogen excretion over that of the liver diet periods occurred in other than the urea and ammonia fraction.

The data obtained in dog 39–316 indicate effective utilization when the digest is given under the skin. Digest equivalent to 82 gm protein was given by vein in period 6 and subcutaneously in period 8, then increased to 138 gm in period 9. Nitrogen balance was positive in all 3 of these periods. A steady rise in the plasma protein level is noted in the absence of bleeding.

These and other observations, to be published later in more detail, show clearly that certain *digests* given by vein or subcutaneously *promote new plasma protein production* as effectively as protein fed by mouth. This holds great promise in clinical therapy.

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[4] R. Elman, *Ann. Surg.*, 112: 594, 1940.
[5] S. S. Altshuler, H. M. Hensel and M. Sahyun, *Am. Jour. Med. Sci.*, 200: 239, 1940.
[6] For references see S. C. Madden and G. H. Whipple, *Physiol. Rev.*, 20: 194, 1940.
[7] This casein digest was prepared by the Eli Lilly Company.