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THE GENERAL BIOLOGY COURSE AND THE TEACHING OF ELEMENTARY BOTANY AND ZOOLOGY IN AMERICAN COLLEGES AND UNIVERSITIES¹

THE general biology, or elementary biology, course originated with Huxley about fifty years ago and was introduced into this country by the physiologist, H. Newall Martin, one of Huxley's earlier students. In the introduction to Huxley and Martin's little text-book on Elementary Biology, Huxley states as his conviction "that the study of living bodies is really one discipline, which is divided into zoology and botany simply as a matter of convenience"; that "sound and thorough knowledge is only to be obtained by practical work in the laboratory"; and, further, that through the study of a series of selected animals and plants "a comprehensive, and yet not vague, conception of the phenomena of Life may be obtained, and a firm foundation upon which to build up special knowledge will be laid." A more recent text-book (Sedgwick and Wilson's "General Biology") states that general biology "deals with the broad, characteristic phenomena and laws of life as illustrated by the thorough comparative study of a series of plants and animals taken as representative types."

In the average general biology course the laboratory material is selected more or less indiscriminately from both the plant and the animal kingdoms, but with animal material greatly preponderant. The study of animals thus alternates with the study of plants: now a few animals and then a few plants. The aim of such a course is not so much to bring out the fundamental characteristics of plants as plants and of animals as animals, but rather to demonstrate that the two are merely different expressions of matter in the living

¹ Contribution from the Osborn Botanical Laboratory.

state and that the same broad underlying biological principles are applicable to both. Indeed there are some teachers who become so inspired with the idea of biology as the study of *living organisms* and with the prime importance of *underlying biological principles* that their students, pondering over the vague structures and intangible phenomena of a mysterious microscopic world, are led to lose sight completely of the fact that, after all, it is *plants* and *animals* they are dealing with—something they have been familiar with all their lives.

There are some botanists and zoologists to whom a general biology course means something quite different from what has just been described. It means two virtually independent, but consecutively arranged and more or less closely coordinated courses, the one in plant biology or elementary botany, and the other in animal biology or elementary zoology: these two, alike in their pedagogical objects but different in their material, being grouped together for educational or administrative purposes. But this is *not* the sort of a general biology course with which the present article deals. We are concerned rather with the first-mentioned type—the type which, in no small degree at any rate, has been responsible for the popular delusion that biology is the study of animals: that the words *biology* and *zoology* are synonymous.

Through the influence of Martin and his students general biology obtained a rather strong foothold in this country. It has been widely adopted by the high schools and was given a place in the curricula of many colleges and universities. Abroad, however, so far as the higher institutions of learning are concerned, it was not so favorably received. "In the universities of Britain, Germany and in most cases of France," according to a prominent American botanist, "a biology course has never been admitted or regarded as of sufficient thoroughness." And even in our own country, as will be pointed out in detail presently, the number of institutions of college grade which offer a course in general biology has diminished greatly in recent time. To use the picturesque phraseology of

a noted contemporary botanist: general biology "is a kind of course introduced years ago by the Huxley and Martin book and discarded when botany became strong enough to stand on its own legs."

For a number of years it has been the conviction of the writer that a course in general biology of the type specified above ought not to be offered to elementary students, either as a cultural study or in preparation for more advanced work in botany or zoology. It has seemed particularly undesirable that in an institution having both a department of botany and a department of zoology such a course should be given by one department alone. With a view to ascertaining certain facts and securing a consensus of opinion regarding certain relevant problems, a questionnaire on this subject was recently submitted to 105 botanists, representing 67 colleges and universities, and to 65 zoologists, representing 49 similar institutions. Replies have been received from 86 botanists and 46 zoologists, representing altogether 66 institutions. The present article, in the main, is based on these replies and on a series of 19 letters relating to similar problems which was secured a number of years ago and courteously loaned to the writer by Professor Margaret C. Ferguson, of Wellesley College. To a very large extent the writer has acted merely in the capacity of editor or compiler in adapting and coordinating the various individual expressions of opinion set forth in these communications. Although quotation marks are seldom used, much of the subject matter in this paper has been quoted verbatim or with slight modification. For obvious reasons neither individuals nor institutions are referred to by name.

For present purposes American colleges and universities may be divided more or less naturally into two classes: *Class A*, those which maintain distinct departments of botany and zoology; and *Class B*, those in which both botany and zoology are under one head, the department of biology. Among the institutions investigated by the questionnaire, 47 of those heard from belong to class A, 19 to class B. Of those belonging to class A there

are only 6 which at the present time offer a course in general biology,² while among those of class B there are no less than 14 that give such a course. It is thus apparent that, among colleges, the giving of a general biology course is largely restricted, at the present day, to institutions which do not have distinct departments of botany and zoology. Of the institutions of this character investigated, 74 per cent. give such a course, and it is probable that this proportion would be considerably higher if the multitudinous smaller institutions not investigated were taken into account. Among the institutions which maintain distinct departments of botany and zoology, less than 13 per cent. of those investigated by questionnaire give such a course, and this proportion doubtless would be considerably lower if account were taken of various agricultural colleges and other institutions not included in the canvass. This disparity in itself is significant. But it is even more significant that, as was developed upon investigation, among the 41 institutions in class A which do not at the present time give a course in general biology there are no less than 21 which have given such a course in former years but have abandoned it. In other words, among the institutions included in this category, during the last twenty-five years *there has been a decrease of nearly 80 per cent. in the number which give a course in general biology.*

Some of the questions asked in the questionnaire, together with the expressions of opinion they called forth are as follows:

1. Is it your opinion that a course should be offered in general biology, complete in

² In presenting these figures, no account has been taken of the subject-matter or the mode of presentation of these courses. It is important to note, however, that in 2 of the 6 institutions of Class A where general biology is still given, the course is virtually half botany, half zoology, being taught conjointly by botanists and zoologists. The same holds true in several of the 14 institutions of class B which are cited as giving general biology. In 3 of the 6 institutions in Class A, referred to above, general biology is placed in a class by itself, not being required as a prerequisite to courses in botany or zoology.

itself, so far as it goes, and necessarily overlapping more advanced courses in both botany and zoology: a course designed primarily for its educational value to the student who probably will pursue no further work along biological lines?

Replies.—Botanists: Class A, *No* (46:16); Class B, *Yes* (8:3). Zoologists: Class A, *Yes* (20:14); Class B, *Yes* (11:0).

2. If such a course is given, should it be made a prerequisite to more advanced courses in botany and zoology, or should it be treated as an entity in itself and be disregarded in arranging the regular courses of study in botany and zoology.

Replies.—Botanists: Class A, *an entity* (36:15); Class B, *an entity* (8:4). Zoologists: Class A, *an entity* (14:12); Class B, *a prerequisite* (8:1).

3. Is it your opinion that some sort of an elementary course in general biology is a desirable prerequisite to all courses in either botany or zoology? Should it be made an obligatory prerequisite?

Replies.—Botanists: Class A, *not obligatory* (51:9), and *not desirable* (47:13); Class B, *not obligatory* (8:4), and *not desirable* (7:5). Zoologists: Class A, *not obligatory* (21:10), and *not desirable* (19:14); Class B, *both obligatory* (8:1) and *desirable* (9:1).

4. Do you consider an elementary course in general biology to be superior, from the standpoint of the biological sciences in general, to two virtually independent but consecutively arranged courses: one in elementary botany, given by botanists; the other in elementary zoology, given by zoologists? Do you consider it inferior?

Replies.—Botanists: Class A, *biology inferior* (50:3); Class B, *biology inferior* (7:4). Zoologists: Class A, *biology inferior* (17:8); Class B, *biology superior* (8:0).

5. Assuming that an elementary course in general biology is to be given, should it be taught by zoologists alone? by botanists alone? or by both zoologists and botanists?

Replies.—Botanists (a) *by both botanists and zoologists*, 58; (b) *by one teacher, by a biologist, or by one trained in both botany and zoology*, 12; (c) *immaterial—depends on*

teacher, 3. Zoologists: (a), 25; (b), 12; (c), 6; (d), by a zoologist, 2.

Summarizing the opinions above stated, it is evident:

1. That the majority of botanists (49:24) are opposed to a course in general biology, while the majority of the zoologists (31:14) favor such a course.

2. That, if given, the majority of botanists (44:19) would treat it as an independent entity, while the majority of zoologists (20:15) would make it prerequisite to courses in botany and zoology.

3. That in the opinion of the majority of botanists a course in general biology does not constitute a desirable prerequisite (54:18) to courses in botany and zoology, and should not be made an obligatory prerequisite (59:13); while in the opinion of the majority of zoologists it is a desirable prerequisite (23:20), although it should not be made obligatory (22:18).

4. That the great majority of botanists (57:7) regard a course in general biology as inferior to two consecutively arranged but virtually independent courses, elementary botany and elementary zoology, while the zoologists are about evenly divided (inferior, 17:16) on this question.

5. That in the opinion of the majority both of botanists (58) and zoologists (25) a course in general biology should be taught by both botanists and zoologists rather than by either one or the other; while in the opinion of a minority (15 botanists, 20 zoologists) it should be given by one teacher.

Theoretically, a course in general biology such as the one here prescribed may seem desirable; practically it is not. This in effect is the opinion of many botanists and zoologists, both among those who voted in its favor and among those who voted against it. The truth of this assertion is substantiated by the relatively large number of institutions which in times past have organized such a course, only to abandon it. Whatever may be said in its favor, the fact remains that in the long run the general biology course has not proved satisfactory in at least the majority of those institutions having distinct depart-

ments of botany and zoology. On the whole, it appears that the advantages gained, if there are any, by attempting to dove-tail botanical and zoological material into one harmonious whole are more than outweighed by the disadvantages. The nature and seriousness of these disadvantages, as expressed by various college and university teachers, is indicated in the paragraphs which follow.

1. *An elementary course in general biology is altogether too dependent for its success on the personnel of its teaching staff.*

It is quite as important how a thing is taught the student as what is taught him. In the hands of a master, general biology, or any other subject, can not fail to be a source of profit and inspiration. But the type of course that leans too heavily for support on the personality of the teacher is destined to fall, sooner or later. Huxley's own course in elementary biology virtually died with him, for when he ended his teaching career at the Royal College of Science it was divided into two practically independent courses, a botanist being appointed to do the botanical teaching and a zoologist the zoological—an arrangement that has continued to the present day.

It is doubtless true that there are some zoologists who are capable of giving a better course in botany than are many botanists (and vice versa). But how many zoologists or botanists of this sort are there in charge of courses in general biology? Unquestionably there are occasional teachers of biology in our higher institutions of learning who are well equipped both on the botanical and the zoological side of biology, and who are impartially interested in both phases of life—men with a broad vision over both fields and competent both to organize and to conduct a course in general biology: in other words, true biologists. But in these days of specialization men of this type are so rare as to be almost extinct. The average biologist, so styled, is not a biologist at all in the true sense of the word. He reads the *Journal of Experimental Zoology* or the *Botanical Gazette*, but rarely both. He is a member of the Society of American Zoologists or of

the Botanical Society of America, but never of both. His research is in animal biology (or zoology) or in plant biology (or botany), one or the other. In short, he is either a zoologist or a botanist. To be sure, certain groups of botanists and zoologists find a common meeting ground in the American Society of Naturalists or in the Ecological Society of America. The geneticist, whether working with plants or animals, reads *Genetics* and the *American Naturalist*; the ecologist reads the *Journal of Ecology*. But the mutual interests which bind together various groups of zoologists and botanists are in very special fields, such as genetics, evolution, cytology and ecology. The fact remains that, while there are plenty of ardent zoologists and ardent botanists, there are few, if any, ardent biologists.

In charge of either zoologists or botanists how can a course in general biology help becoming one-sided? One phase is almost sure to be emphasized at the expense of the other, and the student can not avoid getting a distorted view of biology. Where taught by a zoologist general biology too often becomes zoology with a mere sprinkling of plants, and possibly vice versa. Even if he means to give fair and impartial treatment to both phases of biology, it is indeed a rare enthusiast who can avoid instilling his students with the greater importance of his own particular field of interests.

But there is still another objection to a general biology course being given either by a zoologist or by a botanist. There are altogether too many good zoologists, for example, whose knowledge of biology outside their own field is extremely limited. Only too often their familiarity with plants is little more than skin-deep. They may have sufficient information to enable them to work into a general biology course whatever of botany they deem essential, but beyond the covers of the text-book they have no real knowledge of the subject. Their thin veneer of botanical wisdom may well pass muster in a high school, but it does not take the more mature college student long to penetrate beneath the surface. It is an experience altogether too common that a

student coming into botany from a course in general biology is so woefully lacking in his comprehension of plant life that it is necessary for him to repeat all over again the botanical studies he has already made. And what is more, such impressions as he has gained, quite as often as not, are inaccurate if not absolutely incorrect. The old adage is a good one: "Let the cobbler stick to his last."

If a course in general biology is to be given at all it should be conducted either by genuine biologists or else conjointly by both zoologists and botanists. A dual teaching force, part zoologists and part botanists, apparently has proved successful at some institutions where general biology is taught, but more often this arrangement seems to have proved a failure. A course given by two heads is liable to lack the necessary unity. Different points of view, interdepartmental jealousy, human nature: all these interfere with complete harmony. Such a course will naturally tend to resolve itself into two more or less distinct portions. Why not recognize this danger and, instead of attempting to splice together the subject matter of the two fields of biology, give two courses from the outset?

2. *Biology is a hybrid course.*

An elementary course in general biology interweaves a study of plants and animals in an impossible attempt to show to beginning students that the two sets of forms illustrate the same principles. The fact is that while botany and zoology are both biological subjects, botany is the study of one phase of life and the structures which it has built up, just as zoology is the study of another phase of life and the analogous but not homologous structures which it has built up. The elementary student needs to have emphasized, in studying these two sciences, the dissimilarities rather than the similarities. Each line of study has its most important problems of relationship, evolution and physiology connected in its series, and these can not be brought out as clearly nor with as much emphasis when the two are mixed up together. There may be some advantages, if one is con-

sidering only the lower organisms, in studying plants and animals together, but when it comes to the higher forms there is a distinct disadvantage in attempting to mix the two in one elementary course. For example, "what advantage is there in studying a fern by the side of a lobster, or an earthworm by the side of a moss, or a monkey with an oak tree—unless, indeed, you are going to consider problems of the athletics of the monkey in relation to the tree?"

There is no more justification for combining botany and zoology into one elementary course than there is for giving a combined elementary course in physics and chemistry. We may equally well have a general Greek-and-Latin course for elementary students which will introduce them at once to philology. The general biology course belongs in the same class with the general science course, which is universally conceded to be of too superficial value to merit a place in the curriculum of any institution above the grade of high school. It is but a step removed from the natural science course which figured in so many college curricula of a past generation.

3. *An elementary course in general biology lays too much stress on abstract principles and too little on concrete facts.*

"Sound and thorough knowledge is only to be obtained in the laboratory," writes Huxley. A firm basis of fundamental facts is absolutely prerequisite to a clear comprehension of underlying principles. This is just as true in the biological sciences as it is in chemistry or physics or mathematics. The student must actually work with plants as plants and with animals as animals and become thoroughly familiar with their structure, physiology and reproduction before he can appreciate broad generalizations. Make general biology, if anything, an advanced course in evolution or biological principles, to follow specific courses in botany and zoology: a summation, rather than an introduction. Teach the student to generalize on many particulars, not on a few. Train him first to be precise in his methods and accurate in his conclusions. Develop his powers of observation. In an elementary

course in general biology the student is apt to become so enamoured of the grand general underlying principles that he has little use for details, with the result that he becomes loose and slipshod in his methods and utterly incapable of accurate, independent work. Let the student learn to be analytic before he attempts synthesis.

4. *An elementary course in general biology, as ordinarily presented, tends to give the student the impression that he has something he does not possess.*

Dealing in one short course, as too often it pretends to do, with all the large problems of life, general biology commonly aims to accomplish the impossible. Covering, as it seems to, the whole realm both of plant and animal life—morphology and physiology, evolution, cytology and genetics, not to mention bacteriology and hygiene—it leads the student to think he has a comprehensive knowledge of it all, when in fact he has only a superficial smattering of anything. Touching as it must only the high lights, it tends to muddle the student's mind and to leave him with little more than an uncoordinated jumble of facts.

5. *For students who plan to take further work in either botany or zoology, an introductory course in general biology is especially disadvantageous.*

It is primarily essential that such students, at the outset, should lay a firm foundation of fact upon which to base subsequent studies; that they should develop their powers of observation; that they should learn to work and think independently, to draw careful and accurate conclusions. It is disadvantageous that the introductory course should encroach upon the work of more advanced courses, for "when the student begins these more advanced courses he loses the advantage of entering entirely novel fields." And it is further disadvantageous, as so commonly is the case, that a student going on in botany should receive his introductory training in this phase of biology at the hands of a zoologist (and vice versa).

6. *In an institution having two distinct departments, a department of botany and a department of zoology, it is disadvantageous that*

one of these departments should give a course called general biology.

The disadvantages accruing from such an arrangement are patent to everyone and need not be detailed. The botanical department should give an elementary course in botany and the zoological department a similar course in zoology. If the zoologist wishes to use plant material to illustrate certain features (and vice versa), let him do so, but do not on that account let the course be labeled by the misnomer "general biology."

The general biology course owes its perpetuation, as it did its inception, primarily to the zoologists. The fact can not be overlooked that in institutions having distinct departments of botany and zoology, but where general biology is still taught, this course is in charge of zoologists, although in two of these institutions it is given in part by botanists. Further, in institutions having but one department, the department of biology, and where such a course is given, the department, as a rule, is predominantly zoological. And finally, it is more than a coincidence that nearly all of the many text-books in general biology now on the market, like their progenitor, have been written by zoologists (or else by high-school teachers). The Huxley and Martin text-book, to quote a former leader among American botanical teachers "was very useful, but its influence on botany was distinctly vicious. Wherever the book went, it put botany back as a mere 'Anhang' to zoology." It is books of this description that have led a well-known eastern botanist to define biology as "botany taught by a zoologist."

What, then, should be the nature of elementary courses in the biological sciences?

1. There should be two distinct courses: elementary botany or plant biology, taught by a botanist, and elementary zoology or animal biology, taught by a zoologist.

2. Each of these courses (or the two taken together; see below) should aim to achieve a two-fold end: it should serve as an introduction to more advanced courses, and it should also satisfy the requirements of the student

for whom it will constitute the only biological course.

3. It is felt by many botanists and zoologists that special courses in the biological sciences should perhaps be arranged for the benefit of students who wish to take but one course in this field. Thus, nearly half of the botanists and zoologists who voted *in favor* of the general biology course, advocated that it be given, *not as a prerequisite* to advanced courses in botany and zoology, *but as an entity in itself*. Where the resources of an institution permit, "culture courses" in botany or zoology, or in botany and zoology, might well be offered in addition to the introductory courses in these subjects. Such courses would not be open to certain of the objections which have been urged against the general biology course. Indeed, while they might be planned along quite different lines from purely introductory courses, there is no reason why they should lay themselves open to any criticism whatever. There is always the danger, however, of attempting to be too comprehensive. Though perhaps to a lesser degree than when taken as a professional study, the value to the student of botany or zoology as a cultural study lies quite as much in methods acquired and in facts observed as it does in the information which is received. First and foremost the student should be taught to be careful in his technique, to be precise in his observations, to be thorough in his attention to details, to be keen in finding out things for himself, to be accurate in his conclusions. The content and scope of such courses must be determined by the individual teachers or departments concerned and the writer ventures no recommendations on this point.

In 50 of the 66 colleges and universities investigated by the questionnaire the elementary courses in botany and zoology are distinct from one another (this number includes 4 which in addition have a course in general biology). With reference to the arrangement of these courses, however, there are two groups. In one group, comprising 23 institutions, each course, elementary botany and elementary zoology, extends over a half year and the two, though vir-

tually distinct from one another, are so arranged that it is possible for the student to take them consecutively and practically as one continuous course within a year. In the other group, comprising 30 institutions, both the elementary botany course and the elementary zoology course extend through the entire year. In three institutions both of these schemes are in effect. While it is not the intention of the writer to express his personal views regarding the relative merits of these two schemes, the expressions of opinion elicited from botanists and zoologists at the various institutions where the respective plans are actually in operation, if not conclusive, are certainly suggestive.

In institutions where both elementary botany and elementary zoology are half-year courses, consecutively arranged, so that the student can take both within a year and practically as one continuous course, essentially the only objections offered are that in some places it is possible for the student to take one course, but not the other. Assuming, however, that a year's work is required (as of course it would be by either alternative arrangement) the consensus of opinion is as follows. This arrangement produces results satisfactory to both botanists and zoologists (botanists, 25:1; zoologists, 9:0). It possesses no serious disadvantages (botanists, 25:2; zoologists, 10:0). It is a satisfactory arrangement, both for the student who contemplates further work along biological lines (botanists, 25:1; zoologists, 10:0) and for the student who plans to go no further (botanists, 20:4; zoologists, 7:1).

In institutions where both elementary botany and elementary zoology are full-year courses, wholly independent of one another, the consensus of opinion is as follows. It produces results satisfactory to both botanists and zoologists (botanists, 27:3; zoologists, 16:6). According to the majority of botanists (20:8) it has no serious disadvantages; but the zoologists, by a small majority (12:9), are of the opposite opinion. According to the majority of both botanists (21:4) and zoologists (13:5) it is a satisfactory arrangement for students who plan further work in the biological sciences; but according to the majority of the

both botanists (16:13) and zoologists (12:7) it does not constitute a satisfactory arrangement for the student who contemplates no further work along biological lines.

The arguments in favor of consecutive half-year courses in botany and zoology are self-evident. This arrangement gives students who will go no further some knowledge of the facts, principles and problems in both fields of biology, and at the same time it constitutes a satisfactory introduction to further work in either botany or zoology. Whether and to what extent it should be attempted to coordinate the two is a question concerning which opinions seem to vary, and in all probability this should be determined in large measure by local conditions. There is little question, however, that if properly coordinated these two courses will accomplish everything which can reasonably be expected of the general biology course, but with the objectionable features of that course eliminated. Advocates of the full-year elementary botany and zoology courses are of the opinion that a half year is not sufficient time for an elementary course in either botany or zoology; that botany and zoology, like chemistry and physics, should be treated as separate sciences; and that the student in either course obtains an introduction to the fundamental biological principles, methods, and facts. The chief objection to this scheme is obvious. The student who is going on with botany or zoology loses the advantage of an early introduction to both sciences, while the student who takes only one year of biological science loses entirely either one phase or the other.

But the object of this paper is *not* to recommend any specific arrangement of elementary courses in botany and zoology. It is *not* to settle questions as to the subject-matter of elementary courses in either subject. The primary purpose of this article is to urge, in the interest of the students, teachers, and departments concerned, and in the interest of the biological sciences themselves, that, in elementary courses, botany should be taught *as botany* and zoology *as zoology*. The general biol-

ogy course is "simply a survival of an early stage in the pedagogy of the subject and has no place in a modern educational scheme."

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STATE ACADEMIES OF SCIENCE

CERTAIN groups of people interested in the development and application of the sciences in many of the states of the union have established academies of sciences. Some of the academies have developed into institutions exerting considerable influence at the present time, others have flourished for a period and then gradually have declined in their force until now it has become a question whether they should disband or should reorganize. Others have struggled to develop interest for a considerable period in their communities but finally have ceased to exist.

During the past year data have been collected and an attempt has been made to determine the general status and activities of all the state academies in order that each one may know its own relative standing in regard to resources and activities.

CLASSIFICATION OF MEMBERS OF STATE ACADEMIES

State Academies	Botany	Chemistry	Geology	Mathematics	Medicine	Physics	Zoology	Unclassified	Total
Colorado.....		20	75	11	5	15		20	146
Connecticut ..	4	4	12	2	12	4	7	128	172
Illinois.....	63	45	28	9	29	29	56	55	314
Indiana.....	51	24	16	10	22	23	55	30	231
Iowa.....	60	30	40	18	12	30	60	100	350
Kansas.....	20	30	10	10	12	12	10	79	173
Kentucky....	13	24	12	9	4	13	12	9	96
Michigan....	55	0	30	0	21	0	45	33	208
Nebraska....	13	8	5	4	9	5	10	19	73
New Mexico..	3	3	3	5	0	3	2	6	25
North Carolina	13	13	4	4	1	6	15	24	80
Ohio.....	66	6	40	4	16	29	79	13	258
Tennessee....	5	14	6	4	0	8	1	37	75
Utah.....	11	6	4	1	5	10	14	41	92
Total.....	377	227	285	91	148	187	366	599	2,293
Per cent....	16.4	9.8	12.4	3.9	6.4	8.1	15.9	26.1	

Questionnaires were sent to all state academies of science and the returned informa-

tion has been tabulated. The classification of members was arbitrarily limited to eight groups and only aims to indicate the general field of interest of the members. Several academies did not furnish a classified list of their members. Each secretary was asked to state whether the interest in the affairs of the academy by its members was "lively" or "apathetic." Such statements, in some instances, should be taken with reservations because of the personal element or the period of the year in which it was given. Much of the data is self explanatory and needs no comments.

Among the various conclusions that may be drawn from the data the one that is especially evident is that only a small percentage of the scientific people of the country are members of the various state academies. The reason for this lack of interest and activity is explained by one secretary as being due to the fact "that the day has gone by when men interested in widely different special lines of research or activity can profitably meet for the common discussion of their interests."

At the present time nearly all specialists belong to a national society composed of members all of which are interested in the same special science. Such people derive more benefit from this society than they would from a local academy. In order to meet this situation many of the academies have attempted sectional meetings in which those interested in any particular science might convene. This has been successful in a few large academies but in the smaller ones it has failed.

Whatever may be said in regard to the weaknesses of the academies two points should be remembered. First, the academies provide at their general meetings opportunities for considerable social intercourse between people from different parts of their respective states. This social factor has a tendency to promote good fellowship between the various institutions of the state and also to encourage research in the smaller colleges and normal schools. Second, many of the academies are able from funds provided from