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WHENCE PROTOPLASM?

IN THE Virginia Teacher for November, 1929, the author sketched in bold outlines the progress of animal life on the earth. The present article deals with the nature and origin of protoplasm. It is impossible to give the sources for much of what follows. They have been too long part and parcel of a teaching equipment. However, it may be said that the treatment of the subject as found in Osborn’s Origin and Evolution of Life has furnished a particular inspiration for much of what follows.

Ever since Purkinje first used the term “protoplasm,” as a name for living substance, its nature has been a subject of absorbing interest. It is not strange that its unique properties fostered the idea that it must have had a supernatural origin, that it must be a thing apart, utterly mysterious. Yet, to the most casual observer, living beings, plant or animal, have substance. They are definitely material objects. Since this is so, they must be subject to physical and chemical analysis like any other substance. However, when we come to apply the methods of the chemist to matter in the living state; when we attempt to determine its chemical structure, we upset that subtle interplay of forces within the protoplasm which we term life. In spite of the difficulties met with in all attempts to analyze protoplasm, some progress has been made. This has been done indirectly by studying the properties of non-living colloidal systems, and directly through microdissection of the living cell.

Assuming that the reader is familiar with the elements which are found in protoplasm, and with the fact of its colloidal nature, we will consider for a little the possible ways in which these particular elements may have come to be associated together as living systems.

The greatest contribution of science has been to establish that all phenomena of nature proceed in an orderly fashion, following certain fixed laws. The behavior of protoplasm is no exception to this principle. We are accustomed to thinking of the universe as being comprised of two things, matter and energy. The work of the last decade or so on the nature and structure of the atom seems to indicate that after all there is but one thing in nature, and that this thing is energy. Matter, viewed in this light, is but an expression of various energy relationships. However this may be, we usually think of energy as being of two kinds, potential or stored energy, and kinetic or active energy. Protoplasm has the unique power of automatically storing potential and releasing kinetic energy in the performance of its work. It is this property which, together with its power of self-perpetuation, that distinguishes matter in the living state from that which is not alive.

How did this peculiar state of energy relations which we term living substance come to be? It is impossible to know exactly how life came to exist upon the earth. None of us were delegated as official observers. It is not strange that much of mystery attaches itself to the synthesis of protoplasm, one of the most dramatic events in the earth’s history. Does it, as many believe, represent something new in the universe, or does it as Osborn so well states, mean “the continuation and evolution of forms of matter and energy already found in the earth, the sun, and in the other
stars?" Our analysis of protoplasm has shown it to be a colloidal substance. Colloidal chemistry and colloidal physics are relatively new fields of investigation. There is much to learn about colloids, and particularly about those in the living state. That which is unknown is always mysterious, hence living matter has seemed to be something so different from matter in the non-living state that it is still regarded by many as being something apart from the rest of the universe, a thing of mystery called into being by a special creative act. As the knowledge of colloidal substances increases, the mystery concerning the nature of protoplasm decreases, and we are less and less prone to regard it as being a substance distinct from the rest of the universe. Still our added knowledge, though it has marvelously increased our insight into the activities of protoplasm, has shed but little light upon its origin.

There are three possible methods by which life may have come to exist on the earth. Some incline to the belief that it has come to us from outer space, borne on meteors or planitesimals. Many believe that living organisms have arisen as the result of special creation. Still others believe that life has resulted from the action of natural forces similar to those operating in the rest of the universe, at a time when the primitive earth had assumed a form essentially like that of the present, but when conditions on its surface were possibly more favorable to the gradual changes necessary for the extensive synthesis of living matter from relatively simple inorganic substances.

To assume an extra-terrestrial origin for protoplasm is but begging the question. It is true that certain forms of living substance can endure extreme cold, possibly temperatures of the degree believed to obtain in interstellar space. Those who hold to this theory forget that meteors are heated to white heat by friction as they pass through the earth's atmosphere, so that any life they might have upon their surfaces would be destroyed by heat even were it able to withstand interstellar cold. Moreover, this theory does not account for the ultimate origin of life. It had to begin somewhere, why not on the earth? The physical and chemical structure of protoplasm point to its having arisen as the result of natural forces which may very well have been particularly active in the early days of the world's history. Because living matter has seemed to be a mysterious substance, it has been given a supernatural or miraculous origin by many. Such a belief tends to deny the very fact of the orderly progress of the universe. It is far more reasonable, far more reverent, to consider as most biologists believe, that living matter has arisen through the gradual establishment of those peculiar energy relations of colloidal substance which we recognize as attributes of matter in the living state. Osborn has well stated that "without being a materialist or a mechanist, one may hold that life is a continuation of the evolutionary process rather than an exception to the rest of the cosmos, because both mechanism and materialism are words borrowed from other sources which do not in the least convey the impression which the cosmos makes upon us. This impression is that of limitless and ordered energy." Nor does such an idea deny the existence of that creative force which we call God. Rather, it adds greatly to the dignity of our conceptions, giving them a force and majesty, a true reverence lacking in more primitive ideas.

What was the nature of the earth when life first arose? What conditions were necessary for the evolution of the living from the non-living? No exact answers can be given. One must arrive at the nature of the primitive earth from indirect evidence. Among the earliest rocks we know, sedimentaries are to be found. Since they were deposited in layers, we are sure that the same agencies of water, ice, and wind
now at work in rock-making were then operative. Vulcanism has always been a force instrumental in modifying the surface of the earth. We have direct proof of this written in the rocks throughout all stages of the earth's history. Volcanic emanations contain gases such as free hydrogen, carbon dioxide, volatile hydrocarbons, sulphur, and compounds of ammonia which are substances entering into the composition of protoplasm, and which may have played a part in its synthesis. Volcanic waters and those of hot springs contain similar substances in solution. These facts are true for volcanic gases and waters of the present, and there is no reason for supposing that they were essentially different earlier in the history of the earth. Even though the earliest rocks which overlie the primordial granite are sedimentaries, it is obvious that they were less abundant than now. The primitive world must have been richer in igneous rocks, which are usually alkaline in reaction. Water coming into contact with such rocks would accordingly have been richer in alkaline compounds than the soil waters of the present, and so would have contained more of the substances necessary for the synthesis of protoplasm which is alkaline in nature.

The atmosphere of the primitive earth is believed to have been more heavily charged with water vapor than is now the case. It must have been more cloudy, and the surface of the earth must have received less sunshine and more rain. In that case, the heat which reached the earth would have been retained by the blanket of cloud, so that there is no reason for supposing that there was any essential difference in mean temperature then and now. In fact, the temperature was in all probability more equable, subject to fewer extremes. It is probable, too, that volcanic activity was greater then than now, and if so, the atmosphere may well have been richer in carbon dioxide, at least in the vicinity of canoes and hot springs. Free oxygen was probably present, but in less amount than in the atmosphere as we know it, for there were no green plants to continually release it from combination.

The ocean owes its salinity to minerals brought to it by surface waters which have dissolved salts from the soil through which they have percolated. It is believed that the primitive ocean was very nearly if not entirely fresh. If this was the case, the conditions necessary for the synthesis of protoplasm would not have obtained in the sea. However, water is the main constituent of living matter if we consider bulk alone, and there can be little doubt that life had its origin in the water. Since the waters of the primitive ocean were not suitable for the origin of life, one has to look to the land for bodies of water in which protoplasm could have had its beginning. It is altogether possible that pools in the neighborhood of hot springs furnished favorable conditions of temperature, and an abundance of the substances necessary for the formation of protoplasm. The steps in the organization of such materials into colloidal substances we do not know. Nor can we understand how the store of carbon dioxide in the air was rendered available for the manufacture of protoplasm. It is doubtful if primitive protoplasm contained chlorophyll. The process of photosynthesis seems to have been a later development. We have no way of knowing if the primitive life stuff utilized free oxygen, was aerobic, or whether it depended upon chemically combined oxygen, was anaerobic in habit. Both systems for obtaining the necessary oxygen may have existed from the very beginning. The nucleus of every cell contains chromatin, that substance necessary to the life of cells as we know them, and different from the protoplasm outside of the nucleus. The question of the origin of chromatin may never be answered. We do not know whether it arose separate-
ly, independently, and later became associated with the cytoplasmic colloids, or whether the two were associated intimately from the very beginning as now. However, they may have arisen, it is certain that they are now inseparable, and that their association in the form of living cells is one of the most important facts made known through biology.

We have no way of telling how long it took to establish life. The rocks leave no record of this, the most important episode of terrestrial history. We may be sure that the time was exceedingly long, and that many combinations of colloids were formed which could not function as living systems, unsuccessful attempts as it were at making the living from the non-living. Once established, however, protoplasm by its very nature became self-perpetuating and self-varying so that life has continued from that early time to the present in ever increasing complexity, in ever increasing amount, in ever increasing variety of form, until the earth has come to so teem with it that a balance has become established among living things without which the world would speedily revert to its original lifeless form.

RUTH L. PHILLIPS

A BOTANIST-EYE VIEW OF EUROPE

KNOWING that the International Plant Congress was meeting in England last summer, another botanist and I decided to attend, and since a European trip was more or less of an event in our lives, we decided to make the most of it and see some other interesting places and people before the congress. After landing at Cherbourg and staying overnight in Paris, we went directly to Switzerland, which might rightly be called a “country on edge.” Geologically, the Alps are mere infants among mountains, being probably not more than six million years old—hence the steep slopes and narrow valleys. One of the occupations of the Swiss people is wine-making, so we expected to see vineyards, and plenty of them. But they did not look like the vineyards with which we are familiar—at first sight they reminded us of fields of pole beans. Each grapevine had its own individual trellis—an upright pole with no cross bars. The Swiss people do not take kindly to mass production; the cultivated slopes are all divided into small plots, each planted with a different crop. Even the meadow slopes are divided. Of course, sometimes these divisions are natural ones—terraces or irrigation ditches.

Mention of irrigation ditches seem queer in a land associated with rushing streams, but actually, the un-irrigated slopes are too dry to be good meadows or pastures. The mountain roads are masterpieces of engineering, though they are so narrow and winding that a driver traveling on them with safety must be a very good driver indeed. In many places the road is too narrow for two cars to pass, and on many curves the edge is guarded by scattered concrete posts above a sheer drop.

The alpine laboratory of the Botanical Institute of the University of Geneva was our first stop. It is located at a tiny village eight miles below the pass of Grand St. Bernard. It is a small building on top of a knoll, with no heat except two small electric grills. The “Cours des Vacances” was given this past summer by Professor Chodat and his son, and consisted of morning lectures—mostly in French—and afternoon excursions or research. Some of the morning lectures lasted from nine in the morning till the big cow bell was rung at our hotel down the hill to let us know that the noon meal was ready. On rainy days it was very cold—so cold that our hands became almost too numb to write notes. It was always cold in the morning, and we rarely stripped down to the bottom sweater at any time of the day unless we were climbing. But when
we climbed we found it very warm, and the sunlight was so bright that we had to wear hats to guard against sunstroke. On one memorable day we walked to the St. Bernard Pass—in the rain—and spent the night in the monastery. We were met by the almoner, who showed us to our rooms and told us when supper would be ready. We slept four in a room in beds draped with sheets. The next morning we made the rounds of the library, museum, and chapel, then visited the almoner’s garden on the mountainside, where he had made a collection of the unusual plants of the neighboring country. We worked our way back home, “botanizing” over peaks and down valleys, crossing snowfields and landslides, and arrived late at our hotel after almost ten hours of continuous walking.

The group at the laboratory was truly a cosmopolitan one. There were people from Italy, Austria, Germany, Switzerland, England, Scotland, Ireland, Wales, Poland, Hungary, Canada, and the United States. The official language, of course, was French, but so many of the continentals spoke English and spoke it well, that a great deal of the conversation was in English, with occasional digressions in French or German. Much interest in American customs was manifested on the part of the continentals. They were especially interested in our educational system.

The alpine flora is exceedingly interesting. Since the land mass of Switzerland is one so recently raised, the flora is cosmopolitan, being made up of immigrants from the neighboring countries. The meadows are whole flower-beds in themselves. Such a wealth of color and variety of bloom cannot be imagined growing wild, unless one has seen the alpine meadows of the Rockies or some similar area. In the meadows we found Dianthus pinks, a small, yellow relative of our sweet pea, a large and beautiful sister of our smartweed, several species of gentians, wild pansies, and many other flowers. I believe that my favorite is the Trollius, a large golden flower like a giant buttercup, with a faint sweet odor. In the middle of July the Rhododendron was past its best in the valleys, but we found it on a trip to a glacier in the neighborhood. One of the interesting plants which we found on our trips was an “herbaceous” tree—a willow which is not woody. Another willow which we found—this time a woody one—had almost decided to be a vine and was crawling over a big rock.

From Switzerland we went directly to Amsterdam, where we joined a group of botanists. Holland last summer had more rain than they had had before in eighty-one years, so raincoats and umbrellas were indispensable equipment. After a visit to the art gallery and a trip on the Zuyder Zee we visited the Botanical Institute and were received there by the successor to the great Hugo DeVries. The professor, Dr. Stomps, showed us through the rooms where DeVries worked and taught, then showed us the garden where the first work was done on Oenothera. It is full of Oenothera (evening primrose) of various species and varieties from the giant Oenothera gigas to a dwarf descendant from one of the experimental species. The work on Oenothera is still going on in the Amsterdam laboratories, and Dr. Stomps told us that he considered it his duty to continue the work there as long as investigators in other parts of the world were working along the same line.

I believe that the afternoon of that day was the high point of the whole summer, for, accompanied by Dr. Stomps, we went out to a suburb of Amsterdam to visit the great DeVries himself. Dr. DeVries met us at the door, and Madame DeVries received us just inside. DeVries is an old man with soft white hair, a twinkle in his eye, and a keen sense of humor. Soon after we arrived we were served tea and then (for a wonder the rain had stopped) we
went out to see the garden. DeVries talked about his plants in excellent English, and showed us a pet of his—a plant which had leaves so closely resembling pebbles that when the plant was growing in coarse gravel it was very difficult to distinguish between leaves and stones. When we had fully inspected the garden and taken a number of pictures, we returned to the house, where we were served an excellent dinner. DeVries has been called the greatest living botanist, and we felt that it was a great privilege to meet him informally.

Dr. Stomps, in his enthusiasm, declared that we must see the Naardemeer, a nature preserve outside of Amsterdam. The Naardemeer had been drained a century or so ago, and an attempt had been made to cultivate the land. The attempt was so unsuccessful that the drainage was abandoned, and the area was allowed to go back to the natural state. Some time ago it was acquired by a group of naturalists in Amsterdam, and is being kept as nearly as possible in its primitive condition. We left Amsterdam in the rain again and finally came to a small station, where we left the train and walked half a mile or so till we were forced to take shelter in a shed containing piles of straw being cured for thatch. When a break in the storm came, we made a dash for a fishing shanty, where our boatmen awaited us to take us on the "lake." The "lake" looked to us very much like a swamp intersected by many canals, and as we rode along the canals Dr. Stomps told us many interesting things about the place. In some places the canals became very narrow and so choked with lily pads that we had to get out and walk along the springy shore while the boatmen pulled the boats through. The waterlilies in the canals were disappointing to us. They were lovely white ones like ours, but they lacked the sweet scent which our lilies have. The shores were lined with viburnums and mountain ash loaded with berries—bright red and orange splashes against a dark green background. The vistas up the canals were interesting, and we were sorry that we had to leave after a short time to return to Amsterdam. Holland is a land of dykes and canals, but I shall remember it as a land of showers.

From Amsterdam we went to London, where we visited places interesting, both botanically and historically. Of course, we made the rounds of the Tower of London, Westminster Abbey, etc., but our main interests were botanical, so we spent a large part of our time in visiting gardens. At Regent Park we saw the Victoria regia in bloom for the second time (we had seen it before in Amsterdam). The leaves of this waterlily were fully five feet in diameter, and would support a whole chorus of frogs. Kew gardens formed the goal of one excursion. There we found a large and interesting collection of trees new to us—Cedar of Lebanon, Araucaria, and others equally interesting. In the conservatories, of which there were many, we saw numbers of tropical plants—ferns, orchids, and vines, and a large collection of cactoid plants. One of the most surprising of these last was a sure-enough grapevine which was trying to masquerade as a cactus. An interesting visit was made to the Chelsea Physic Garden, which is maintained by the London Apothecaries company. It was originally a garden of medicinal plants, in which the prospective apothecaries studied. The plant population is now more representative, and includes many forms of no particular medicinal value.

One trip from London was in the nature of a pilgrimage—a trip to Darwin's last home, Down House. Darwin certainly had an inspiring place in which to work. In front of the house is a view of the old village of Down, behind the house is a wide expanse of lawn, and beyond the lawn a shady walk leading off into the woods. It was easy to imagine Darwin wandering along the walk pondering his ideas for
which he received so much criticism, or walking over the lawn gathering material for his work on the earthworm, where we saw so much evidence of its activity. Darwin’s life was not an easy one, as he tells us himself: “My health is very weak; I never pass twenty-four hours without many hours of discomfort, when I can do nothing whatever. At no time am I a quick thinker or writer; whatever I have done in science has been by long pondering, patience, and industry.” And we get discouraged if things do not turn out to suit us the first time! Darwin’s adversaries were quick to malign him. They said he had no religion. Here is what he said: “I may say that the impossibility of conceiving that this grand and wondrous universe, with our conscious selves, arose through chance, seems to me the chief argument for the existence of God; I am aware that if we admit a First Cause, the mind still craves to know whence it came and how it arose. The safest conclusion seems to me that the whole subject is beyond the scope of man’s intellect; but man can do his duty.” And they called Darwin an atheist!

After visiting the Shakespeare country and Oxford we spent a time all too short in the lake region. We were fortunate in being there when the heather was in full bloom, and made the most of our opportunity to wander through it. The fields are divided by high stone walls which have been there so long that even the traditions of the place do not tell who built them. We climbed the highest hill in the neighborhood and had a glorious view from the top.

The climax of the trip was the International Plant Congress at Cambridge. The enrollment of the congress totaled twelve hundred botanists from all over the world. Half of the number were Americans. Here was a chance to see the eminent investigators in plant science assembled in one place to discuss their views of various questions. The congress opened with a reception in London followed by a reception in Cambridge the next day. On Sunday evening we were treated to an organ recital in the chapel of Kings College. The chapel is a beautiful building, and its beauty was enhanced by the light of the tallow candles, which are the only means of illumination. On Monday the work of the congress began in earnest. Some sessions drew crowds so large that another meeting place had to be found, but some questions were so specialized or so technical that the groups discussing them were very small. The question of whether or not the stem is a collection of leaf traces became an international fight, but no hard feelings prevailed. There were three official languages in the congress—German, French, and English—but since the congress was so largely made up of English-speaking people, many of those using French or German in their papers finished with a summary in English. On one occasion a Viennese rose to speak in the general discussion of a paper, announcing that he would speak in English, as he had been told that previous day that his German could not be understood. The questions discussed were, on the whole, of a very technical nature, ranging all the way from Genetics to Bacteriology. One interesting group was the section in Paleobotany, in which the English paleobotanists demonstrated the technique of making sections of fossil plants by flooding a polished surface with a gelatine solution.

Following the congress there were scheduled several interesting trips in and around London. On two afternoons the British Museum of Natural History had a special exhibit for the visiting botanists. Among the interesting features were some sheets from the herbarium of Linnaeus, some of Schleiden’s drawings, John Ray’s European herbarium, and Clayton’s Flora Virginica.

Of course, only a few places of botanical interest could be visited on this trip. However, we did not confine ourselves entirely
to gardens and laboratories, but included many places of purely historical or literary interest, such as Anne Hathaway's Cottage, Stratford-on-Avon, Kenilworth Castle, and St. Paul's Cathedral. The summer was an interesting one, and one very much worth while from several standpoints, but no experience was quite equal to that of seeing the Statue of Liberty through the mist as we came into New York Harbor.

M. Dorisse Howe

COMMENTS ON HIGH SCHOOL LABORATORY EXPERIMENTS

The purpose of this article is to familiarize the biology high school instructors with the organization and preparation of a wide variety of subject material from the standpoint of the teachers—to give them a series of comments that we have made by performing and testing all experiments found in Peabody and Hunt's Biology and Human Welfare, the textbook adopted for use in the high schools of Virginia. We hope to lighten their load in teaching and increase the value and effectiveness in their methods of instruction. On the following pages the instructor will find the number of the experiment and the page on which it will be found in the text. Some experiments are omitted because we had no comments to make other than those already given in the text.

Minimum Requirements

A. Time
1. Three 40-minute recitations
2. Two 80-minute laboratory periods

B. Experiments
1. At least 36 Laboratory Experiments

C. Equipment as listed by the Department of Education

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<th>Quantity</th>
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<th>Estimated Price</th>
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<tr>
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<td>Beaker, 150 cc.</td>
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<td>Test tube support (10 tubes)</td>
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<td>Test tube brush</td>
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Total $5.24

One Set for Each Laboratory

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<td>1 doz</td>
<td>Directing needles</td>
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<td>Petri dishes, 100 M. M.</td>
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<td>Microscope</td>
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<td>Ring Stands</td>
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<tr>
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<td>Test tubes, 6x3/4-in.</td>
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<tr>
<td>1 doz</td>
<td>Water glasses, plain</td>
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<td>Lactometer</td>
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<tr>
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<tr>
<td>1 set</td>
<td>Cork borers</td>
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<td>Trowel</td>
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<td>Insect pins No. 2</td>
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<tr>
<td>1 sheet</td>
<td>Parchment paper, 17x22-in.</td>
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Total $107.66

CHEMICALS

(One set for each laboratory)

| 2 lb. | Paraffin | $0.50 |
| 1 lb. | Hydrochloric Acid | $0.70 |
| 2 pts. | Alcohol, Denatured | $0.30 |
| 1 lb. | Ammonium hydrate | $0.70 |
| ½ lb. | Ether | $0.35 |
| 1 lb. | Formalin—40% | $0.40 |
| ½ lb. | Potassium cyanide | $0.50 |
| 10 grms. | Carmine, red | $0.60 |
THE VIRGINIA TEACHER

January, 1931

9

lb.—Nitric Acid. ............... .30
1 oz.—Iodine Solution ......... .15
1 vial—Litmus paper (red). .... .10
1 vial—Litmus paper (blue). ... .10
½ vial—Manganese dioxide. ... .10
1 vial—Absorbent cotton ....... .45
2 vials—Plaster of Paris ....... .40
½ vial—Cornstarch ............ .10
1 oz.—Fehling Solution A .... .25
1 oz.—Fehling Solution B .... .30

Total .................. $ 6.30
Total equipment (minimum)... $119.20

The equipment may be purchased from the following:

W. M. Welch Scientific Co., Chicago, Ill.
Central Scientific Co., Chicago, III.
Standard Scientific Co., New York, N. Y.
Chicago Apparatus Co., Chicago, Ill.
Marine Biological Laboratory, Woods Hole, Mass.
Emer and Amend, New York, N. Y.
Kay-Scheerer Co., New York, N. Y.
New York Biological Supply House, New York, N. Y.

These supplies may be secured through the Virginia School Supply Co., Richmond, Va.

Laboratory furniture may be secured from the following:

Branch office, Richmond, Va.
Leonard Peterson Co., Chicago, Ill.
Urese Laboratory Furniture Co., Manitoue, Wis.

Note.—Furniture manufactured by the State Penitentiary similar in design and quality may be obtained much cheaper from the Superintendent of the Industrial Department, State Penitentiary, Richmond, Va.

Criticism of Experiments in Peabody and Hunt

Exercise I, p. 12

Care should be taken to have the top of the glass put in parallel with the water; otherwise, if the glass is put in sideways, bubbles of air will escape from the glass, and will be replaced by the water. If the water is over three inches deep, the glass will tumble over. The small amount of water in the glass is due to the compression of the air when the glass is pressed hard against the bottom.

Exercise 2, p. 12

By experimentation it was found that it makes no difference whether the glass is full of water or not, but the paper should be pressed down with the palm of the hand before inverting to keep the paper from falling off.

An extra experiment can be used here on “How to make a barometer and read air pressure.” The directions can be found in a General Science or Physics text.

Exercises 3, p. 13

Although limewater gives the best results, due to the white precipitate it forms with carbon dioxide, other bases such as lye may be substituted. The lye may be obtained from soaking wood ashes.

The part of the experiment that proves nitrogen is present in the air is poor. This part only proves that there is an inert gas present.

You will not be able to get the exact proportion of oxygen in the air, as the candle cannot possibly use up all the oxygen before it is extinguished by the carbon dioxide gas.

Exercise 4, p. 17

An automobile pump may be substituted for the bicycle pump. You may not get results you expect in five minutes, because of the small per cent (.04%) of carbon dioxide present in a ventilated room.

Parallel with this, the children should now exhale the air from their own lungs through the limewater. From this experiment, they can immediately see the results of a larger amount of carbon dioxide on limewater.

Exercise 9, p. 39

Sometimes in making the starch test on a number of substances, you may get a positive test when you shouldn’t. Free-running salt gives the characteristic test for starch, which is due to the cornstarch that is added to absorb the moisture.

When applying the iodine test, if you cannot see the desired color results, it is advised that you use the microscope. In the apple, for instance, the blue starch grains are visible under the microscope within the larger plant cells.
Exercise 10, p. 39

The reducing sugar test should not be tried on ordinary cane sugar, unless the cane sugar has been changed to a reducing sugar by addition of an acid.

Old Fehling's solution should be tested by boiling. If it retains its transparent blue color, it is ready to use; otherwise a fresh supply should be made.

It has been found that the Fehling's tablets are very convenient. They may be obtained from any chemical supply house or from many drug stores.

Exercise 11, p. 40

Heavy brown paper reveals the presence of fat in food materials more satisfactorily than white paper.

Chloroform, benzine, ether, carbona, or any solvent of fat may be used, but caution should be given about the use of inflammable substances. The last solvent mentioned does not afford this danger if bottle is kept corked.

Exercise 13, p. 42

The tumbler must be cold, or else the moisture from the foods will not condense and the wrong conclusions may be drawn.

Exercise 15, p. 44

In the preparation of hydrogen dilute acid must be used, but it must not be over 50% water.

The connections may be made airtight by using the wax from a burning candle.

Be sure you have pure hydrogen not mixed with air before applying a lighted match. The text gives the test in that hydrogen mixed with air give an explosion. Pure hydrogen burns quietly. The testing is done in a test tube of collected gas, and not at the apparatus in which hydrogen is prepared.

Exercise 16, p. 45

Unless the substances are thoroughly dried and tested with a cold tumbler as to dryness, the wrong conclusions may be drawn as to the presence of hydrogen, since burning hydrogen forms moisture.

Exercise 18, p. 51

Carbon paper may be substituted by tin foil. Whatever substance is used, care must be taken to see that no sunlight reaches the leaf.

The covered and uncovered leaves must be left on the plant several hours in the sunshine before testing, or else you might get the same results with the covered as with the uncovered leaves.

A caution might be given here as to the boiling of alcohol over a direct flame. A water bath is much safer.

Exercise 20, p. 55

The experiment is often a failure because enough of the growing water plant is not used. Elodea is very satisfactory.

The note at the bottom of p. 56 on why this experiment fails should be read with care.

An extra experiment, “A Balanced Aquarium,” will work splendidly here. Two biology manuals that contain this experiment are Meier’s The Study of Living Things, p. 27 (Ginn and Co.), and Bailey and Green’s Biology Manual, p. 64, (Allyn and Bacon.)

Exercise 22, p. 63

If no Dewar flasks nor thermos bottles are available, improvised ones may be made by using sawdust as a non-conductor of heat. This is placed in a fruit jar, and a smaller jar containing the sprouting seed is placed down in the sawdust. An opening should be left just large enough for the thermometer. Cotton may be used for plugging as a cork would exclude oxygen.

Exercise 23, p. 67

Poor results might be obtained if enough sponge material is not put in the bottom of the jar to hold moisture in a wide-mouthed jar over night.

Exercise 24, p. 68

This experiment fits in so well with the
unit of work, "The Air as a Part of Our Environment," that the suggestion might be given here to recall the results obtained when carbon dioxide passes through lime-water as found in Ex. 4.

**Exercise 25, p. 69**

Clear filtered lime water should be used, so that you may readily observe the change that takes place in a short time.

Special attention should be given to the fact that respiration, which is the taking in of oxygen, and giving off of carbon dioxide, is taking place night and day. Photosynthesis, which means putting together by light, occurs only in sunlight. At this time carbon dioxide is taken up and used by the plant in the manufacture of sugar, and the oxygen is set free from the carbon dioxide, the plant using only the carbon for photosynthesis.

**Exercise 26, p. 77**

The iris plant gives equally as good results as onion bulbs when studied under the microscope as to plant cell structure. For this purpose the epidermis is stripped off with a knife.

At this point a suggestion may prove helpful about reproducing slides or drawings of cells, cell-division, etc., on oilcloth or the blackboard at a nominal cost.

Focus the lantern slide you wish to reproduce on the back or rough side of the oilcloth. Make it any size you desire, preferably large enough to be seen by pupils from any part of the room. Now trace with pencil or crayon the outline. Different colored crayons or ink may be used to make your chart clear and helpful. You will find this is a cheap way for obtaining permanent charts, as the oilcloth can be rolled up, and kept in a minimum amount of space.

**Exercise 27, p. 78**

Although this experiment calls for the study of human cells, this is a splendid opportunity for the pupils to see the likenesses of cells of the human body, one-celled animals, bacteria, etc.

The same reference that was used in Ex. 20 may prove helpful "Study of Living Things," p. 25.

**Exercise 29, p. 131**

A membrane which might be substituted (the intestines of calf called for in the experiment might not be procurable) is the skin or covering of sausage.

Parchment paper may be used.

Another way than suggested by the text that proves water will pass through a membrane is the egg experiment. The large end of the egg is shelled, so that the membrane is exposed. Through the small end of the egg a hole is bored and a tube is placed substantially in the egg yolk. Sealing wax will help to seal the tube to the edges of the bored hole, and help hold the tube upright. The egg is now placed in a glass filled with enough water to cover the membrane exposed. The tube may be several feet long, and if this experiment be left for several days a greater part of the tube will be filled with egg yolk.

A root plant, such as a carrot, may be placed in a jar of water. Through the top a glass tube is placed through a bored cork in upright position. A hole is made in the top of the carrot with a large cork borer to receive the cork.

**Exercise 32, p. 137**

The germination of grain requires air, moisture, and heat. Do not cover the grain with water and expect good results.

The "Rag Doll" method may be used, in which grain is spread out on a towel, the edges folded over so that the spread-out grain can be rolled up and tied. One end of the doll can be placed in a jar with enough water to allow the towel to become saturated, and some extra for evaporation. In twenty-four hours the grain will show sprouts.
Exercise 33, p. 138
Diastase contains the enzyme needed to digest or change starch into sugar. Other enzymes, such as pancreatin, may be used with similar properties. Allow time for the enzyme to act.

Exercise 34, p. 138
Allow time for action of saliva before testing for reducing sugars.

Exercise 35, p. 144
Any red solution will show up in the plant, but blue substances can not be seen so well.
If the plant is left too long before being examined the colored solution will diffuse to the phloem and you will not be able to distinguish the path the soil water takes to the leaf from the path it takes from the leaf.

Exercise 40, p. 155
The wax from a burning candle or melted paraffin will seal any place that moisture might escape from the container if top and sides are coated with it.
If a bell jar is not available, a half-gallon fruit jar or large candy jar may be inverted over the potted plant.

Exercise 41, p. 169
Exercise 42, p. 170
The two experiments listed under “Digestion in the Human Body” deal only with teeth as related to digestion.
Since a laboratory for high school biology is not equipped to carry out experiments dealing with the different steps in digestion, a suggestion might be made that this phase of work be taught by means of charts. These charts, illustrating the mechanical and chemical processes involved, can be prepared by the pupils as described in Exercise 26.
The average pupil can understand the digestion processes much better if each class of food is carried through separately.
A very good experiment on digestion is given in Bailey and Green’s Biology Manual (Allyn and Bacon), pp. 130-132, which includes (1) mouth digestion (2) stomach digestion (3) intestinal digestion (4) action of bile.

Exercise 43, p. 194
The part of the experiment 63 that deals with the circulatory system of the frog may be used in connection with the unit of work in “How Circulation is Carried On.” There is a note at bottom of p. 493 describing how the movement of the corpuscles in a tadpole’s tail can be observed under the microscope. This is an excellent demonstration of the blood current. The same thing can be shown by using the web of the foot of a live frog.

Exercise 44, p. 212
Again the part of experiment 63 p. 484 on the breathing organs, etc., of a frog may be used in connection with the unit of work, “How Living Organisms Breathe.”

Exercise 50, p. 256
If possible, have the pupils bring an isolated stalk of corn, and after examining the ear of corn explain why the ears are not well developed.
In working out the experiments on plants and plant reproductions, let the pupil plant his seed, watch it change its form, bring in photosynthesis in the growing plant, and finally reproduction.
This exercise and also No. 48 would be helpful in the unit, “How Living Things Reproduce.”

Exercise 53, p. 281
The teacher must be certain that the hay infusion contains no one-celled animals or plants that the pupils might mistake for bacteria. The one-celled animals are often very numerous in infusion, and this must be explained so that the wrong idea of bacteria may not be gotten.

Exercise 54, p. 283
It may be necessary to have high school
pupils know something about culture media for bacteria such as agar mixture, but since the topic of the experiment is “Where are bacteria found?” they should look for the more common sources of natural bacteria culture, such as milk, cooked food, soil water, roots of leguminous plants, hay infusion, and teeth scrapings.

Again a reference that might prove helpful in this topic is Meier’s *The Study of Living Things*, p. 59 (Ginn and Co.).

**Exercise 55, p. 284.**

Other disinfectants may be tried besides iodine, such as bichloride of mercury, potassium permanganate, carbolic acid, lysol, salicylic acid, chlorine, hydrogen peroxide, alcohol, formaldehyde, and mercurichrome, as well as various combinations of table salt or sugar.

**Exercise 56, p. 347**

Fish, such as sun perch, can be kept in an aquarium for study while the unit is being studied. A large aquarium of very few fish are necessary. Water plants are desirable.

They can be used later for the experiments that call for dissection.

**Exercise 61, p. 472**

The common mistake made by some authors is that hay infusion gives paramecium. This may happen if pond water or other such sources of water be put over the chopped hay, but if chlorinated tap water or distilled water is used the single-celled animals will not be paramecia. They may be exytricha colpodium and others that have ability to become cysts in the dry hay, but since paramecium does not encyst, it is a fallacy to leave the directions as they are given. In preparing pure paramecium culture boil hay infusion to kill all other animals and cool. Innoculate with a small number of paramecia.

**Exercise 63**

Part of this experiment could be used in connection with the unit, “How Circulation is Carried On.” Another part could be used in connection with the unit, “How Living Organisms Breathe.” Otherwise the exercise is too long to obtain understanding.

**George W. Chappelear and others**

**SOME PROBLEMS OF BIOLOGY**

The term biology most frequently calls to the lay mind visions of bugs and worms and all manner of crawly things. Those of us whose life work it is either to teach the subject to others, or to further extend the boundaries of biological knowledge by painstaking investigations, may in the very intensity of our work be as prone to miss some of the “bigger and better” bearings of biology on human life, and the enrichment of the human mind and spirit which come from the great truths of biology itself and those which become evident when we survey the borderland between biology and other branches of natural science, as our less well informed brother to whom the thought of our subject is uninteresting if not actually repulsive. It is the purpose of this brief article to note some of the major problems of this science and point out their application to human beings that we may better understand one another and the better appreciate some forms of human need.

Biology, embracing as it does all scientific knowledge concerning matter in the living state, has for purposes of convenience been grouped into a number of subsidiary sciences, most of which may be considered from either the botanical or the zoological point of view according to individual interest. Closely related to animal physiology are the sciences of psychology and sociology. The investigation of the behavior of animals as individuals and in groups brings us to the realization that their various reactions differ from our own more in degree
than in kind. Pathology, in its study of the abnormal, of diseased conditions both among plants and animals has been of untold value to mankind. Paleontology, which might be termed the biology of forms long extinct, has given that balance to the biology of the living which is essential to the complete understanding of the plants and animals of the present, and also to a better comprehension of our fellow men. It is these border-line sciences which intimately touch human life and serve to unite complex human society with all living things, thus emphasizing the essential oneness of all life.

Biology has given us one of the greatest of Nature’s laws, that of the continuity of life; the idea that life, once started on this planet, has continued in an ever increasing, ever diverging stream to the present, and will so continue as long as the earth supports it. Nor will this great truth be in any wise altered should it be found that such things as enzymes, filterable viruses of certain types, etc., represent substances intermediate between the living and the non-living, and so indicate that the synthesis of living substance from that which is inert is still in progress. The concept of continuity at once suggests that as all living things represent a continuum, co-operation is at least as important a law of life as is struggle.

It is interesting to follow the course of thought as the laws of nature become more clearly understood; to trace science from its dim beginning in charms and incantations to avert the wrath of vengeful gods to the wonders of the present. Sometimes misinterpretations of laws or undue emphasis on some one law to the exclusion of others may lead to tragedy. From our biological infancy we have been taught the Darwinian principles of the struggle for existence, the survival of the fittest and natural selection. No one will deny that these are laws of nature, but there is another law just as important, and just as clearly taught by Darwin. This is the law of co-operation, of mutual aid. All too often ignored, possibly because of the flare we humans have for the startling, the terrible, rather than for the peaceful, the quiet, the law of co-operation is the one which will eventually operate for World Peace, as yet a dream of the future, one fears, because of the lack of a complete understanding of the action of this law.

Vernon Kellogg in “Headquarters Nights,” a delightful series of conversations published in the Atlantic Monthly when, as a member of the C. R. B., he was stationed at German Grand Headquarters, brings out very clearly the warped idea of the Darwinian principles of the survival of the fittest, etc., held by the German leaders, some of whom happened also to be leaders in biological investigation before the War. They interpreted these principles of Darwin as teaching that a superman must inevitably arise as the result of human struggle. Moreover, they believed that he must be Teutonic, a German, since they held this people most fit of all races to survive. It was this attitude of mind, due directly to a misunderstanding of Darwin’s teachings, which led to the World War. A fearful price for failure to think straight by the leaders of a nation! During the course of his arguments with these men, Kellogg points out the significance of the equally important Darwinian principle of mutual aid. He traces its development from such simple symbiotic associations as those of Hydra and alga in green Hydra, and of fungus and alga in the lichen. Wholly unconscious though these instances of mutual aid are, they yet lead by gradual transitions to conscious associations for mutual helpfulness which culminate in the highest type of human altruism and self-sacrifice. A full understanding of the interactions of these laws of biology will make possible a
sane direction and control of human relationships.

Another fundamental law of biology, a corollary of the law of continuity, is that of growth. It may seem strange that so obvious a fact as the increase in size of a plant or animal should be imperfectly understood, yet this is true, and upon the correct solution of this problem rests in a large measure, the control of cancer. Since this disease ranks second in mortality statistics as a cause of human death, it is vitally important that it be controlled. Whatever else may be involved, cancer results from the failure of whatever it is which normally inhibits unrestricted cell growth and multiplication to act. To understand the disease and so wipe it out, necessitates learning why it is that a balance exists by means of which no one tissue develops at the expense of the rest. To say that it is heredity, or the hormonal action of the glands of internal secretion, does not answer the question. The cause goes deeper than either of these. Woodruff, in his classic experiments with Paramecium, found that protoplasm is essentially immortal. That is, if all unfavorable extrinsic conditions which prevent multiplication of this animal be removed, it will go on dividing, reproducing, indefinitely. He calculated that had all the animals produced as the descendants of a single individual during the eleven years of his experiment been allowed to live, the resulting bulk of protoplasm would have exceeded that of the earth! In this protozoan the factors which inhibit growth seem to be extrinsic rather than intrinsic; the result of unfavorable environment rather than due to any phenomena arising within the cell itself. Carell, in his experiments with the heart muscle of chick embryos, established the same essential truth, the inherent immortality of protoplasm. He demonstrated that if this embryonic tissue be grown in the serum of the animal in question, kept free from bacterial contamination, and incubated at the proper temperature, care being taken to transfer it to fresh food at frequent intervals, it continues to form new cells, to grow indefinitely. Others have obtained like results with other tissues. The growth of cancer cells has been studied by this method. Clark, of the University of Pennsylvania Medical School, has just perfected a method whereby cell and tissue growth can be studied in the living, adult animal. Great progress is being made toward the solution of the problem of growth, but the question of why it is, that in the complicated adult multicellular organism, there comes a time when cells no longer respond to the impulse to divide, when there is no further increase in bulk, remains a mystery. This must be solved if we are fully to understand why and how the brakes are removed in some instances; why when the law of the ratio of surface to mass again comes into play with unrestricted cell growth and multiplication in a given locality, cancer results.

Many of the problems of biology are those of physics and chemistry as well. Moreover, they lead us far into the past, to the dim beginning of life's history upon the earth. We know that protoplasm is made up of common elements, that it is colloidal, and emulsoidal. The problems of the chemistry and physics of colloids are also the problems of biology. When solved, or even better understood, they will throw much light on the way in which living substance has been synthesized from matter in the more simple non-living state. When we know these things we shall have definite information on one more of creation's dramas, and again the reality will doubtless prove to be more wonderful than any poet's dream.

When the Curies discovered radium they transformed our lives, completely upsetting our previous conceptions of the nature of
matter. Since this discovery, great advance has been made in the science of radiology, and in the practical application of this knowledge to human progress. In biology we are using this information to investigate problems of heredity, for in radium and X-rays we have powerful weapons with which we can actually alter the structure of chromosomes and so change the expected nature of offspring. The fact that these rays, if intensely used, will kill, has made them useful in treatment of cancer. Recently Milliken has discovered what he terms "cosmic rays." These are believed to come to us from outer space. They have a far greater penetrative power than any rays thus far discovered. We are constantly exposed to their action, but as yet we have no idea of their action on living substance. One of the problems awaiting biologists is to determine this. It has been suggested that the phenomena of degeneration accompanying old age, may in some way be associated with the lifelong bombardment to which we are subjected by cosmic rays. Be that as it may, it is "another story," not to be solved save through much labor.

Believing that it is sometimes well for us as teachers to pause and meditate, mayhap to dream in an orderly scientific manner, I have suggested a few of the fundamental laws of biology with their bearing on human life, both those whose operation, though indefinite, are yet deep in significance, and those whose understanding appears, because pertaining directly to our bodies, to be more immediately necessary. If this presentation in any way helps its readers to understand, or stimulates them to look further for biological help in living, it will have done its work.

RUTH L. PHILLIPS

In Nature there's no blemish but the mind; none can be called deformed but the unkind. Virtue is beauty.—SHAKESPEARE.

Josiah Holbrook—Father of the Lyceum

The Lyceum is my pulpit," said Ralph Waldo Emerson in 1836 when asked to accept the pastorate of a leading Boston church. He referred to a system of lecturing before all sorts of audiences in all sorts of places that has in recent years become known as the American Lecture System.

The Lyceum was the invention of Josiah Holbrook of Derby, Connecticut, who spread his idea for "associations of adults for the purpose of self education" in October 1826 issue of the American Journal of Education. Holbrook was a graduate of Yale College, class of 1810, who in 1819 had started a school on his farm near Derby for boys, the first school in America where a popularized form of the natural sciences was taught, and where manual labor was combined with education. Poor boys were allowed to pay a part of their tuition by laboring on the farm.

But Holbrook himself was so interested in the study of geology that he soon forsook his school and began to study his favorite subject by tramping over most of New England, studying the rock formations and lecturing to whatever audiences would assemble in the Town Halls in the villages and hamlets through which he passed. He was immediately impressed by the hunger for information exhibited by nearly every man and woman that attended his lectures. Intellectual hunger peered from their eyes night after night, and it bothered him to such an extent that he began to wonder if something could be done about it. A typical Yankee was this man Holbrook—and a born educator, too.

A plan took form and finally found its way on paper, but that didn't help much. It only served to crystallize the plan more fully in Holbrook's own mind. He finally
decided that the way to start a movement is to start it. After lecturing on geology in the little Town Hall at Middlebury, Mass., he outlined his plan to the forty farmers and mechanics that composed his audience, and asked them if they wished to do anything about it. Enthusiastically and unanimously they responded, and the organization formed that November night in 1826 was called “Middlebury Branch Number One of the American Lyceum.”

After the Middlebury experience, Holbrook formed a town Lyceum in every village he visited, but soon realized that he needed help if this movement was to become the influence that he had hoped for it. Boston was then the intellectual and cultural capital of the country, and Holbrook laid siege to it. In November, 1830, as the result of his work, the Boston Lyceum was formed with Daniel Webster, then at the very pinnacle of his fame and power, as its president. The Lyceum was now news; it had been approved by cultured Boston; it was now quite the thing to belong to a Lyceum. Important people in every community now were willing to sponsor the new movement. And it grew by leaps and bounds. Massachusetts, dissatisfied with the slow progress of the movement, formed a State Lyceum Board whose duty it was to speed up the formation of Town and County Lyceums in order that the state might have the honor of forming the first State Lyceum. But New York State beat Massachusetts by six weeks, and Florida quickly followed with the third state organization.

The New York State Lyceum Association immediately issued a call for a National Lyceum Convention. It met in the Court Room of the City Hall Building, New York City, on May 4, 1831, with delegates representing more than one thousand town Lyceums. And with the holding of this national convention amidst great enthusiasm, the movement started by Josiah Holbrook in November, 1826, could rightly lay claim to being a genuinely national movement for adult self education.

**Holbrook’s Plan**

But what did these Lyceums do? Holbrook’s plan was most comprehensive. It provided for the formation of an association of adults in every town, city, village, or community, which would be called a “Lyceum.” He obtained the name from the Greek Lyceum, originally a grove near Athens with tree-shaded walks consecrated to the Lycian Apollo, whose surname was Lykios, “the wolf-slayer.” Here, Aristotle daily wandered up and down, teaching philosophy, slaying the wolves of ignorance. Holbrook hoped to do the same thing with his Lyceums. They were to be organized in towns, in counties, in states, in nation—and then there was to be an International Lyceum, of which Chancellor Brougham, of England, was to be the president, with fifty-two vice-presidents, one for each nation—a sort of League of Nations Lyceum!

From 1826 to 1845, more than three thousand town Lyceums were organized from Maine to Florida and as far west as Illinois.

And what were these organizations to do? It was so simple that at first the plan seemed unimportant to many people. The people of every community were to assemble in the Town Hall or other place of assembly once a week and those who could, because of superior knowledge, should impart their superior knowledge to their fellow-townsmen. Debates became frequent. If a member of a community took a trip to Boston or to New York, and especially if it were a trip to Europe, he was expected to benefit his townspeople as well as he could by telling about it. There were readings of essays, books, poems, discussions of town problems, national politics, in fact, almost everything was grist for their intellectual mills.

And then the people grew tired of hear-
ing only the home voices. At first the im-
ported speakers weren't imported from very
far away; they were men (and later, after
Lucy Stone and others had broken the ice,
women spoke too) from nearby towns who
had made reputations for themselves as in-
teresting speakers. These Lyceums afford-
ed excellent training quarters for would-be
orators and lecturers. Soon a few men had
achieved fame as lecturers and they became
so in demand that they were compelled to
ask a fee.

Ralph Waldo Emerson became the first
outstanding lecturer, and all his essays after
the thin volume (Nature), were written
for lecturing purposes and delivered many
times before they were put between the cov-
ers of a book. He gave solidity and intel-
lectual strength to this movement. But he
did not long hold the platform alone.
Henry D. Thoreau, a fellow Concordite,
began lecturing in the late thirties. John B.

Gough followed, and then a whole galaxy
of stars made their appearance, including
Wendell Phillips, Edward Everett, Daniel
Webster, George William Curtis, E. P.
Whipple, Henry Barnard, Oliver Wendell
Holmes, Bayard Taylor, James Russell
Lowell, Edward Everett Hale, and more
than a score of equally famous men.
Among the women of that early day who
spoke to large audiences were Lucy Stone,
Elizabeth Cady Stanton, Anna Dickinson,
Julia Ward Howe.

Where Is Holbrook's Lyceum Now?

It isn't possible to trace the develop-
ment of this movement to the present within
the bounds of this short article. To do so
would require the writing of a fairly large
book. Hundreds of the most famous men
and women of the past one hundred years
have taken part in the development of the
movement—a movement that has spread in-
to the smallest towns and that permeates all
of our largest cities.

The many series of lectures of an infor-
mational character that are offered in every
community are all offspring of this move-
ment, no matter by what name they are
called. The more than two hundred lec-
tures presented each season in the heart of

Outstanding Men and Women Who Have Spoken in the American Lecture System Within the Past One Hundred Years

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and Sciences, Philadelphia Forum, Goodwyn Institute, Lowell Institute, Cooper Union, and their prototypes in all parts of America. The University Extension movement is Holbrook’s plan carried out by a University. The Chautauquas are Holbrook’s Lyceum dressed in summer clothes. The Institute of Politics at Williamstown, Mass., and similar organizations are unconsciously doing the thing that Holbrook advocated for his International Lyceum.

A great-granddaughter of Josiah Holbrook told me a few weeks ago that when Holbrook’s young wife died in 1820, he stood at her grave and sang her favorite hymn—and was never known to sing again. I believe that the loneliness of his heart and the affection he would have given to her had she lived, has found overflowing expression in the movement he started a century ago, a movement that has enriched the spiritual, intellectual, and cultural life of all America for a hundred years. His work sang for him. And it is still singing in the hearts of people every day, in our busy cities, as well as in the small villages and hamlets stretched from the Yukon to the Mississippi Delta and from Hawaii to the easternmost point of Maine.

LOUIS J. ALBER

UNCONQUERED FRONTIERS

Geographical frontiers have vanished, but an unconquered frontier exists wherever knowledge and practice based on knowledge stop. To extend the frontier of knowledge and practice in the care of children was the purpose of the recent White House Conference on Child Health and Protection called by President Hoover.” In these words, Secretary of the Interior Ray Lyman Wilbur, the Chairman of the Conference, challenges citizens to see to it that childhood in the United States shall profit by the most extensive and profound single effort ever made by a nation for the health and protection of its children.

Pushing back the borders of the unknown in helping each child to develop to the full his abilities and character was the task of the Conference. In the spirit of pioneers the 1200 members not only gathered existing knowledge but undertook many original studies of influences affecting the development of children in our complex industrial civilization. The Medical Section’s report will not be complete until February, 1931, so extensive is its investigation of the dependence of the child’s physical condition on that of its parents, and of the interrelation between physical care and mental and emotional development.

Just how American children are going to develop into healthy citizens when at least 1,500,000 children every year are reported as suffering from a communicable, which in most cases means a preventable, disease, was one of the questions raised by modern pioneers in the Public Health Section of the Conference. Fifteen per cent of the total deaths in this country every year are caused by such diseases. Of the million children with weak or damaged hearts, of the hundreds of thousands with impaired hearing and the thousands with defective eyesight, many have become thus handicapped as a result of communicable diseases. From fifty to seventy-five per cent of the nation’s crippled children owe their condition to infantile paralysis and tuberculosis. In the prevention and control of communicable disease there are still frontiers to be conquered.

Other evidence of inadequate public health measures in many sections of the country, especially in rural districts and small communities, exists in the record of two hundred and fifty-eight milk-borne epidemics during the past six years. The children of the nation are not yet protected as they can be from such diseases as typhoid fever, scarlet fever, septic sore throat, and
diphtheria. Pasteurization of milk and immunization against disease are weapons of the new pioneer which are still unused by many of our people.

Another frontier is presented by the six million improperly nourished children in the United States. This, the Conference finds, is due rather to lack of knowledge than to poverty. Every child, for instance, is getting on an average but little more than a pint of milk a day. According to scientific studies, the growing child requires at least a quart of milk a day for the building of bones and teeth. If the future citizen of America is to realize the potential size and strength of his physical endowment, the American child today must have both safe milk and more milk.

The progress of each child in achieving the full capacity of his abilities and character was studied by the remaining two Sections of the Conference—on Education and Training and on the Handicapped Child. Since a child's education begins the moment he is born, since most of what he learns and most of the training he gets during the first six years of his life take place in his home, since physical ills and unhappiness in later life often have their beginnings during this early period of childhood, parents need to be pioneers. Whether they take advantage of the parent education movement or consult specialists, parents who secure and use the best knowledge available concerning the influence of the family upon the development of the child are engaging in an undertaking greater than the extension of any geographical boundaries.

According to the experts, the American family is failing, especially, to teach the child a sense of values. In the thousands of homes visited by members of the Conference it was found that most of the children had five types of toys, but that only a fourth of them had stories read to them or told them. Half of the homes in America have less than fifty books and three-quarters of the homes have less than a hundred books. Yet, as the Conference points out, next to persons, reading has the greatest influence on character.

The happiness of American families, under the strain of present day living, depends far less on the use of modern plumbing and period furniture than on the value put on human relationships. "If a child's parents are happy in their adjustment to each other, if they are working hopefully toward the fulfillment of an ideal of living, if they love their children with a sincere and unselfish love, in short, if they are well-balanced individuals, gifted with a certain amount of insight, they are apt to provide the child with a wholesome emotional background which will contribute more to his development than mere material advantages." From his family and from the example of their lives the child adopts the ideals and the attitudes toward things and persons which will guide him to future happiness or misery.

Knowledge of human beings, however, is a field which needs further exploration by teachers as well as by parents. In American education, the Conference stated, the emphasis needs to be shifted from information to appreciation of values in human life. There has been too much teaching of facts, too little development of character. To quote President Hoover again, "Children must not be regimented to a single mold, or the qualities of many will be stifled; their varied personalities and abilities must be brought fully to bloom."

To provide educational opportunities for every child throughout the United States and its dependencies and at the same time to encourage the development of each child's special abilities require adjustments in the school system. Training programs which will assist the handicapped child to become a self-supporting citizen, and which will enable the gifted child to become a leader of men and women have yet to be
worked out—a task calling for much ingenuity. That first steps have been taken in the formulation of modern educational methods and of effective means of vocational guidance, offers evidence of the pioneer spirit among those who aim to teach children not merely how to make a living, but how to live.

Yet the best that the home and the school can do is not enough. More than forty per cent of the time of childhood and youth up to eighteen years of age is spent outside the home and school. Discrimination in the choice of companions during this surprising amount of leisure time depends in large measure on the sense of values which the child acquired from his parents in his early years. His recreation, too, during these hours will be governed by the same influences as well as by the organized activities in the community. Commercial pioneering has brought motion pictures before 115,000,000 persons each week, at least one-third of whom are under sixteen years of age, and has sold 13,478,600 radio sets. Other and unselfish pioneering on the part of community groups is necessary if these commercial amusements are to add to rather than take away from the well-being of American children.

That something serious must be lacking in the well-being of many of the nation's children is shown by the records of the juvenile courts. Two hundred thousand young people were arrested in 1928 for transgressing the law. Though physical defects sometimes have a direct relation to delinquency, its beginnings may be more often traced to behavior problems which in early childhood and during school years were neglected or handled unwisely by parents and teachers. In modern life, guidance is especially necessary to help the child adapt himself to the difficulties of living with other human beings. Two generations ago a boy who surreptitiously enjoyed the fruit of a neighboring farmer's orchard was admittedly normal. Today a boy who attempts the same prank in a crowded city on detection may become a delinquent. Only when "the problem child" becomes "the problems of the child" can the growing number of juvenile delinquents be reduced.

These are but some of the points emphasized at the White House Conference. The detailed findings will fill many volumes, for judges, doctors, nurses, health officers, psychiatrists, welfare workers, and teachers were agreed that health implies wholeness, meaning the growth of the child in his complete endowment—physical, mental, emotional, and spiritual. The responsibility for directing this growth lies first with the family. It is shared, however, by all adults in the community because the example of their lives unconsciously is woven into the lives of the future generation. The citizens of today are building the nation of tomorrow. If their performance has its roots in the pioneer spirit which is their heritage, they will, by wise and full development of the resources available in each individual child, conquer the frontiers still existing in the childhood of this country.

AN ARGUMENT

"Mr. Peter said plainly that the rod only was the sword that must keep the school in obedience and the scholar in good order.

"Mr. Wooten said: 'In mine opinion the schoolhouse should be the house of play and pleasure, and not of fear and bondage, and therefore if the rod carry the fear of the sword, it is no marvel that those who are fearful by nature choose to forsake the play, rather than to stand always within the fear of a sword in a fond man's handling.'

"I said: 'Young children were sooner allured by love, than driven by batting, to attain good learning.'"—Extracts from "The Schoolmaster" (1750) by Roger Ascham, Tutor to Princess Elizabeth.
EDUCATIONAL COMMENT

SOMETHING ABOUT SCHOOLBOOK PIRACY

The work of an author usually implies originality, research, and literary skill. In recognition of the fact that a service thus performed constitutes a contribution to the cause of civilization, the several countries of the world encourage authorship by distinguishing its products as property which is entitled to the same measure of protection accorded to all other forms of property. Thus the copyrights issued by governments covering books and magazine literature, plots, plays, engravings, become certificates of ownership, established by custom and law, and internationally observed, as well as nationally.

The reputable publisher not only respects the copyright law, but is anxious that the author does not violate the rights of his fellow authors. And yet the invasions upon the rights thus established occur only too frequently, either in the form of outright plagiarism or in some form of altered reproduction.

The violations of the copyright law have manifested themselves in the school field of this country in a somewhat peculiar way. A new book comes off the press. Sample copies go to the school public. Its merits are recognized. The author has produced something which excels all other similar books. But what happens? Is there an honest purchase of a number of books sufficient to supply the student class? Would anyone attempt to pilfer the contents of the book, or at least to pilfer the part of the book that is deemed most valuable? The several questions are answered by submitting the following typical case:

A representative of an educational publishing house recently presented a copy of a new book to an instructor with a view to securing its adoption in the particular school. The instructor pronounced the book as being wholly unsuited for his class. He explained that he had himself prepared a set of lessons, and hence did not require a textbook of any kind.

When the representative insisted upon seeing the reproduction, he discovered that the text had all been copied verbatim from the very book he had just presented. The instructor had, by means of reproducing devices, produced seventy copies of the main problems of the book, and thus supplied his classes with the latest textbook material. Other instructors in other cities have done the same thing; in fact, it has become the common practice of certain schools.

The instructor may defend his action upon the plea of economy, and at the same time pride himself upon having ingeniously circumvented the author and publisher. And yet the conscientious instructor will interpret such an action as an underhanded theft. If the author, who has spent time, thought, and labor upon his book, is entitled to a royalty, and the publisher, who has invested his capital and energy in its production, is entitled to an earning, then the instructor's "stolen" textbook pages constitute nothing more nor less than an infraction upon property rights.
According to the testimony of publishers' representatives, the practice of pilfering modern textbooks is growing rather than diminishing. While the practice, as already stated, is confined to certain schools only, it is, nevertheless, reprehensible and should be dis- countenanced wherever it asserts itself. The instructor may not appreciate the fact that the contents of a textbook, as well as the book itself, represent property rights which must be respected. The fact is that the author is a fellow instructor who is as much entitled to his book royalties as is the instructor to his monthly salary.

The owner of copyright has a remedy at law in that he may secure an injunction restraining infringement, and also sue for damages. The more serious part, however, of the copyright law is found in the criminal statute by which it is made a misdemeanor to willfully infringe upon the work of an author. Such infringement is punishable by imprisonment not exceeding one year, or a fine of not less than $100, nor more than $1,000, or both, in the discretion of the court.

The law also includes in an action all persons who have wilfully aided and abetted the offender. Thus, if an instructor is charged with pilfering copyrighted material, those likely to have knowledge of the offense, such as the president of the board of education, the superintendent of schools, the supervisor or principal, may be included in the action. If the violation of the law is carried on with their knowledge and consent, they become a party to the misdemeanor.

The authors and publishers, who have been exposed to the purloining of textbook contents, have thus far accepted the situation somewhat complacently. But the prediction has been made that the day is not far distant when legal steps will be taken to stop a reprehensible practice and compel a proper respect for the offerings and the rights of author and publisher.

It is not likely that the school adminis-
THE READING TABLE

BOOKS RECEIVED


NEWS OF THE COLLEGE

President S. P. Duke attended the meeting of the Association of Colleges and Secondary Schools of the South, held in December, in Atlanta, Georgia. On his return, he spoke in chapel telling something of this association and its work.

Mr. Conrad Logan attended the annual meeting of the National Council of Teachers of English, held in Cleveland Thanksgivings week.

During the Christmas holidays, Dr. J. A. Sawhill attended the meetings of the American Linguistic Society, held in Washington.

Climaxing their last class day with the murder-melodrama, “The Dead of Night,” the Class of ’31 celebrated Senior Day on December 12, carrying out all the usual activities successfully. Participating in the play were Donalene Harvey, Nancy Trott, Lois Mitchell, Mary Watt, Lillie Frances Blankenbaker, Sara Ellen Bowers, Frances Snyder, and Delphine Hurst.

With an address by Rev. J. J. Gravatt, Jr., rector of Trinity Church, Staunton, and a varied and beautiful program of Christmas music, the Glee Club held its annual Vesper Service on December 14, under the direction of Miss Edna Shaeffer, and with the assistance of a number of male voices.

The Annual Bazaar this year was an extremely colorful and picturesque affair. For the second time in succession, the Art Club was judged to have presented the best entertainment.

The following girls completed their courses at the end of the fall quarter: Ruth Maloy, of Monterey; Ethel Willard, of Rural Retreat; Virginia Little, of Palmyra; Clarinda Mason, of Roanoke; and Bessie Evelyn Smith, of Healing Springs, Virginia.

Marking the opening of the basketball season, the first interclass games ended with the following results: Juniors—49, Seniors—4, Sophomores—37, Freshmen—30.
Convocation exercises for the winter quarter were held January 7, at which time, Rev. E. B. Jackson, pastor of the Harrisonburg Baptist Church, conducted the devotional program. Professor Vittorio Macchioro, of the University of Naples, was the convocation speaker; he told of the differences between Italians and Americans, contrasting the Italian attitude toward authority and tradition with that of the typical American. The speaker is in America to promote international peace and understanding, under the auspices of the Carnegie Foundation.

Professor Macchioro, during the first week in January, gave a series of three lectures, illustrated with lantern slides, on Rome, stressing different phases of this civilization as they have been discovered through archeological findings.

The three literary societies have elected the new officers for the winter quarter as follows:

Laniers—Pauline Efford, president; Frances Bell, vice-president; Rebecca Leatherbury, secretary; Louise Hooks, treasurer; Louise Mapp, sergeant-at-arms; Maxine Pointer, critic.

Lee—Marie Burnette, president; Lena Bones, vice-president; Florence Stephenson, secretary; Mary Hyde, sergeant-at-arms; Martha Franklin, critic.

Page—Harriet Ullrich, president; Maxine Karnes, vice-president; Martha Ellison, secretary; Florine Collins, treasurer; Betty Bush, sergeant-at-arms; Elizabeth Oakes, critic; Sarah Dutrow, chairman of program committee.

Keeping house for the winter quarter, ten home economics students have moved into the Practice House. They are Virginia Gilliam, Mary Watt, Evelyn Glick, Lucille Bywaters, Gaye Philipp, and Ethel Harmon.

Frances Land, Lelia Kearney, Virginia Jones, Martha Ellison, Mildred Henderson, Virginia Ruby, and Gladys Farrar have recently been added to the Breeze staff.

ALUMNÆ NEWS

Mary Wilson, class of 1913, who is now Mrs. J. S. Turnbull, of Jamestown, Ohio, paid the college a visit recently and was much pleased with the evidences of growth in buildings, general equipment, and student body. At present she is spending some time at her old home, near Rockbridge Baths.

Mary Emma Scott, who will be remembered as an active participant in the Shakespeare pageant of 1916 and as an efficient member of the Schoolma'am staff for two sessions, is a well-known organizer of European tours. After protracted residence and study in France, England, Italy, and other countries of Europe, she has located in New York City. The Wonderland Tours, to which she gives her chief attention, are popular and justly celebrated. Her residence and office are at 603 Fifth Avenue.

Mary Miller Snead has made a great success as teacher and school principal. For several years past she has been working in the counties of Fairfax and Arlington. Not content with a measure of training that is already extensive and effective, she is continuing her work as a student at George Washington University. Her present address is 2100 Eye Street, N. W., Washington, D. C.

Louise Patrick, now Mrs. Marshall, lives in Charlotte, N. C. In sending a Christmas message to Blue-Stone Hill she wrote: "I have the cutest baby girl you 'most ever saw. She's almost a year old—will be in March."

Maxine Dryden is teaching 5th grade at Poquoson, Va. She likes her work, but she says: "I often wish I were at H. T. C."

Georgie Foreman, as we remember her, now Mrs. Smith, lives at Willoughby Beach, Norfolk. She still has a warm place in her heart for the college, and says, "I want to see you all." She has a daughter, Anne, aged eight, and son, Albert, aged five.
MANY PAY DUES IN THE ALUMNAE ASSOCIATION

The 1930-31 dues have been paid since September by the following:

Helen Acton '18
Mary Brown Allgood '30
Margaret Jarvis Anderson '22
Ruth Bean Arthur '23
Bernice Aylor '26
Constance E. Bailey '23
Pauline V. Bell '30
Virginia Matheny Binns '26
Evelyn Bowers '30
Annette Branson '30
Dorothy Lothrop Brown '13
Elsie L. Burnett '24
Charlotte Byers '29
Rosalie Brock Byrd '19
Frances S. Cabell '28
Marie Canada '30
Lady Louise Clark '24
Edna Crenshaw '29
Zena W. Crone '15
Elizabeth L. Davis '30
Hazel Davis '19
Edna Deichert '17
Lillian Derry '30
Carrie Dickerson '30
Hazel Donovan '21
Gertrude Drinker '30
Maxine Dryden '29
Kate Dunnivin '23
M. Pauline Ellmore '29
Jean Foley '29
Hazel Foltz '28
June W. Foster '19
Lillian Gilgery '14
Elicie Haga '24
Sarah Hartman '28
M. H. Henry
Constance Henry
Stache Hoff '30
Ruth Round Hoof '12
Mae Hoover '28
Rosa E. Hopkins '30
Kathryn Wilson Howard '21
Ruby Hubbard '29
Henrietta F. Jacob '29
Lucille Keeton '24
V. Elizabeth King '29
Edna Anderson Krizter '17
Lillian R. Lanier '23
Edyth T. Maddox '27
Mary Yowell Mahanes '14
Linda Malone '30
Susie Maloy '15
Margaret Thorma Martyn '22
Elizabeth Primrose Murphy '18
Octavia Goode Maxwell '12
Maretta O. Miller '27
Anne Moore '28
Mary W. McCown '14
Vivian McDonald '30
Helen McLee '30
Byrd Nelson '23
Bernice Nicholson '29
Corinne Bowman Nye '14
Doris Persinger '26
Lucille Biedler Piner '22
Ruby M. Pryor '30

Louise Ramsburg '29
Florence Reese '29
Idell Reid '13
Alma Reiter '13
Lila Lee Riddell '24
Eva Reynolds '29
Haseltine Reynolds '30
Suella Reynolds '30
Margaret Roberts '29
Grace Rohr '30
Frances Selby '15
Margaret Chandler Shreve '28
Sarah K. Pruden Six '17
Mary Finney Smith '29
Clara Belle Smith '29
Elizabeth Sparrow '23
Isabel Sparrow '22
Lenia Shoemaker '25
Helen Bendall Still '16
Nina Randolph Swecker '23
Frances V. Titus '30
Sarah E. Thompson '27
Virginia Turner '28
Hannah Marie Via '30
Nell Walters '29
Sarah Moffett Walters '13
Viola E. Ward '29
Marguerite B. Washington '25
Rachel Weems '14
Emily O. Wiley '30
Mildred Garter Williams '21
Katherine Wilmoth '23
Emma Winn '27
Zelia E. Wisman '27
Evelyn Wolfe '29
Evelyn Wolfe '29
Doris Woodard '26
Maggie Worster '21

($1.00 from Clearbrook, Va. $1.00 cash—no name)

I have noticed that folks are generally about as happy as they have made up their minds to be.—ABRAHAM LINCOLN.

To stop learning is to stop growing. That is why the minds of so many men and women are dwarfed and atrophied.—JOHN OLIVER RATHBONE in Foursquare.

OUR CONTRIBUTORS

RUTH L. PHILLIPS is professor of biology in the State Teachers College at Harrisonburg. Dr. Phillips received her training at the University of Cincinnati, at the University of Pennsylvania, and at Syracuse University. She has also been a research worker at Woods Hole, Massachusetts.

M. DORISSE HOWE is associate professor of biology in the Harrisonburg State Teachers College. Dr. Howe’s graduate work was done at Syracuse and at the University of Chicago.

GEORGE W. CHAPPELEAR is professor of biology and head of the biology department in the State Teachers College at Harrisonburg.

LOUIS J. ALBER is president of the Affiliated Lecture Association.
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