Barthélemy-Saint Hilaire's French translations. In my youth I had hoped and expected to translate the 'History of Animals,' and even commenced it; other matters, however, distracted me, and I endeavored to interest others, but without eventual success. Some years ago Professor D'Arcy W. Thompson, of Dundee, informed me that he had almost completed a translation, but it has not yet been put to press. A good translation would demand a union of such qualifications as Professor Thompson has, and most of his predecessors did not have—an intimate acquaintance with the Greek language as well as of the Greek animals. The union of President Jordan with Professor Hoffman realized the demand so far as the fishes were involved.

The difficulty encountered by the would-be translator of Aristotle was entertainingly illustrated in 1862. The Rev. W. Houghton, in an article in the *Natural History Review* (II., 136–149), "On the Desirability of an English Translation of Aristotle's 'History of Animals,'" gave a translation of the first chapter of the first book of the history, which was soon criticized (II., 329–332) by Dr. John Scouler and, after a couple of admissions, defended (II., 408–415) by the translator. Meanwhile, in the same year, appeared Richard Creswell's translation. A comparison of Houghton's and Creswell's translations with each other and the original will show how different such may be without either deviating excessively from the Greek text. On the whole, there is no urgent reason to regret that Houghton's translation was not completed instead of Creswell's. The absence of a sufficient knowledge of zoology is, however, sometimes glaringly manifest in Creswell's work, especially in the identifications of the Aristotelian names in footnotes and the index.

Scores of mistranslations or faulty translations occur in Creswell's work, and a couple illustrating the kinds may be cited. "Some animals unite in their nature the characteristics of man and quadrupeds, as apes, monkeys and cynocephali"! (p. 32). This does not represent what Aristotle intended; he meant that some animals combine in their persons characteristics of man and quadrupeds, and instanced as such macaques (πιθηκοι), monkeys (κηβοι) and baboons (κυνοκεφαλοι). The word ape nowadays is mostly limited to the tailless anthropoid apes which were entirely unknown to Aristotle and the Greeks.

Apropos of tails and hair, Aristotle promises to speak of the monkey-like animals subsequently, but notices the hippelaphus or nilgau and indicates that it has a beard under the throat. Creswell says (p. 26): 'the hipellaphus has a beard upon its larynx'! The erroneous spelling hipellaphus is repeated on the same page.

A word as to the use of Aristotle. His zoological treatises are not repertories of exact information to which a learner should be referred, though proclaimed to be such by some. In my youthful days I was advised by an eminent naturalist of the time to study and follow Aristotle. It happened that I had studied and in a special article 'On the Status of Aristotle in Systematic Zoology' (*Am. Nat.* for 1873) I gave reasons why I considered it inexpedient to follow him. Let me add another now. As Dr. Eastman well knows, several paleichthyologists have recently been basing new names on fossil otoliths or earbones of fishes. He and others may be amused by Aristotle's ideas respecting the otoliths of some Greek fishes. "Those which have a stone in their head, as the chromis, labrax, sciæna and phagrus, suffer most in the winter; for the refrigeration of the stone causes them to freeze and be driven on shore" (VIII., xx, 5)!

THEO. GILL.

ENGINEERING PROBLEMS IN A COURSE IN PHYSICS.

TO THE EDITOR OF SCIENCE: Last fall my attention was attracted to a letter published in SCIENCE from a professor of physics in a school of engineering. He asked if others agreed with him that more of 'pure science' ought to be required in engineering courses. At least some of us who are not teaching in either technical or engineering schools feel a need that is just the opposite to the one above expressed. It would be of much assist-

ance to those of us who are not engineers, and, because of preferences in other directions, do not wish to become engineers, to have a laboratory manual which, along with courses in measurement, contains directions for work which is on clearly and definitely stated engineering problems. From our standpoint what we need is to get our teaching in part out of the confines of the class-room and even of the laboratory and bring it more into touch with the commercial application of the work. The following outline, arranged to supplement my laboratory course in heat, may serve to indicate what it seems to me is wanted in each branch of physics. If there is a laboratory guide published which includes such plans, I should like to know of it.

SUPPLEMENTARY WORK IN PHYSICS. II. HEAT.

1. Coal.

Plan an experiment to determine the amount of heat generated in the combustion of a pound of coal, and write out a report in full in the usual form, leaving blank spaces for the insertion of the data when obtained. After consultation as to the plan you may determine how many pounds of water a pound of coal will raise one degree Fahr. when no heat is lost.

Average data for comparison: Heat from the combustion of one pound of anthracite coal will raise the temperature of 14,000 pounds of water 1° F. Heat from the combustion of one pound of coke will raise the temperature of 14,000 pounds of water 1° F. Heat from the combustion of one pound of crude oil will raise the temperature of 19,000 pounds of water 1° F. Heat from the combustion of one pound of gas will raise the temperature of 1,000 pounds of water 1° F. Heat from the combustion of one pound of hard wood will raise the temperature of 8,500 pounds of water 1° F. Heat from the combustion of one pound of soft pine will raise the temperature of 9,000 pounds of water 1° F. Heat from the combustion of one pound of peat will raise the temperature of 6,000–10,000 pounds of water 1° F. There are no data on the kind of coal which we have.

2. Boiler. (Study of boiler at the college heating plant.)

The engineer will tell how much the level of water in the boiler has been lowered in one day without return of water to the boiler, and how much coal was actually used.

How much would have been needed to evaporate this water under the pressure of forty pounds per square inch if no heat were lost? What is the efficiency of the boiler? What horse power was actually generated?

About ten square feet of heating surface are needed per horse power. What is the rating of the boiler?

The ratio of water heating area to the area of the grate is generally 20–25 to 1. What is the ratio in these boilers?

What is the pressure of steam in one of the boilers? Determine with a thermometer the temperature of the water in the boiler. How does this temperature compare with the temperature given in the curve of steam pressure?

3. The System on Heating.

Follow the steam pipes to the tunnels, determine the use of each pipe and see what the different valves control. Is any part of the system not under complete control? How is air removed from the pipes? In what different ways may water be obtained and forced into the boilers?

What is the temperature of steam in the mains? What is the temperature of the water in the return pipes? How much heat was radiated from the radiators and pipes? (For quantity of steam, see data obtained on boilers.)

Make the necessary measurements in the room assigned you to determine the number of cubic feet of space, the area of the radiating surface, etc., and ascertain whether there is sufficient radiating surface for the room. The following is one of the tables used in such estimates: For each 200 cu. ft. of space allow 1 sq. ft. of radiating surface. For each 20 sq. ft. of exposed wall allow 1 sq. ft. of radiating surface. For each 2 sq. ft. of glass allow 1 sq. ft. of radiating surface. If the building is poorly constructed twenty per cent. is added to the radiating surface. (To save a large part of the computing, see tables on page 6, Mechanics' Pocket Memorandum.)

If a hot water heating system were used five thirds as much radiating surface would be required. What is the exact ratio between the heat given out in the pipes by a quantity of steam at one and one half pounds pressure and the same quantity of water at 150° F., both cooling down to the temperature of the water in the return pipes? What bearing does the curve of cooling which you have drawn have on the selection of a ratio for estimates?

4. Engine (at electric light plant).

Explain how the valves control the steam ad-

mitted to the cylinder. At what pressure is the steam when admitted to the cylinder? What is the temperature of the steam for this pressure? (See curve of steam pressure.) Does the maximum pressure recorded on the indicator card correspond to that registered by the steam gauge? During what fraction of a stroke is the maximum pressure upon the piston exerted? (See indicator card.)

Ascertain the internal dimensions of the cylinder. What is the temperature and what the pressure of the exhaust steam?

How many units of heat disappear as the quantity of steam which enters the cylinder at one time expands to the temperature and pressure at the close of the stroke? (For final pressure see indicator diagram.) How many units of heat disappear as the quantity of steam which enters the cylinder at one time expands to the temperature and pressure of the exhaust steam? (In what other ways has heat disappeared?) What efficiency do these figures indicate?

Count the number of strokes per minute, and determine the average pressure of steam in the cylinder. (See indicator diagram.) What horsepower is the engine developing?

If the exhaust steam were conducted to another cylinder attached to the same shaft and all the heat which escapes to the exhaust were utilized in this second cylinder, how many times larger should the area of the piston be than that of the first, the length of stroke in the two engines being the same?

Assuming the boiler at this plant to have the same efficiency as that of the boilers at the college heating plant, and omitting further loss by radiation from the steam pipes, what part of the energy developed in the burning of a pound of coal actually appears as work?

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ARGUMENTS ALLEGED AGAINST THE DOCTRINE OF ORGANIC EVOLUTION.

TO THE EDITOR OF SCIENCE: It is not often that in a single article emanating from good authority, one is able to find, in concise form, many of the so-called arguments of the anti-evolutionist against the theory of the animal descent of man. One of the most typical and most recent of these expositions upon the relation of belief in this theory, with Biblical teachings and established scientific facts, together with what purports to be a registration of vital points which would make a belief in the evolution theory incredible, has come from Professor L. T. Townsend, of Drew Theological Seminary, in an address entitled, 'The Collapse of Evolution,' delivered recently before the American Bible League, at the Boston convention.

This exposition appears to give in brief form, an excellent idea of the attitude of the average anti-evolutionist in respect to some of the fundamental principles of the descent theory (especially from the theological standpoint). Believing that there may be some of your readers who would appreciate a concise statement of this attitude, and of the arguments which so many of the more conservative anti-evolutionists of theological profession hold towards certain phases of this much troubled question, I have ventured to enclose to you in brief, argumentative form (although the address does not readily lend itself to such arrangement) an account of this article which, so far as I am aware, has appeared only in a periodical of limited circulation, *The Bible Student and Teacher;* and which, to my mind, shows the theological anti-evolutionist's standpoint in a definite and concise manner.

I undertake at this time no criticism of any part of Professor Townsend's argument, but attempt merely to state the argumentative points of the address in the clearest and most logical sequence possible. That many points require criticism will be apparent to the most casual reader; that, however, I leave to others. The following is the gist of the argument:

ASSERTION.

The theory of evolution and the animal descent of man is a poorly constructed affair, supported by not one single well-established fact in science, philosophy or religion, for:

I. The assertion that the original germs of animal life do not require the supernatural is false, for:
   1. Natural forces to-day can not produce the same germs.
   2. Spontaneous generation, in any sense, is not proved possible at the present day, 'and is no longer mentioned in scientific circles.'