says the commotion in the water was like a line of breakers coming from due south toward the island, but with field glasses it was easy to determine the real cause of the disturbance. Mr. Kunder estimated the number of seals in the herd at 8,000 to 10,000.

On March 10, 1917, Mr. Kunder witnessed a similar phenomenon. This herd appeared at about five o'clock in the evening, in the same locality, and its movements, appearance, and course were about the same as with the 1920 herd. The 1917 herd was, however, considerably larger than that of 1920, the number of seals in it being estimated by Mr. Kunder at 15,000. Mr. Kunder says he has never seen any single fur seals or small groups in the vicinity of the island.

So far as I am aware this is the first record of the occurrence of the fur seals in large compact herds anywhere in the open sea; they have hitherto been observed or reported only in more or less scattered numbers.

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California Academy of Sciences

THE PHYSICAL MUSEUM OF THE UNIVERSITY OF WISCONSIN

So much interest has been shown in this little museum that a brief description of it in the columns of Science seems worth while. It is the outgrowth of an attempt to build up on a small scale, for the benefit of our students, a collection of simple demonstration experiments such as is exhibited in, say, the Urania of Berlin. When our new laboratory was built some four years ago we arranged for a room, in size about 18 × 40 feet, parallel to the main corridor and separated from it by a glazed partition. In this we have gradually accumulated some forty "exhibits," each with an explanatory card setting forth the theory as simply as is consistent with scientific accuracy. While many of the exhibits are of the fixed variety, *e.g.*, the parts of an ammeter, various stages of lamp bulb construction, transparencies and the like, the most interesting demonstrations, needless to say, are those which "work."

First and foremost, of course, is the Foucault pendulum, which in this case is 1440 cm. long and occupies a special well. It is started every morning at 8 o'clock and swings over a card graduated in hours (for this latitude). It is accompanied by a small rotating table of the usual demonstration variety with a miniature Foucault pendulum. A large electrically driven gyroscope mounted in a box which may be wrestled with, gives a striking demonstration of gyroscopic reactions. A loop-the-loop model, ball on stream of water, probability board (shot), Kater pendulum and simple air-pressure demonstration are among the other mechanics exhibits. There is also a conservation-of-angular-momentum rotating platform (contrived with the aid of a Ford front-wheel bearing) on which one may stand with a dumbbell in each hand and perform this somewhat startling experiment.

The Melde experiment, various Foucault current phenomena and certain magnetic effects are all susceptible of easy demonstration, as are also simple thermo-electric effects. One of the most interesting and simple optical arrangements is a pair of plane mirrors set at a right angle. In these one may—possibly for the first time—"see himself as others see him," while reflected printed matter is readable. The explanation is almost obvious. Our two most recent and pretentious exhibits—an oscillating audion circuit and a vacuum discharge demonstration—have attracted considerable attention.

The interest shown in the museum has been very gratifying. Just now, although this is its third year, the attendance is in the neighborhood of two hundred visitors a day. It is very unusual to find less than half a dozen trying the experiments and sometimes the room is literally crowded full. The wear on certain pieces of apparatus shows graphically the thousands of times they have been handled. While drawn mostly from the student body the visitors frequently include the casual outsider who comes to take a "one-hour course in physics."

It is very difficult to estimate just what good "results" may be claimed for such a museum. Undoubtedly many come merely to toy with the apparatus, but some few pore over the explanations and ask questions about them. That it has awakened an interest in the subject in many for the first time may be taken for granted. One very definite advantage is that it allows the instructor to refer his students to certain experiments in the museum with the request that they try them and report on the results, *e.g.*, all our elementary students determine, from its period, the length of the large pendulum.

However, while it seems eminently worth while it is needless to say that such a museum, simple as it is, will not run itself. Although it does not require the presence of an attendant, its continued demand for new experiments as well as the upkeep of the old ones would constitute a perhaps unwarranted liability on the time of the instructional force of the department if it could not, as in the present case, be entirely turned over to an ingenious and able apparatus man.

L. R. INGERSOLL

MADISON, WIS.,
November 5, 1921

HOW TO DO RESEARCH [1]

I HAVE never done any research. I am therefore able to give unbiased advice regarding it.

Research—in the broadest sense—consists largely of repairing leaks in glass tubing.

More specifically, it consists of gathering in a cell down in the Ryerson basement a weird assembly of switches, wires and glass tubing—and then keeping other students from borrowing it.

Apparatus may be borrowed or acquired. If you borrow it you are expected to return it. If you acquire it, you keep it until you are found out.

Tools at one time could be found in the student's shop. Now you find them everywhere.

[1] Read at a gathering of the graduate students in Physics of the Ryerson Physical Laboratory on a social occasion preceding Professor Milliken's departure from Chicago.

In order to do research, one must have ideas. *One* idea is sufficient. Two ideas are apt to contradict each other.

Ideas are easy to get. If you haven't any, consult Dr. Gale. He can be found adjusting gratings down in the basement.

By all means do *not* search for something original. If you think you have a *new* idea read Professor Groszkopf's articles in "Zeitschrift für So und So" published about 1700. You will find he suggested the same thing two centuries ago.

After all, it is doubtful whether even one idea is necessary. Merely get some apparatus, solder it together and take readings.

Readings are always taken through a telescope.

You will get certain numbers. Plot these numbers against other numbers which you get from variable parts of the apparatus.

If you get a straight line on plotting your observations you know at once that the results could have been predicted.

However, if you get a curve the situation is different. Examine the curve carefully for sharp bends or breaks. If you find one, you have made a discovery. These breaks are significant. Consider carefully what may have caused such breaks. Try to trace them to atomic or electronic phenomena. Draw a picture of the atom. Don't be discouraged if your picture doesn't agree with other pictures. Dr. Lunn will show it doesn't mean anything anyhow.

Having obtained a curve and concocted a theory, it is befitting that you present the whole to the Physics Club.

The Physics Club was invented to keep research students from getting the big head. It consists of a crowd of professional knockers. There is one booster. You are the booster.

It is fitting here to give you details on your conduct at the meeting.

The latter is always preceded by tea. While this is being served go into the lecture room and copy a few weird sketches of your apparatus on the board. Make everything as