spring balance used which measured absolute weight, the dealer who should purchase tea at one latitude, and sell it at another, would be subject to a gain or loss, depending upon the difference in the force of gravity.

It is not, however, on merely commercial grounds that the change rests. For scientific purposes a unit is used as a term of comparison between different quantities of the same kind, and must be so defined and chosen as to fulfil this function with the greatest convenience. Now, a unit of force which shall furnish a direct and convenient standard of comparison between forces or weights at different places is entirely impracticable. At any one place the weight of a given mass of metal may be taken as a convenient unit; but this unit will change when we go to any other place, owing to the difference in the force of gravity. Indeed, every student of physics knows that the measure of the force of gravity at any one place is one of the most delicate and difficult problems in physics. In the definition which refers to the latitude of 45° it is assumed that the force of gravity is the same at all points on this parallel. We now know that this is not the case, and that if we adopt such a unit we shall have to define the exact spot on the earth's surface which is taken as the standard. Reference to such a standard would be impracticable. Hence a unit of force must be subsidiary to the unit of mass. The most convenient way of fixing it is to take the unit of mass as known, and to determine the force of gravity at the place of observation. The combination of the two gives a standard by which weight may be expressed in force. To be more explicit: if we have a piece of metal the mass of which we know to be one gram, and if we determine the force of gravity at the place to be n, then the gravitating force of that piece of metal will be known to be n units of force. In practice this must be the method used in physics, if an accurate measure of forces is really required.

Let us now consider M. Jamin's objections. He says that the mass of a body is not susceptible of direct determination; for to measure it we must commence by determining its weight in a balance, and afterwards dividing by the number which expresses the acceleration of gravity at the latitude of 45° and at the level of the sea. It is difficult to attribute this remark to any thing but inadvertence, since the division by g at 45° is necessary only on the French system. If we measure it by means of a balance having grams as weights, the resulting weight is at once the mass on the C. G. S. system, no matter where the weighing is made, and therefore needs no division whatever.

He then adds, "Suppose, on the contrary, that we have to measure a force: we determine it directly by means of weights at the place of observation. Afterwards we apply to these weights the corrections relative to the latitude and the altitude, to have an expression of the force as the function of a normal gram. We must remark that we cannot avoid these corrections to taking mass as the fundamental unit; because it is always weights that we measure, and the course followed in the experiments is necessitated by the nature of things." This is quite true, but it does not prove that one system affords any more convenient unit of force than the other. Simon Newcomb.

STANDARD RAILWAY TIME.

The problem of simplifying the system of time standards used by the railways of this country seems to be near solution. The representatives of various railway-lines, who are to-day in session at Chicago, will receive the report of the secretary, Mr. W. F. Allen, and, it is expected, will take final action. For some years past, committees of various scientific bodies, as the American metrological society, the American association for the advancement of science, and the American society of civil engineers, have called attention to the urgent need of reform in the standards of time in use, and suggested plans for action. The railways, which are naturally most interested in the movement, have recently taken hold of the matter in earnest. The plan which has met with the most favor is that in which five standards of time, differing by consecutive hours, are proposed for the whole territory occupied by the United States and Canada. These are based upon the meridians from Greenwich, but receive other names for purposes of convenience. It is proposed by the railways that in Canada the standard shall be known as *intercolonial time*, and shall coincide with the local time on the meridian four hours, or 60°, west of Greenwich. In the United States the standards will be known as *eastern*, *central*, *mountain*, and *Pacific time*, and coincide with the local times on the meridians five, six, seven, and eight hours, or 75°, 90°, 105°, 120°, respectively, west of Greenwich. The advantage of this system is, that the standards will differ from the true local times of the various parts of the country by amounts not greater than thirty minutes, if the divisions are made rigidly according to longitude, and no one will be inconvenienced

thereby. The great difficulty, however, of the plan, lies in the selection of the places where the changes of one hour are to be made; and as some of these, especially that between eastern and central time, must pass through country well settled, no matter how much freedom is allowed in selecting the points of change, it has seemed to many that the inconvenience would be great. Railway interests require that the changes be made at the termini of sections of the road, which are often large cities. At these points there will be two times, — one for eastern, one for western roads, differing by an hour. In dealing with this practical difficulty, the railways have shown a desire to conform as nearly as possible to the theoretical system, but have adopted the principles that "changes from one standard to another should be made at well-known points of departure," and that "these changes should be made at the termini of roads, where changes now occur, except on the transcontinental lines and in a few other unavoidable cases, where they can be made at the ends of divisions."

At the railway-time conventions held in St. Louis and New-York City in April last, the following resolutions were adopted: —

1°. That all roads now using Boston, New York, Philadelphia, Baltimore, Toronto, Hamilton, or Washington time as standard, or standards based upon meridians east of those points, or adjacent thereto, shall be governed by the seventy-fifth meridian or 'eastern time' (four minutes slower than New-York time).

2°. That all roads now using Columbus, Savannah, Atlanta, Cincinnati, Louisville, Indianapolis, Chicago, Jefferson City, St. Paul, or Kansas City time, or standards based upon meridians adjacent thereto, shall be run by the ninetieth meridian time, to be called 'central time' (one hour slower than 'eastern time,' and nine minutes slower than Chicago time).

3°. That west of the above-named section the roads shall be run by the one hundred and fifth and the one hundred and twentieth meridian times respectively (two and three hours slower than 'eastern time').

4°. That all changes from one hour standard to another shall be made at the termini of roads or at the ends of divisions.

Another resolution provided that the secretary should prepare a pamphlet containing an explanation of the subject, with accompanying maps, and endeavor to secure the acquiescence of all parties to the proposed plan, that the next convention might take final action.

The report of the secretary contains a fine railway-map, with the standards proposed for each road designated by different colors. It is the intention to use the eastern standard from Maine and the eastern coast to Detroit, Mich., and Bristol, Tenn.; but all the Ohio and Georgia railways will use the central standard, as well as those in Pennsylvania west of Pittsburg. The western railways whose termini are in Buffalo, Salamanca, and Charlotte, are allowed to use the central standard as far east as those points. The important places where the change of one hour from eastern to central time occurs, are Detroit, Buffalo, Pittsburg, Charlotte, and Augusta. The change from central to mountain time is made at Bismarck, North Platte, Wallace, Coolidge, and others; from mountain to Pacific time, at Ogden, Yuma, and others.

The secretary, Mr. Allen, has received assurances from the great majority of roads, that the system is approved. At the beginning of this month, railways operating 70,000 miles of road had responded favorably; and replies were coming in daily, none in the United States having refused assent. The roads centring in Boston gave assent, provided satisfactory arrangements could be made with the Cambridge observatory, upon which they depend for their time-signals. Of this there can be no doubt, as it may be assumed that every observatory in the country will contribute its part in the movement which inaugurates such a needed reform. The eastern standard differs from Boston time by sixteen minutes.

It seems almost certain, then, that the convention now in session will authorize the proposed change, and appoint a time when the plan shall be put into practical operation. On that date the observatories will make the change in their signals which the railways use, and the system will at once be under trial. The next question will be, whether the cities will adopt the railway system for their use. Of this there can be little doubt; and, in cases where two standards differing by an hour come together, it will be necessary to adopt one of the two for the city standard. The state of Connecticut, which several years ago hastily adopted New-York time for the standard, will have the small change of four minutes to authorize. All these adjustments may be left to the future. They will be made or not, as the popular interests demand. Of the wisdom of the action of the railway managers there can be no doubt. Without discussing the relative merits of the plan adopted, and others which have been suggested, it is certain that the present confused arrangement should be abolished. The new plan is simple

and practicable; and its adoption is an important reform, which is deserving of hearty support and encouragement.

LETTERS TO THE EDITOR.

Phalansterium digitatum Stein.

THERE is no published evidence that the infusorial colony here referred to has been seen by any observer except its German discoverer. It is stated not to occur in English waters; and this uncommon animalcule had not been taken in America, until the writer recently found it in considerable profusion, attached to the leaflets of Myriophyllum from a millpond near this city. The colonies and the enclosed zoöids differ from their German relatives in no essential character, the only perceptible divergence being in the somewhat smaller size of the American Infusorium.

The tubular colonies, which take an irregular digit-like form, and branch somewhat dichotomously, are in great part built up of granular digestive rejectamenta remarkable for their coarseness. The distal extremity of each tubule is slightly inflated, each zoöid sitting singly in the hollow thus formed, except after having undergone the reproductive process, when two or more may be present, the flagellum alone extending beyond the aperture.

The conical collar, embracing the flagellum for some distance above its point of origin, is often thickened by an outward flow of the body-sarcode; but whether a regular circulation takes place in the collar substance could not be determined.

Although the zoöids are apparently entirely free from all connection with the walls of the zoocytium, they have the power of suddenly darting back into the tubules for a distance equal to two or three times their length. They seem to exercise this accomplishment at pleasure, but especially when any unwelcome object comes in contact with the flagellum. I have seen a large animalcule glide across the front of a colony, and each zoöid in regular succession, as its flagellum was touched, shoot back into the tube, remaining there some minutes before cautiously reapproaching the aperture.

I have several times witnessed the reproductive process, and have verified the statement that it takes place by transverse fission. An interesting fact in this connection is, that the only other species of the genus reproduces itself by dividing longitudinally, a method directly the opposite of that which obtains with the present form.

The two posteriorly located contractile vesicles pulsate at intervals of about thirty seconds.

DR. ALFRED C. STOKES.

Trenton, N.J.

Solar constant.

I enclose a translation of a portion of a letter to me from Dr. Josef Pernter of the Austrian meteorological service. Dr. Pernter writes: —

"Speaking of radiation, I remember to have read several times in SCIENCE, under the 'letters to the editor,' various things concerning the solar constant, — lately, a letter from John LeConte, but which, like former communications, appears to make the subject a little unclear.

"The solar constant is a quantity of heat, and the number which is the expression for the solar constant must mean calores. If, for example, Violle says the solar constant is 2.54, then it must be 2.54 calores. But since the solar radiation is a summation, during time, extending over space, the duration and the surface certainly come into the question. The minute has been taken as the unit of time, and the square centimetre as the unit of space.

"That the solar constant is 2.54 calores, means, therefore, that the sun's rays bring to the outside of our atmosphere, in each minute, 2.54 heat-units upon each square centimetre. What becomes of these heat-units, or calores, does not belong at all to the conception of the solar constant.

"The new solar constant of Langley, 2.84, signifies, consequently, that the amount of heat furnished per minute per square centimetre by solar radiation is 2.84 calores. But this number, 2.84 calores, must be comprehended. Lately the term 'calore' has been used in two significations, — the large calore, or the amount of heat that raises one kilogram of water 1°; and the small calore, or the amount of heat which raises a gram of water 1°. The latter, or small calore, is applied to the solar constant. Expressed in large calores, the solar constant of Langley would not be 2.84, but .00284 calores; that is, 1,000 times smaller.

"After these explanations, one can immediately say how many great or small calores fall upon the square metre per minute from the solar radiation; viz., 10,000 times as many as on the square centimetre."

FRANK WALDO.

Deutsche seewarte, Hamburg, Germany,
Sept. 16, 1883.

Dissemination of Phlox.

I have had for some time past, on my table, some capsules of Phlox Drummondii, which is so commonly cultivated in gardens. The capsules were picked while still green, and had dried gradually. Several times I have been puzzled at finding small seeds and parts of the capsule of a plant on the table, and could not think where they came from; but, a day or so since, I heard a sharp pop, and, looking up, saw that one of the capsules had burst, and sent the seed several feet away. Since then it has often occurred. This is an evident means for the dissemination of the seed. The most of the capsules I have examined have perfected only one seed, instead of three; and the sudden opening of the capsules have sent the seeds flying far and wide.

JOS. F. JAMES.

Cincinnati, O.

The Iroquois institutions and language.

The very courteous and complimentary manner in which my work on the Iroquois book of rites has been noticed in a recent number of this journal has made me reluctant to take exception to any portion of the review. On further consideration, however, I must beg to be allowed, in the interests of both science and history, to refer to one or two of the remarks of my friendly critic. He expresses the opinion that 'the sceptical reader' may be inclined to regard the portion of the work which relates to 'the league and its founders' rather as 'classic historical romance' than as history; and this on the sole ground (as I understand his suggestion) that the Iroquois cannot be supposed to have been capable, five hundred years ago, of the intellectual efforts implied in this narrative. This suggestion, it will be seen, opens up the entire question of the comparative mental capacity of civilized and uncivilized, or rather unlettered, races.

The question is one altogether too large to be fully discussed in this place. But as regards the particular subject now referred to, I may remark that the existence of the league itself, with all its judicious and statesmanlike regulations, is a fact of which there can be no possible question. Any one can see this remarkable constitution in full and vigorous operation among the three thousand Iroquois on their Canadian reservation. There is ample evidence to show that this league existed in its present form when the people who maintained it first became known to European explorers. It is clear, therefore, that whatever intellectual power was needed for its formation was possessed by the Iroquois before they acquired any tincture of foreign civilization.

But why should their capacity for forming such a government be questioned? The Iroquois tribes, when