Some Properties of Urine.*

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SPECIFIC gravity is the weight of an equal bulk of different substances compared with a *standard* of comparison.

Standard means something of undoubted authority, something that is settled—a test.

We are all acquainted with our English standards of measurement and of weight; namely—1 yd., and 1 lb. avoirdupois. All lengths and distances are measured by the first, for instance, a mile is so many yards—1,760; a foot is so many parts (12 inches) of a yard. This, our standard of measurement, is a bronze bar, 38 inches long, 1 inch square; the defining lines, 36 inches apart, are cut on gold studs, sunk in holes. The standard is kept at the Standards Office, London, where it is in actual use for all important comparisons. Four copies are deposited in other places in case of injury to, or loss of, the standard. When we say that a thing is three yards long, we mean that it is three times as long as our standard of length.

Our standard is a thick disk of platinum about 1⅙ inch across, and 1 inch high, with a shallow groove around it near the top. Four copies are deposited with the four copies of the yard. These standards are divided, for convenience, into smaller lengths and weights, namely, inches and ounces; but in Britain all lengths and weights are compared by these two standards of comparison.

There are many intensely interesting particulars about these two standards, as, for instance, by what scientific calculations the yard of 36 inches was decided upon, and how it became, by Act of Parliament in 1824, our legal standard; how in a great fire in 1834, the standard was destroyed, and the calculations and the Act of Parliament, &c., &c., had to be gone over again, and how two rods with great care and exactness were made (a 100,000th part of an inch would be counted an error at the Standards Office), and each by Act of Parliament declared legal. I mention this to show with how much care a standard is decided upon.

In all civilised countries standards of length are defined on metal bars.

Various natural standards have been proposed, such as the length of the polar diameter of the earth (inch), the circumference of the earth (metre) in a given longitude, a pendulum vibrating in one second at a fixed distance from the earth, &c. But the difficulty of ascertaining the exact value of these lengths prevents any material standard being based upon them. A natural standard is therefore only a matter of sentiment.

The names of measures are generic, and not specific; thus foot, digit, palm, cubit, mile, talent, obol, ounce, hin, &c., mean nothing exact unless qualified by their country or city. Most ancient measures have been derived from the cubit 20·63 inches, or the digit, ·729 inch; both these systems are found in the earliest remains.

In the days of King Edgar it was decreed that there should be in England a standard measure. The Saxon standards were kept at Royal Winchester, and copies were legally compared and stamped; the Normans removed them to Westminster, to the custody of the King's chamberlains at the Exchequer, and they were preserved in the crypt of Edward the Confessor, while remaining royal property. The oldest English standards remaining are those of Henry VII.

Specific gravity. Our standard for specific gravity is pure water at 4° C. (62° F.). Why do we take water for our standard? It is taken quite arbitrarily; we might have chosen any other substance for our standard weight for specific gravity, as we might have chosen a larger piece of platinum for our lb., and longer distances between the points for our yard. Water is the most convenient for the purpose because it is easily obtained and easily purified, so it is chosen for the "standard of comparison" for ascertaining the specific gravity, that is, the comparative weight of the same bulk of any two substances. For instance, take a cubic inch, that is, a solid square inch of iron or lead, or milk, water, ice, and so forth, and weigh each; the weight of each will be found to be different; indeed, water itself has a slightly different weight according to its temperature, becoming heavier as it becomes colder, till 4° C. (62° F.), when it begins, curiously enough, to become lighter again, therefore, our standard water weight must be at 4° C. (62° F.). (33° to 65° F. is called cold water.)

Now suppose that we take a cubic inch of pure water at a temperature of 4° C. (62° F.), and use it as a weight instead of iron, and weigh the cubic inch of iron, we shall find that it takes seven of our water weights to make the scales balance; eleven in the case of lead, and so on. These numbers seven and eleven respectively, are called the specific gravity of iron and of lead. The specific gravities of all important bodies have been carefully ascertained.

We understand, then, that the specific gravity of anything is the weight of a given volume (our cubic inch) compared with the same (our cubic inch again) volume of pure water at 4° C. (62° F.).

Perhaps you will say, how can we weigh a solid inch of water? Thus,—suppose that you *fill* a vessel with water at the proper temperature, and immerse in it a cubic inch, say of iron, and carefully catch the water that overflows, you will have a cubic inch of water of the proper weight. So, when the specific gravity of any substance is said to be *eleven*, we mean that it will take *eleven* pieces, so to say, of water exactly the same size as the piece of substance weighed.

We often have to find out the specific gravity of urine, that is, its weight as compared with pure water at 4° C. This is easily done by using the delicate urinometer. The urinometer is carefully weighted and measured, much as the thermometer is, and by the use of it we obtain the information which we desire, without the actual process of weighing. It would be impossible in every case to measure out several quantities of urine and of water, and weigh them, and so discover how much heavier the urine weighed than the water.

We are familiar with several ways of arriving at the weight of a substance without the use of a pair of scales For example, if we have a stout spring with a hook fastened to the end, and place on the hook a pound weight, and notice how far the spring is depressed, and then put a mark against that point, call it 1lb., and then do the same with 2, 3 and 4lbs., each time marking the position of the spring, and call them 1, 2, 3, 4, respectively, we can arrive at the weight of any substance we choose by attaching it to the hook, and noticing to which of our marks the spring is de-

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