ART. VIII.—*A Short Notice of a Ready and Simple Mode of Measuring Microscopic Objects.* By THOMAS HAYDEN, F. R. C. S. I., Lecturer on Anatomy in the Original School of Medicine.

To those much accustomed to microscopic examination, especially to such as do not cultivate it as a distinct study, but rather use it as an adjuvant in the diagnosis of disease, the want must have been at some time apparent of a ready and simple mode of measuring such objects as are presented in the field of view. An instrument designed to supply this desideratum should be of the simplest construction, and readily applicable to the ordinary compound microscope, without the addition of "eye-piece micrometers," or other extrinsic agencies, and without deranging in any way the focalization of the object.

Having devised a simple contrivance which, at least to my mind, combines the above advantages, I thought it might not be unacceptable to those who, anxious to avail themselves of the valuable aid to diagnosis afforded by the microscope, are still unable to spare sufficient time from the active duties of hospital and private practice to profit by this to the full extent. To such, therefore, I address myself exclusively; and here I would disarm criticism by premising, that I do not claim originality in this plan: it is but a new application of a system of micrometry long known as that of Hooke, or "by superposition;" but whilst Hooke used it solely for the purpose of determining the magnifying power of the microscope, I would venture to extend its application to the further purpose of ascertaining the diameter of microscopic objects.

The magnifying power of the combination of eye-piece and object-glass about to be used having been previously ascertained by means of a stage micrometer, and a scale divided into small parts of an inch, as directed by Hooke, or, if a Ross' microscope be used, from the table supplied with it, the object to be measured should be brought into focus, its outline being made as distinct as possible, and viewed steadily with one eye, whilst, with the other or naked eye, a scale divided into minute parts of an inch, and held at the distance of distinct vision (10 inches), so that the lines will be directed at right angles with the object, should be kept fixedly in view. In a short time the object and the scale will be found to approach each other, and to be "superimposed" by the convergence of the axes of vision. The extent of the inch covered by the object will furnish the basis for determining, by a simple calculation, the size of the latter; thus, for example, suppose the magnifying power used be 300 diameters, and the object is found accurately to coincide with

1-10th of an inch, we have only to multiply 300 by 10 in order to get the size of the object, which would be, in the case supposed, 1-3000th part of an inch. This is easily understood: in order to determine the *real* size of an object we must divide its *apparent* size by the magnifying power of the combination of lenses used. Now suppose that, in the example taken, the object were found to cover the whole inch, its real size would obviously be 1-300th of an inch, but as it has been assumed to coincide with only 1-10th part, its real size is 1-300th part of 1-10th, or, 1-3000th part of an inch.

The above woodcut of a rule which I have had made will explain its object more fully. It has 6 inches marked off at intervals of 1-4th inch to prevent confusion; it will be seen that these furnish one-half, 1-3rd, 1-4th, 1-5th, 1-6th, 1-8th, 1-10th, 1-12th, 1-16th, 1-20th part of an inch. The number of parts might be multiplied at pleasure, but the above, taken with the various combinations of eye-pieces and object-glasses with which every microscope is provided, will afford measures to correspond with most objects,—if one should not suit, another can be tried, and so on. This will be best illustrated by the subjoined Table, showing the range of measurement supplied by my glasses with the rule above sketched:—

Object covering	With Magnifying Power of			
	250	325	500	650
$\frac{1}{2}$ Inch.	$\frac{1}{300}$ th of an inch.	$\frac{1}{350}$ th of an inch.	$\frac{1}{1000}$ th of an inch.	$\frac{1}{1300}$ th of an inch.
$\frac{1}{3}$ "	$\frac{1}{750}$ th "	$\frac{1}{975}$ th "	$\frac{1}{1500}$ th "	$\frac{1}{1950}$ th "
$\frac{1}{4}$ "	$\frac{1}{1000}$ th "	$\frac{1}{1300}$ th "	$\frac{1}{2000}$ th "	$\frac{1}{2600}$ th "
$\frac{1}{5}$ "	$\frac{1}{1250}$ th "	$\frac{1}{1625}$ th "	$\frac{1}{2500}$ th "	$\frac{1}{3250}$ th "
$\frac{1}{6}$ "	$\frac{1}{1500}$ th "	$\frac{1}{1950}$ th "	$\frac{1}{3000}$ th "	$\frac{1}{3900}$ th "
$\frac{1}{8}$ "	$\frac{1}{2000}$ th "	$\frac{1}{2600}$ th "	$\frac{1}{4000}$ th "	$\frac{1}{5200}$ th "
$\frac{1}{10}$ "	$\frac{1}{2500}$ th "	$\frac{1}{3250}$ th "	$\frac{1}{5000}$ th "	$\frac{1}{6500}$ th "
$\frac{1}{12}$ "	$\frac{1}{3000}$ th "	$\frac{1}{3900}$ th "	$\frac{1}{6000}$ th "	$\frac{1}{7800}$ th "
$\frac{1}{16}$ "	$\frac{1}{4000}$ th "	$\frac{1}{5200}$ th "	$\frac{1}{8000}$ th "	$\frac{1}{10400}$ th "
$\frac{1}{20}$ "	$\frac{1}{5000}$ th "	$\frac{1}{6500}$ th "	$\frac{1}{10000}$ th "	$\frac{1}{13000}$ th "

As ten inches is about the average length of the compound body in most microscopes, the rule can be rested upon the stage whilst the object is being viewed, with a certainty of maintaining the distance of distinct vision^a.

Three objections will probably be taken to this plan: first, it will not, in all cases, give the exact measurement of an object in odd numbers or parts of a measure; but no instrument as yet constructed does so except the "Cobweb Micrometer" of Ramsden, which, owing to its complexity of structure and consequent high price, can never be generally available; secondly, owing to the unsteadiness of vision when the axes are made to converge, it will be difficult to fix the object for a sufficient time to enable the observer to take its exact measure; and thirdly, we are measuring microscopic objects "by the inch." To the two last objections it may be answered, that they equally apply to Hooke's method of ascertaining the magnifying power of the microscope; but if, notwithstanding, this method is pronounced by Quekett to be such that "nothing better has been devised in modern times," I think there is an *a fortiori* case made out for its application to the measurement of microscopic objects. It should be remembered, too, that magnified objects are no longer "microscopic" in one sense of the word.

The chief recommendations of this instrument are its simple construction, ready application, and trifling cost. In conclusion I will affirm, after some experience of this method, and having tried it with various objects of ascertained dimensions, that it can be safely trusted as approximately accurate, which is as much as may be said of those at present in general use.

* The ruled margin is to be held next the microscope.