hundred dollars, and with the most elaborate accessories ever offered to the public, — no doubt 'brazen elephantiasis,' but not an American instrument. The latest Zeiss instruments brought to this city have just the same nickle plating and lacquer as the American; and without lacquer any instrument would be soon worthless.

In 1860 I used a French upright, then successively a Nachet best, Zentmayer, Beck small best, Popular, and in my laboratory Bausch and Lomb Model and Harvard. In 1875 I brought over a lot of Zeiss's work. I use the inclined position always, except for watch-glasses, or such large vessels. Have used fluids contantly, on tissues, in the examination of fibres according to Vetillart, and numberless examinations of urine, as well as chemical work. The capillary attraction between cover and slide is sufficient, as a rule, to hold all that is required.

I do not see that the disclaimer in the last article affects the statements made in the 'Complaint.' Histological work is the investigation of the minute structure of plants and animals, and this is just what microscopes are made and used for in this country in biological laboratories and by practising physicians. The number of amateurs is very small, and, of instruments used for petrographical and chemical work exclusively, still smaller. In the Washington society, twenty-six members are physicians, nearly all in practice, seven are teachers and investigators, and seven are amateurs.

The American stand has been developed from, and has re-acted upon, the English stand, — a different and radically better type than the German. There are probably as many microscopes made and used by English-speaking people as by all the rest of the world. A Beck was exhibited at one of the late meetings of the Washington Society numbered over 15,000. This means over that number of jointed instruments in use, of one English maker, of which about one-third are in this country. The latest Zeiss here is 11,468 (August), and all but his lowest styles have a joint.

Most English microscopes have a joint, — a feature of the Germans first despised, then condemned, and finally adopted. The jointed stand does all that the upright does, and much that the upright cannot do. The cost of the joint is about two dollars. The Zeiss stand VII, *a* and *b*, is said by Zeiss to be "especially suitable for laboratory use." It has no joint. Its stage is 67 by 72 mm., and 86 mm. high. The price, with two objectives and two eye-pieces, is $34; with another objective, $41. The Zentmayer Histological (American) was put on the market in 1876. It has a joint. Its stage is 65 by 95 mm., and 76 mm. high. With one eye-piece and two objectives and case, it costs $38 and $46. The Bausch and Lomb Harvard has a stage 85 by 90 mm., and 82 mm. high. With two objectives and two eye-pieces, the price is $43. It is well known that the discounts here are larger than on foreign catalogue prices; and in quantity these American instruments, with lower and broader stages than the foreign instruments of equal grade, can be purchased cheaper. No one is obliged to buy a slide-carrier unless wanted. It is priced separate. The glass slip stage was an American invention, was adopted by the French and English makers, and is stated by Dr. Carpenter, in his last edition, "to be the most perfect yet devised." The Iris diaphragm is not generally applied by American makers to college microscopes.

The prices of German low-power objectives are less than American, but high powers are dearer. A Zeiss $\frac{1}{12}$ costs $90, a $\frac{1}{20}$ $112 to $140, to which must be added the cost of special eye-pieces. A Spencer first-class dry $\frac{1}{15}$ costs $60, a $\frac{1}{15}$ homo immersion $80, both high angle; a professional $\frac{1}{8}$ of 175 B.A., $40. If these prices are averaged with the low powers, the American lenses are cheapest, without any regard to duty. We want three classes of microscopes, — the college, the professional, and the complete. The first may have less finish and no substage fittings, the second with substage fittings and better finish, the third with graduated circles, etc. All require a spreading tripod base, a joint, a Jackson arm sitting square on the trunnions, a firm clamp to the latter, and the arm cast solid from the axis of the swinging tail-piece to the barrel.

Our catalogues should give for each instrument the height and size of stage, and the length of barrel.

There has already been much discussion on the uniform construction of microscopes at the meetings of the American Association of Microscopists. A resolution in this direction offered by the writer last summer was ruled out on the ground that the subject was exhausted for the present. An important contribution on tube-length read at Pittsburgh by Professor Gage has already appeared in *Queen's Bulletin*, and will be published in the forthcoming Proceedings of said society.

Colleges pay no duty on their instruments: hence their selection is not affected by the tariff. As to the principle, I am an American citizen and a teacher, and, other things being equal, I prefer to buy my microscopes of my neighbor, who will send his children to my school, and who, if he grows rich making microscopes, may endow my college, rather than to send afar, to one who is not likely to be interested in my success or that of my country. I know professors of political economy do not teach this view; but most business-men act according to it, though the principle may be unwisely applied. Under it as the rule of our national polity, we have made the best and cheapest watches, telescopes, and apparatus for the investigation of radiant heat; and, if the users of microscopes will only co-operate fairly with the makers thereof, we shall soon have the best and cheapest microscopes the world has yet seen. Many who condemn protection, ask for international copyright; and one of their arguments is, that, by raising the price of foreign literature, it will make a better market for domestic productions. So it will, and tend to shut out some excellent foreign work, and is so far just as 'absurd and senseless' as the duty on microscopes.

For details on the above matters, see HARTING, *Das Mikroskop*, vol. iii. p. 262; MAYALL'S 'Cantor Lectures;' and Hon. J. D. COX, 'Microscopic Work,' *American Journal of Microscopy* for 1879, p. 131.

W. H. SEAMAN, M.D.

Howard University, Washington, D.C., Feb. 25.

Indian Wrist-Guards.

IN a review of Professor Morse's 'Methods of Arrow-Release' in *Science* last year (ix. p. 122), I ventured to suggest "whether it is not possible that the so-called 'pierced tablets,' which are described and figured by Professor Rau (*Archeological Collection of the Smithsonian Institution*, p. 23) and other writers, and which have given rise to so much discussion among American antiquaries, may not have been guards worn to protect the wrist against the recoil of the bow-string." Since writing this, I have happened upon an article by R. S. Robertson, in *The American Antiquarian* (i. p. 100), in which he advances the same opinion. He says, "A short time since, when exhibiting one to an old gentleman, who was a clerk for a fur-trader, while the Miamis still occupied the region around Fort Wayne, he assured me he had often seen them in use, and that they were worn on the left wrist to ward off the blow of the bow-string in hunting." I have lately noticed statements in early descriptions of the customs of the Indians, which seem to me to lend some countenance to this view. Capt. John Smith, in his 'Map of Virginia,' p. 23 (Arber's reprint, p. 68), telling how the Indians make their bows and arrows, says, "His arrow-head he quickly maketh with a little bone, which he ever weareth at his bracer, of any splint of stone or glass in the form of a heart." Strachey, in his 'Historie of Travaile into Virginia' (Hakluyt Society edition, p. 106), employing precisely the same language, adds, "and which bracer is commonly of some beast's skin; either of the wolf, badger, or black fox." In the 'General History of Virginia,' which comprises a reprint, with additions, of 'The Map of Virginia,' Third Book, p. 15 (Arber's reprint, p. 397), in an account of the capture of Smith, we are informed that the Indians had "every one his quiver of arrows, and at his back a club; on his arm a fox or an otter's skin, or some such matter, for his vambrace."

Winslow, in 'Good Newes from New England' (Young's edition, p. 365), says, "The men wear also, when they go abroad in cold weather, an otter or fox skin on their right arm, but only their bracer on the left."

As 'bracer,' or 'vambrace,' was the common term employed by old English writers to designate armor worn upon the fore-arm, we are authorized to infer from these statements that the Indians were accustomed to make use of the skin of some animal for a similar purpose. It would seem to be a very easy transition from a piece of leather to a thin, flat tablet of stone, pierced near the centre usually with two holes, which could readily be adjusted to the wrist as a guard.

In ancient Egyptian tomb-paintings (WILKINSON'S *Ancient Egyptians*, i. p. 351), archers are depicted wearing such wrist-guards; and in the European museums it is quite common to find small, oblong, thin plates of bone or ivory, pierced with holes, which are universally regarded there as having been employed for such a purpose. HENRY W. HAYNES.

Boston, Feb. 29.

Notes on the Geology of the Cascade Range.

IN *Science* of Feb. 10, Mr. Herbert Lang discussed evidence bearing on the history of the Cascade Range in Oregon. It may be of interest in connection with Mr. Lang's conclusions to state some facts observed by the parties of the Northern Transcontinental Survey in explorations conducted in Washington Territory from 1881 to 1884.

Coal was the prime object of these surveys, and work was most thorough where it was found in greatest abundance; but the prospecting parties covered the greater part of the Cascade Range north of Mount Rainier, and the facts which follow are of my own observation unless otherwise stated.

It was found that the formations of the Cascade Range in Washington Territory are, 1. Glacial drift; 2. Tertiary eruptives; 3. Unaltered sandstones and shales containing numerous carbonaceous beds, thickness 13,000′± (Laramie?); 4. Local conglomerates (cretaceous?); 5. Altered sediments; 6. Granite.

The granite base of this column was observed beneath the eruptives of Mount Rainier by Mr. S. F. Emmons in September, 1870; it crops out extensively on Upper Cedar River, a stream which enters Puget Sound at Seattle; it forms the heights of the Peshastan Range, north of Ellensburg; granite cliffs of the western side of the Columbia Cañon oppose basaltic walls of the eastern bank from the mouth of the Methow River to the Wenatchie, and granite forms the mass of the Cascade Range north of the Snoqualmie Pass. In remarks recently made before the Philosophical Society of Washington, Dr. George M. Dawson described the continuation of this granite backbone northward for nine hundred miles, and he dwelt upon the absence of volcanic rocks north of the 49th parallel.

The altered sediments which rest upon the granite have yielded no fossils by which their age might be guessed, but they resemble rocks assigned to the paleozoic age by the Canadian survey, and may be of the same horizons. The beds consist of crystalline schists, limestone, and quartzite. They occur throughout the Cascade Range, from latitude 46° northward, and in the Olympic Mountains. Gold has been found in the crest east of Mount Rainier, in gravels derived from the Olympic mass, and on Ruby Creek, a tributary of the Skagit River. Magnetic iron ore occurs in the formation near Snoqualmie Pass, and hard blue specular ore occurs in association with jasper on the Skagit River. This ore and its associations very closely resemble the specular ores of Lake Superior, but they probably belong to a very different period of geologic history. Limestone and schist traversed by quartz veins form an extensive area south and west of Mount Baker, bounded on the north by coal-bearing sandstones.

The altered sediments underlie later unaltered deposits, probably unconformably; but no contact has been sufficiently well observed to determine a definite relation. A conglomerate containing agatized casts of baculites (?) was observed by an intelligent prospector on Skookum-chuck Creek, south-east of New Tacoma; another conglomerate was seen by myself in the Peshastan Range (it consisted of large granite and quartz pebbles, resting on granite, and was several hundred feet thick); and at the coal-mine on the Skagit River, sandstone dipping 40° south-west rests upon iron ore bearing schists dipping 35° south.

These three instances are the only ones known to me in which the apparent base of the recent sedimentary beds has been seen. They mark the beginning of a profound subsidence during which accumulations of sand and clay appear to have kept pace with the sinking surface. In the Wilkeson Coal-Field the thickness of these beds probably reaches 13,000± feet, with 127 coal-beds, ranging from one to forty feet in thickness. This deposit is shown by its fossils to be of fresh or brackish water origin. Unfortunately no large collections were made, and the fossils do not definitely determine the age of the coal-measures; but Prof. J. S. Newberry and Dr. C. A. White agree in considering them the probable equivalent of the Laramie.

These recent sediments occur throughout the Puget Sound basin, they rim the Olympic mass, they have been found in the high crest of the Cascades near Cowlitz Pass, and north of Natchez Pass, and they were deposited to a thickness of about 1,000 feet in the region now drained by the Upper Yakima and Wenatchie Rivers. The great thickness and wide distribution of this formation are unusual features of a fresh-water deposit, and it is difficult to conceive the conditions which maintained fresh water over the area of such a subsidence. But the problem is somewhat simplified when it is recognized that the region was an archipelago like that so recently studied in southern Oregon by Captain Dutton and Mr. Diller. The Olympic peninsula was then an island, and the continuity of the coal-measure series may well be interrupted by similar spaces not yet traced out.

This formation was checked by compression, which resulted in folds of an Appalachian type having a nearly north and south trend. The closeness of flexure varies in different areas, and the chemical concentration of the coal is proportionate to the mechanical disturbance. The extreme of uniform alteration over an area of fifty square miles was reached in the Wilkeson coking coal; but local alteration, due to later volcanic influences, frequently went much further.

This compression closed the history of sedimentary deposits in this region. It may be assumed that it took place at the same period as the elevation of the northern portion of the Cascade Range, assigned by Dr. Dawson to post-cretaceous time; but we may not yet date the uplift more definitely.

A period of erosion intervened between the uplift and the outpouring of eruptives. Mounts Hood, St. Helens, Adams, and Rainier are the conspicuous peaks of the locus of maximum volcanic activity across which the Columbia has cut its cañon. Mount Baker is the northern outlier of the line of volcanoes which begins with Shasta and Lassens Peak.

Mr. Lang's hypotheses are in part confirmed by the facts stated; but like forces have produced unlike results in California and in Washington Territory. South of latitude 42° 30′ the Cascade's volcanic mass is supported on a slightly disturbed sedimentary base: north of latitude 46° 30′ the range of closely flexed sediments is dotted with volcanic cones. The difference is one of degree, not of kind; but the difference is great.

Many of the facts condensed in this note are stated, with more detailed descriptions of the coal-measures, in a report on the coals of Washington Territory, in Vol. XV., 'Tenth Census Reports.'

BAILEY WILLIS.

Washington, D.C., March 1.

Answers.

21. GLOBULAR LIGHTNING. — The late Prof. John Fries Frazer has frequently mentioned to me having seen in his youth a ball of fire descend and strike a tree in a field in front of him. Of course, this phenomenon happened during a thunder-storm. The distance from the object struck was about fifty yards or less. P. F.

Philadelphia, Penn., March 2.

22. WASP-STINGS. — The discussion going on in your columns at the present time in regard to wasp-stings recalls a curious discovery of my boyhood. I was a very ticklish youngster, and my comrades sometimes used that weakness for their own amusement. One boy used to show me how little effect tickling had upon him; but one hot summer day, as he was lying reading, I tickled him on the ribs, and he almost went into convulsions. I found that he was far more sensitive than any boy in the company, and he revealed his secret to me under condition of my never telling any one else. By holding his breath he became pachydermatous, and would let anybody tickle him as much as they pleased; but of course they always gave it up at once when they saw his stolid look. I tried the plan, and it worked admirably; and it is my only protection, even unto this day, for my cuticle is as sensitive as ever. The deduction is simple: a man holds his breath, — and a wasp, — and the stinger is 'bluffed.' *Verb. sap.* R. MCMILLAN.

Liverpool, Eng., Feb. 21.