the crucible, is ladled out into moulds. Thence it is taken to the refinery, where it is cuppelled in the usual way. The block of metallic zinc recovered in the condenser is removed, and used over again in the first part of the process. All the oxide of lead and dross formed in the different processes are taken to the reducing-furnace, mixed with coal-dross, and reduced to the metallic state. The refuse from this furnace still contains some lead, and is put through the slag hearth, a blast furnace fired with coke, the fumes of lead oxides from which are condensed in what is known as Johnson's patent condenser, and are all recovered. The lead from the slag hearth, containing a number of impurities, as copper, antimony, iron, or sulphur, is taken to the improving furnace—a furnace built in exactly the same way as the dezincifying pan. About 20 tons of this lead are heated for a period generally from four or five days, but the time varies according to the amount of impurities present. The oxidised impurities, as they are formed, float to the surface, and are skimmed off by the workman, who is made to keep the lead perfectly clean, so as to have a fresh surface always exposed to the action of the flame. The dross skimmed off is first of a black color, but gradually becomes lighter as the operation goes on, until it shows nothing but yellow oxide of lead. When this appearance is noted the pan is tapped into moulds, or into the desilverizing pot, where it is treated with zinc, and the silver extracted as in the manner before described. By this process the lead can be desilverized and turned out in the shape of market lead in thirty hours from the time it is put in process ; the loss in working being not more than 1¼ per cent., and the amount of oxide of lead formed is very much less than that formed in any of the other processes, thereby effecting a very considerable saving in the working expenses. It makes an excellent quality of sheets, pipes, red-lead, and litharge, and has even been used for the manufacture of white-lead. There is, however, one product it cannot be used for by itself, and that is the manufacture of chemical lead. Your President gave us a very interesting paper on this subject last session, showing that the reason of its not being suitable for this was on account of its extreme purity. I understand that Mr. James Napier, Jr., of this Society, has made a number of experiments in the same direction, and found that by adding to it a small percentage of copper or antimony, or both, a good chemical lead can be obtained. That all the silver is thoroughly taken out may be seen from the fact that there is an excess of silver obtained on the large scale to the extent of nearly 2 per cent. over the assays. An analysis of the market lead gave—Antimony, 0.0015, and silver 0.0004 per cent., a trace of copper, but no iron or zinc ; from which it will be seen that the lead refined by the zinc process is almost chemically pure, and to this is due the finer quality of the products manufactured from it.

THE TERRESTRIAL PROGRESSION OF THE BRAZILIAN "CAMBOTA," *CALLICHTHYS ASPER.*

To the Editor of SCIENCE :—

Letters from Mr. John C. Branner, who was engaged upon the geological survey of Brazil under the late Prof. C. F. Hartt of Cornell University, contain extracts from letters to him from Mr. Joseph Mawson, Bahia, describing some habits of the siluroid fish, *Callichthys Asper*, there known as "*Cambota*." These habits have probably been observed and described already, but as they are not referred to in Günther's Catalogue of the Fishes in the British Museum the account of a recent observer may be interesting to the readers of "SCIENCE."

"During the rainy season the fish live in fresh water pools. When the pools dry up in the dry season, they bury themselves in the mud and remain there until the rains return the following year. They are noted for overland excursions. It is said that they are often met with going from one pool to another.

I have had six of the fish in a narrow-necked tin of water, with some sand and mandioca meal at the bottom, for five days, and they continue active and vigorous, especially the smaller ones. These examples measure from 5 to 10 cm. in length, and I have seen them much larger. I have had them out in the garden several times. I find that they move best on smooth damp ground, and are embarrased by sticks or other inequalities. They can jump a little vertically, but their progress on land is effected entirely by a quick wriggling motion of the body which is nearly flat upon the ground. The paired fins (pectorals and ventrals) are extended laterally, and seem to bear little if any weight; but they move slightly, and appear to serve to steady the body.

Last night I heard a peculiar sound, and on looking around I saw one of the fish travelling about the room. He had escaped from the tin which was in my bed-room, had fallen from the table to the floor, and travelled along the corridor, about 12 meters (about 40 feet) to the *sala*. I watched him travelling for two hours, during which time I estimate that he moved at least 90 meters. Toward the end of the two hours he seemed to flag a little, but in the earlier part his method and speed were fairly seen. He seemed to start with a sudden movement of the head or the barbels, then wriggled briskly for 5 to 10 seconds, advancing about a meter. Then he would rest for about 10 seconds, and start as before. This was kept up during the whole two hours, and I left him still moving. This morning, five hours later, I found him dead. While he was moving I spilled some water on the floor, but he crossed it ; hence I concluded that it was mud rather than water of which he was in search. The fish are eaten and considered good food."

It may be added that some examples of these fish were brought me by Mr. Branner, and found to be the *Callichthys asper*. The species of the genus are easily recognized from the fact that the trunk is covered by only two rows of large scales, a dorsal and a ventral series.

The ability of *Callichthys* to withstand a somewhat protracted deprivation of water, which it shares with other fishes of South America and India, with the North American Ganoids *Amia* and *Lepidosteus*, and with some other Ganoids and Dipnoans, is probably accounted for by the observations of Prof. Jobert of Rio Janeiro, published in the *Annales des Sciences Naturelles*, sixth series, V. and VII.

ITHACA, Dec. 21, 1880. BURT G. WILDER.

ASTRONOMY.

A PROBABLE VARIABLE STAR.—On Nov. 25, Swift's Comet was compared with the star No. 4339 of Lalande, by Mr. Talmage at Mr. Barclay's Observatory, Leyton, the magnitude of the star being estimated 8, as it was also by Lalande. Argelander in the *Durchmusterung* gives it 6.4 and Heis made it a naked eye star 6.7, but erroneously identifies it with Lalande 4359. It escaped observation in the Bonn Zones and may be worth occasional examination as likely to prove an addition to our variable star list.—*Nature.*

WINNECKE suggests that Hartwig's Comet is identical with the comets of 1382, 1444, 1506, 1569 and that it therefore has a period of 62⅓ years.

THE asteroid picked up by Peters on Oct. 10, is identical with that discovered by Palisa on Sept. 30.

M. TRIPIER is expected to take charge of the Observatory of Algiers in April, 1881.

DR. COPELAND at Dunecht, using Prof. Pickering's device of a prism introduced between the eyepiece and

objective of his telescope, discovered a small binuclear, planetary nebula. Its position for 1880 is R. A. 21h. 2m. 11.8s, Dec. 47° 22.2′ N.

Washington, December 23, 1880. W. C. W.

SWIFT'S COMET.

The following are two more positions of this comet. These were obtained by the aid of a ring micrometer. Nov. 20, 1880, R. A. 1h. 6m. 24s. : Dec. +54° 22′ 39″ : Time is 10h. 49.1m. Washington *m. t.* Dec. 5, 1880, R. A. 4h. 7m. 49.2s. : Dec.+48° 30′ 10″ Time is 9h. 49m. Washington *m. t.* I have also an observation of position for Nov. 7, which has not been reduced as I have not yet managed to find the position of a fifth magnitude star, to which the comet's position was referred. The star's position will soon be obtained.

Nashville, Tenn., Dec. 21, 1880. E. E. BARNARD.

NEW COMPANION TO ζ FORNACIS.

Sir John Herschel entered this as No. 2161, of his Fifth Catalogue of Double Stars, by reason of a distant eleventh magnitude which he detected, at an estimated distance of 45″, in the direction of 169 4°. This star was measured by me in 1879 in connection with a series of observations of a class of stars given in "Smyth's Bedford Catalogue." Since then, in repeating the measure of the Herschel Star, I have discovered a much nearer component, which fairly entitles the large star to be classed as double. The new star is very faint, and a rather difficult object with the 18½-inch refractor of the Dearborn Observatory. This, however, is partly due to its low altitude in this latitude, it being 25° south of the Equator. The mean result of my measures of these companions on four nights is :—

A and B	P=144.4°	D=11.53″	1880.93
A and C	157.0°	48.85″	1880.68

I have estimated the new companion as thirteenth magnitude. This, it will be remembered, is in the Struve scale of magnitudes, which would make it very much smaller than Herschel's twentieth magnitude.

The place of the principal star for 1880 is :—

R A. 2h. 44m. 33s.
Decl. —25° 3″

S. W. BURNHAM.

CHICAGO, Ills., December 21, 1880.

To the Editor of SCIENCE :

Professor Winchell, in the last number of "SCIENCE," refers to what he supposes "to be some errors in the dates in the list of minor planets discovered by the late Professor Watson," viz. :

(133) Cyrene, discovered Aug. 14, 1873, *Am. Jour. Sci.* III., VI., 296.
(174) Phaedra, " " 8, 1877, " " " III., XIV., 325.
(175) Andromache, " Sept. 2, 1877, " " " III., XIV., 325.

In correcting these supposed errors Prof. Winchell has fallen into more grievous ones.

Owing to a misprint in the *Astronomische Nachrichten* I was led to record the date of the discovery of (133) as August 26 ; it should be August 16, vid. *Astron. Nach.* 82,241 *Am. Jour. Sci.* III., VI., 296.

(174) Phaedra was discovered September 2, 1877, vid. *Am. Jour. Sci.* III., XIV., 325. This date is given September 3 in *Circ. Berl. Jahr.* No. 76. September 2 is undoubtedly the correct date. The object discovered August 8 turned out to be (141) Lumen, vid. III., XIV., 429, *Circ. Berl. Jahr.* No. 76.

(175) Andromache was discovered October 1, 1877, vid. *Astron. Nach.* 91-127 ; also *Circ. Berl. Jahr.* No. 81. The object called (175) in *Am. Jour. Sci.* III., XIV., 325 was really (174) Phaedra, as is explained in *Circ. Berl. Jahr.* No. 81. AARON N. SKINNER.

U. S. NAVAL OBSERVATORY,
WASHINGTON, D. C., Dec. 22, 1880.

BOTANY.

PILOSITY AS A TERATOLOGICAL PHENOMENON.—Hitherto teratologists have considered undue pilosity, or the adventitous production of hair in plants, as a matter of minor importance, but M. Ed. Heckel, in a recent note to the French Academy, (*Comptes Rendus*, xci., p. 349), insists that there are certain phases of this sort of change in plants which have a higher significance than that of a simple variation. He proposes to divide the phenomenon into the following three categories :

(1.) *Physiological Pilosity*, which includes the formation of hairs, or the increase in number of these, on the parts of plants where they are normally present, or even entirely wanting. Such cases are oftenest seen when plants change their habitat from a wet to a dry soil. This sort of physiological adaptation takes place within quite narrow limits ; and it varies from glabrousness to pilosity unaccompanied by any alteration of specific characters.

(2.) *Teratological Pilosity*, which begins at the moment the specific habit is altered, and acquires its maximum when the modifications are profound enough to suggest the idea of a new species. A large number of conditions capable of producing nutritive troubles in plants may give rise to this peculiar phenomenon, which M. Heckel proposes to introduce into teratological literature under the distinctive term of "Deforming Pilosity" (*Pilosisme deformant*).

(3.) *Pilosity due to the Sting of Insects or to Organic Variations*, which is clearly distinguished from the former in being very localized (e. g. certain galls, the filaments of *Verbascum* with aborted anthers, etc.,) and which cannot change the habit of the species.

Of changes due to *deforming pilosity*, M. Heckel gives two prominent examples which he has studied, *Lilium Martagon*, L., and *Genista aspalathoides*, Lam. The alterations in the last named plant are so profound that its monstrous state has even been described by De Candolle as a species, under the name of *G. Lobelii;* while by Morris it has been regarded as a marked variety, and named by him var. *confertior*.

MICROSCOPY.

The remarks of the "Fellow of the Royal Microscopical Society," who so ably advises *The English Mechanic* on Microscopy , on the faulty construction of many forms of "Student's" microscopes, is well timed.

In regard to the system of getting as much as possible for the money, he says : "It is just this petty economy in the original outlay on a practical stand that cramps the student when he has acquired some manipulative dexterity. Dealers and manufacturers are, of course, driven to supply what is recommended by the 'authorities.' The continued refrain of 'cheapness, cheapness,' brings down the construction of the microscope until it has become (in far too many instances) the baldest tube, stage, mirror, objective, and eyepiece with which it is possible to view a speck of saliva on a slip of glass. This perpetual reduction of the finish and design of the microscope tends to exclude all the better opticians from supplying students' microscopes, for they cannot do justice to themselves when the price is to be cut down as it has been during the last few years. The consequence is that an enormous number of common French or German instruments has been imported into this country and America ; students have been 'set up' with these things, to discover later on, when they have become experienced enough to judge of such matters, that they have no market value except as lumber.

The severe competition, lately, has been mainly confined to the production of *low-priced* microscopes, *not* the production of an *efficient* instrument at a moderate cost ; the consequence appears to have been that manufacturers whose appliances are about equal to the task of making gas-fittings have been induced to enter the competition ; a model of stand has been placed before them which they have copied 'more or less ;' at any rate, the