

York and Massachusetts; tail slightly longer proportionally, white all around for about 25 mm. at tip. Length 225, tail 126, hind foot 30 mm. (Type ♀ ad.; No. $\frac{464}{887}$, collection of G. S. Miller, Jr., Restigouche, N. B.; September 10th, 1880; E. A. Bangs, collector.) The skull closely resembles that of *Z. hudsonius*, but is slightly larger, with brain-case a trifle broader and flatter.

The other two specimens are males. They agree perfectly with the type, except that the tails are longer, with the white tips reduced to 13 and 11.5 mm. They measure: Length 224, tail 141, hind foot 30.8; and length 235, tail 140, hind foot 30.4; and were taken at Restigouche, September 8th and 10th, respectively.

The three specimens agree in lacking the upper premolar usually usually found in *Zapus hudsonius*; but as all are old, and have the teeth much worn, it is possible that this tooth may have been shed, leaving no trace of its former presence. I can find no published account of the occasional absence of this premolar in *Z. hudsonius*; but Mr. F. W. True writes me that a single specimen from Pennsylvania in the U. S. National Museum shows this peculiarity.

Apparently the only description of a jumping mouse with white-tipped tail is that given by Dawson (*Edinb. N. Phil. Journ.*, III., 1856, 2), who describes the animal from near Halifax, and uses the name *Meriones labradorius* Rich. for it. Richardson took his name from Sabine (*Zool. App. Franklin's Journ.*, 1823, 661), whose specimen "from Cumberland House" was imperfect, having the tail only 2.50 inches long, thus rendering the name *labradorius* undeterminable. The first adequate description given under the name *labradorius* is that of Richardson, in the "Fauna Boreali-Americana," and this refers strictly to *Z. hudsonius*, or at least to a dark-tailed animal.

My warmest thanks are due Mr. Bangs for his kindness in permitting me to announce this new species, which is his discovery rather than my own.—GERRIT S. MILLER, JR., *Peterboro, N. Y., June 28th, 1891.*

Descriptions of Three New Species of Mexican Bats.—

During a recent collecting trip, made for the Comision Geografica-Exploradora, to Las Vegas, Canton of Jalapa, Vera Cruz, I found what appears to be a new species of *Vesperugo*.

Close by the hamlet of Las Vegas is a small, long-since-extinct volcano, on the sides of which are found numerous "sink-holes" that give entrance into long, narrow caves or tunnels, through which formerly flowed the lava after it had ceased to be fluid on the surface. Some of these tunnels are as smooth and clean as though but lately emptied of their fiery contents, whilst others are strewn with great

heaps of angular fragments of lava, jarred down from the roof by some earthquake. Not infrequently two or three superimposed tunnels have been united in parts of their length by their respective floors having fallen through. In these caves, even on the hottest day, the air is fresh and cool, and has a perceptible current down the mountain side, which at the constrictions becomes a strong breeze. This coolness of the atmosphere was a fortunate circumstance for my collecting, as because of it I found most of the bats in a state of semi-hibernation, enabling me to take with the hand all those within arm's reach. Prof. J. A. Allen's recently described *Vespertilio velifer* was the prevailing species, abounding in hundreds, and of which I took with the aid of my assistant, Señor Carlos M. Teran, 193 specimens; 151 being males, and the remaining 42 females. This I take to be a fair average of the proportion of the sexes in what is probably one of their permanent headquarters. *Plecotus macrotis* was scattered about in very sparing numbers, but five specimens being seen. Unlike my former experience with this species in the valley of Mexico, all were found solitary, completely isolated from the other species as well as from one another.

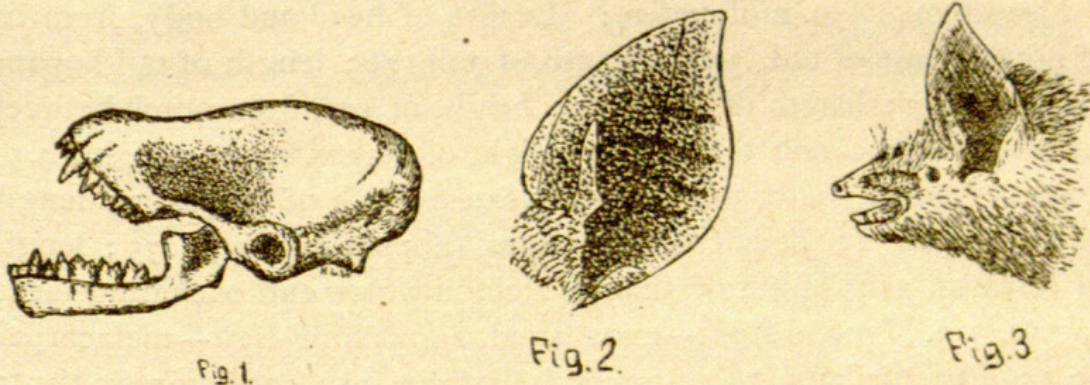
While collecting these bats I came across one whose small size immediately distinguished it from the two other species; yet from its general similarity in form, viewed by the uncertain light of a stearine candle, and its almost exact identity in color with *velifer*, led me for the moment to suppose that it was a young of that species. But upon finding another of these small bats I made a closer examination, and at once saw that I had another species to deal with, new to me, and I fancied new to science. A search through all the literature of the subject that I have at hand confirms me in the belief that it is an undescribed species.

Six specimens, five males and one female, were taken, and no others were seen. In every case they were hanging from the sides of the caves, instead of from the roofs, as was the case with *velifer*, and unlike it were always solitary,—a point on which I place no special stress, as I find this and several other habits of bats to vary with locality, etc. Some were taken not far from the entrances, where, when the eyes were accustomed to the darkness, a faint sort of phosphorescent glow could be seen in the direction of the mouth of the cave. Others were taken many hundreds of yards within, where intervening abrupt angles rendered it absolutely impossible that the slightest ray of light could at any time of day penetrate. That this locality is not the headquarters of this species I am satisfied; whether higher up in the *tierra templada*, or below in *tierra caliente*, will prove to be its

center of distribution I am not positive ; but I think that it will be in *tierra caliente*, at least during the winter months. The semi-hibernation of the specimens taken point toward this opinion, for I am inclined to believe that here, where ten miles of travel may bring an entire change of climate, the bats, as a rule, prefer to migrate rather than to hibernate.

These bats, when first taken, were entirely motionless ; but in a few moments the heat of my hand revived them, whereupon they occasionally gave voice to a faint, high-pitched squeak,—so high in pitch that I fancy it lacked little of being beyond the range of the ordinary human ear. They went into none of those ecstasies of rage seen in many of the larger species that bite whatever comes within range of their mouth, be it their own foot or wing. One, found in a comparatively dry part of a cave, was completely beaded over with dew, indicating, I think, that it had passed at least several days since taking flight. When taken into the daylight they closed their eyes and covered them over with the carpal portion of their wings.

VESPERUGO VERÆCRUCIS, sp. nov.—All six specimens were indistinguishable one from another in point of color. The following color-description is taken from a dried skin, whereas all the rest of the description is taken from a specimen preserved in alcohol.



Vesperugo veræcrucis.

Hairs of back clove-brown for basal half, followed by two equal zones respectively broccoli-brown and clove-brown ; some of hairs furthermore tipped with light Vandyke-brown, giving a decidedly "rusty" tone to the back. Ventral surface, bases of hairs slightly lighter than those of back, followed by light hair-brown, producing a grayish or smoky effect.

Wing membranes naked, except a very limited area on upper surface along sides of body, not exceeding three or four millimeters in width ; and on lower surface, the area included between a line passing from

the middle of humerus to the knee and the side of the body is scantily haired.

Interfemoral membrane with a small, triangular patch of hair on its upper surface, covering base of tail, and extending to one-fourth of its length.

Legs and arms naked. Wing extending from base of outer toe. Antebrachial membrane losing itself at middle of radius. Two caudal vertebræ free from membrane.

Black glandular prominences between eyes and nostrils well developed, fringed with longish hairs on both upper and lower edges, and with three or four long, black, bristly hairs growing from its upper surface.

Inner edge of ear conch evenly convex. Outer edge coming up, in an even, sweeping curve, from angle of mouth to level of tip of tragus, where it meets a slightly concave line leading up to the obtusely rounded tip. A nearly semi-circular antitragus is developed from that part of the conch passing below the tragus. Bone of inner margin of tragus concave, thus throwing this organ forward, followed by a straight margin. Bone of outer margin with a sub-triangular lobe, followed by a deep notch, above which the greatest width is quickly reached. From here a nearly straight line leads to the tip, which is obtusely rounded. (See Fig. 2.)

Measurements in millimeters: Length of head and body, from tip of nose to base of tail, 37.5; length of tail, 36; length of tail beyond membrane, 3; length of head, 15; height of ear, from notch between antitragus and conch to tip, 10; height of tragus, inner margin, 4.5; height of tragus, outer margin, 6; greatest width of tragus, 2; length of antitragus, 2; height of antitragus (approximately), .75; length of forearm, 31; length of thumb, including claw and excluding metacarpus, 7.5. Second digit—metacarpal, 29. Third digit—metacarpal, 30.5; first phalanx, 11.5; second phalanx, 11; cartilaginous tip, 5. Fourth digit—metacarpal, 29; first phalanx, 10; second phalanx, 7; cartilaginous tip, 2.5. Fifth digit—metacarpal, 28; first phalanx, 8.5; second phalanx, 5; cartilaginous tip, 1. Interspace between tips of third and fourth digits, 16; interspace between tips of fourth and fifth digits, 37; interspace between tip of fifth digit and juncture of membrane with foot, 42; extent of outstretched wings, 212; length of tibia, 13.5; length of foot, 9; length of calcaneum, about 8.

Teeth $\frac{2-2}{3-3} \frac{1-1}{1-1} \frac{2-2}{2-2} \frac{3-3}{3-3} = 30$.

Middle upper incisors separated by 1.5 mm., inclined forwards and inwards; a large internal cusp on posterior-external edge halfway up

from base to tip. Outer incisors simple, conical, inclined parallel to their respective inner mates, separated from canines by about .75 mm. Lower incisors tri-lobate, evenly spaced. Upper canines long, simple, slightly recurved. Lower canines straight, with basal cusps on forward edge only. First upper premolar interior to tooth line, visible from the exterior. Second upper premolar longer than any of its corresponding molars.

A prominent conical excrescence is on the lower gum, opposite the space between the premolars, in front of which the point of the upper canine passes. Two much less prominent excrescences are on the upper gum immediately above this lower one. Type No. 527 ♂, Las Vegas, Vz., Feb. 19, 1891. Collectors, H. L. Ward and C. M. Teran.

Vesperugo veræcrucis appears to be most closely related to *V. georgianus*; therefore I append a comparative table of measurements:

	Tip of nose to tail.	Length of tail.	Length of forearm.	Length of tibia.	Length of third finger.	Expanse.	
<i>V. veræcrucis.</i>							
527. ♂	37.5	36.	31.	13.5	56.	212.	Alcoholic specimens in the Museum of the Comision Geografico- Exploradora.
528. ♀	38.5	36.	32.	14.	55.	215.	
529. ♂	37.	34.	30.	13.	52.	210.	
530. ♂	34.	32.	30.	14.	51.	207.	
531. ♂	38.	34.5	30.5	13.5	54.	210.	
<i>V. georgianus.</i>							
Largest individual measurement,	46.	41.	36.	18.	61.	237.	Extremes of measurements of ten alcoholic specimens of U. S. Natl. Mus., taken from H. Allen's Mon. N. A. Bats, p. 37, and reduced to millimeters.
Smallest individual measurement,	41.	38.5	33.5	15.5	56.	219.	

From this table we see that, with but a single exception,—*i.e.*, third finger,—the smallest measurements given by Dr. Allen of *georgianus* exceed the largest measurements of *veræcrucis*. Were this the only difference found, I should probably consider my specimens as representing a smaller southern variety; but taken in consideration with difference of color pattern, the dorsal hairs having three and some even four distinct bands of color, instead of but two, as *georgianus* is described, the nakedness of the legs, less extent of hair on interfemoral membranes, etc., an apparent difference in the form of the ear, and slight differences in the teeth, lead me to also consider this difference in size as a characteristic of the species.

NYCTINOMUS DEPRESSUS, sp. nov.—For about a year I have been aware of the existence in this museum of an apparently undescribed species of *Nyctinomus*, an adult male taken within the museum building. I have vainly endeavored to obtain other specimens of this species, but

have so far found no other of the genus except *brasiliensis*, which is extremely numerous here, as well as in several other parts of the country where I have collected.

The specimen under consideration appears to be more closely allied to *N. macrotis* than to any other described species, but quite distinct from this, as will appear by a comparison of the figures and description here given with Dobson, Catl. Chiroptera in Brit. Mus., pp. 435, 436, Pl. xxii., Fig. 6.

Above, burnt umber; below, Prout's brown; bases of hairs on both surfaces, white. Membranes and ears, in the alcoholic specimen, nearly perfectly concolor with the under surface of body. A line of



Fig. 4

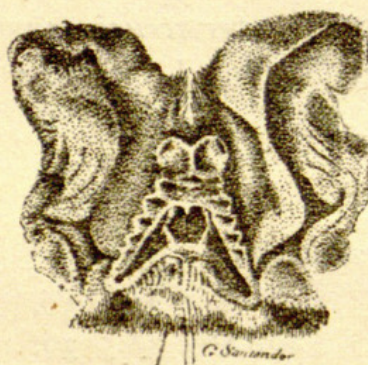


Fig. 5.

Nyctinomus depressus.

very short hairs bordering humerus and radius on upper surface of ante-brachial membrane, so fine as scarcely to be perceptible when wet. On upper surface of wing membrane, short lines border the radius, except at the extreme elbow, and occupy the angle formed by the juncture of the fourth and fifth metacarpals. On both upper and lower surfaces the membrane is covered with hairs to a line extending from the proximal third of humerus to the middle of the femur. Inter-femoral membrane covered for three or four millimeters below femora on upper surface, and naked on lower. Inner edge of ear evenly convex when flattened out, but from its vertical waviness appearing as in Fig. 5. The forward interior margin is reflexed over the deep depression at the upper extremity of the keel, thus forming a sort of pocket. Outer margin bilobate, the lower lobe arising from a short, straight base coming up from behind the antitragus, the upper lobe being continuous with the tip and inner edge. Keel large, strongly reflexed at angle near base, extending slightly exterior to the antitragus. Tragus straight on inner and upper margins. Outer margin formed by two slightly concave lines producing a slight lobe by their juncture at

the center of this margin. Conch with seven diagonally transverse flutings appearing as furrows on the upper and as ridges on the lower surface, the posterior one being very slightly marked. On the outer surface, passing through the centers of these flutings, and at right angles to them, is a slight ridge formed by a doubling of the skin. The peculiar depressed angle formed by the juncture of the two lobes of the external margin of the conch (*vide* Fig. 4) gives to the ears of this species a peculiar drooping appearance that has suggested to me *depressus* as a fitting specific name.

Nostrils circular, opening forwards, outwards, and very slightly downwards. A prominent subcircular swelling between the eye and nostril and slightly below a line connecting them. Side of face with five flutings extending to lip. A deep furrow under eye. Face and chin nearly naked. Wing membranes from inner surface of distal ends of tibia and from calcanea, indefinitely edged with yellowish-white, more defined in centers of interdigital spaces and in center of the space between the fifth finger and tibia. Outer edges of first and fifth toes closely fringed with short, curved white hairs; on the fifth toes, dorsal to this outer fringe, is a row of less numerous curved hairs, exceeding them about three times in length. From the upper surface of base of each claw spring three or four long curved hairs, about 8 mm. in length on chord. No gular pouch. Thumb with well-developed callosity at base of first phalanx.

Teeth $\frac{1-1}{2-2} \frac{2-2}{1-1} \frac{2-2}{2-2} \frac{3-3}{3-3} = 30$.

Upper incisors semi-conical, parallel, separated by space of 1 mm. Lower incisors bifid, crowded; the middle pair in a straight line, the outer ones starting from near centers of inner surfaces of middle pair and diverging at an angle of 45° from them. Canines long, with distinct, unbroken anguli, somewhat dilated on posterior-internal part of lower one, but not forming a true cusp. The upper canines are curved backwards, saber-shaped, passing 1.5 mm. below gums of lower teeth when the mouth is closed, the lower pair fitting into sockets between upper incisors and canines. First upper and lower premolars much smaller than second ones, in middle of spaces between these and canines. Second upper premolars decidedly longer than molars, with very acute outer cusps; the internal cusps not particularly developed, as is the case with *macrotis*.

Measurements in millimeters from alcoholic specimen: Length of head and body, from tip of nose to base of tail, 79; length of tail, 52; length of tail beyond interfemoral membrane, 33; length of

head, 31; length of ear, from notch between antitragus and conch to anterior point of margin, 25; length of antitragus, 7; height of antitragus, 4.5; height of tragus at inner border, 2.5; height of tragus at outer border, 4.5; width of tragus at top, 2.5; ears unite at base for 3.5; length of forearm, 60; length of thumb, not including metacarpal, 8. Second digit—metacarpal, 55. Third digit—metacarpal, 58; first phalanx, 24; second phalanx, 22; cartilaginous tip, 7. Fourth digit—metacarpal, 56; first phalanx, 21; second phalanx, 2. Fifth digit—metacarpal, 29; first phalanx, 20; second phalanx, 5. Interspace between tips of third and fourth digits, 31; interspace between tips of fourth and fifth digits, 60; interspace between tip of fifth finger and attachment of membrane to tibia, 60; extent of outstretched wings, 357; length of tibia, 18; length of foot, 13; length of calcaneum (poorly defined), about 16.

Type, and only specimen, No. 516 ♂ ad. Tacubaya, D. F., Mar., 1887. Collector, Louis G. Ruòz.

A comparison of the measurements of this species with *macrotis* shows that although the length of ear, forearm, and peculiarly short second phalanx of the fourth digit are the same in the two species, yet *depressus* is considerably the larger bat of the two.

CENTURIO MINOR, sp. nov.—I have in hand an adult female Centurio that I cannot identify with either *C. senex* or *m'murtrii*, because of some apparent differences in the cutaneous folds of the chin, and because of differences in measurements that I cannot believe to be due to individual variation. Unfortunately the collector commenced to make a skin of the specimen, dissecting the head to forward of the eyes, before deciding to preserve it in alcohol. For this reason I give



Fig. b.

Centurio minor.

only a figure of the lower jaw, for I know by experience that at best I could make but a guess at what was the original shape of the head. Fortunately the specimen has never been permitted to dry, so that the cutaneous folds and ears are in their normal condition.

The specimen contained a (about half-ripe) foetus that is preserved entire, and that shows all the cutaneous folds of the adult, and besides possesses a curious cone of skin springing from the occiput, looking like the top-knot of hair of *macmurtrii* as figured in the Biologia Centrali-Americana.

Description of type, No. 525 female ad, Cerro de los Pajaros, Las Vegas, Vz., July or August, 1888. Collector Carlos M. Teran.

Color, above Broccoli-brown, lighter on occiput and neck, darker toward the tail. Each hair three-zoned; base brown, middle white,

and tip brown; the white occupying one-half of entire length. On the lower part of back the white becomes more and more soiled until it is scarcely noticeable. Or the hairs may be described as brown on lower back, with slightly lighter centers that fade to pure white on neck, and occiput. Belly same as back, becoming lighter on head and neck, which is white, washed with brown. No distinct zones of color as on dorsal surface. At ventral aspect of junction of antibranchial membrane with the body is a small, triangular spot of white fur. Wing membrane externally covered with unicolored hairs, same shade as dorsum, to line from middle of humerus to near knee. Upper surface of interfemoral membrane thinly clothed, same color as rump. Wing membranes from tarsi. Antibranchial from bases of first phalanges of thumbs. Face naked, with the exception of a few white bristles and a row of short white hairs from corner of mouth to antitragi. Lower jaw naked in front, bordered by a fold of skin, free in central part that passes from antitragus to antitragus. Another narrower fold leaves this at corners of mouth extending across the line in a slightly curved line. In its center this fold is greatly widened (see Fig. 6), having a slight central depression or pit with a small one on each side of it. From this widened part of fold a straight sided, naked patch extends backwards having, a trifle below its center, a lanceolate pit. Below on each side this naked space throws out an arm terminating in a rounded lobe. Lower down, and separated by a line of hair, are two warts, one on each side of central line, each with a slight depression in its center. The sketch will, I think, explain this more easily than words. The white hair bordering this inverted T-shaped, naked space is very short and fine, quite invisible to the naked eye when the specimen is wet. I have purposely greatly exaggerated its length in the sketch that it may not be overlooked.

Ears divided into two lobes of equal proportion, and form with those of *senex* as figured by Dobson in Catl. Chir. Brit. Mus. Facial cutaneous folds, and the peculiar markings between the fourth and fifth fingers, and internal to the fifth, are apparently the same. These markings are not exactly the same on each side, several of the lines being branched, tuning-fork shaped, and not conforming one side with the other. They, therefore, can probably be but little relied upon for diagnostic purposes.

$$\text{Teeth } \begin{array}{cccc} \overline{2-2} & \overline{1-1} & \overline{2-2} & \overline{2-2} \\ \overline{2-2} & \overline{1-1} & \overline{2-5} & \overline{2-2} \end{array} = 28.$$

The only noticeable difference between the teeth of this specimen and those of *senex* (*vide* Dobson) is that in *minor* the second lower

molar is equal to the first instead of the half its size, and sectionally is quadrangular instead of triangular.

Comparative measurements of *minor* and *senex* in millimeters, those of latter species reduced from measurements in inches given by Dobson :

	<i>C. minor.</i>	<i>C. senex.</i>
Length of head and body (about)	65	77
Length of head	20	25
Length of ear	13	17
Length ¹ of tragus	4	7.5
Length of forearm	*40.5	53
Length of thumb	13	13
Length of second finger, metacarpal	33	
Length of third finger :		
Metacarpal	37	38.5
First phalanx	14	17.5
Second phalanx	22	23
Third phalanx ²	11	15.5
Length of fourth finger :		
Metacarpal	34	34
First phalanx	14.5	14
Second phalanx	13	14
Length of fifth finger :		
Metacarpal	36	35.5
First phalanx	14	15
Second phalanx	12.5	14
Interspace between tips of third and fourth fingers	32	
Interspace between tips of fourth and fifth fingers	45	
Interspace between tip of fifth finger and foot . .	52	
Extent of outstretched wings	277	
Length of tibia	17	17
Length of calcaneum	5.5	6.5
Length of foot	14	10

In three of these measurements,—*i. e.*, thumb, fourth metacarpal, and tibia,—the two species measure the same ; in three others,—*i. e.*, first phalanx of fourth finger, fifth metacarpal, and foot, *minor* is the larger ; in all the other thirteen comparative measurements it is the smaller. The difference in length of forearm, 12.5 mm., is much more than I

¹ This is greatest possible measurement,—*i. e.*, taken on extreme outer margin ; that of inner margin is 2.5.

² This is the osseous phalanx ; with cartilaginous tip it is 14.

have yet found in individual varieties of bats. That of the foot and of the ear, each 4 mm., is great for so short organs. The difference in tragus, 3.5 mm., particularly strikes the attention. I am inclined to believe that this is the least variable organ in bats.

Notwithstanding these differences the closeness of these two bats is very marked, and I should not be surprised if *minor* should eventually prove to be but a variety of *senex*. However, until there is positive evidence that such is the case, it is advisable to consider it as a separate species.

The collector failed to note the date of capture, but informs me that he is certain that it was in July or August, and probably in the former month. From this I imagine that the young bat would have been born some time in September. The specimen was taken at night while flying about a bonfire.—HENRY L. WARD, *Tacubaya, D. F., Mexico, April 20th, 1891.*

EMBRYOLOGY.¹

Some Notes on the Breeding Habits and Embryology of Frogs.—The following notes are the outcome of several years of observations on the breeding habits and stages in the development of frogs. They are confessedly very incomplete, having been collected rather as an amusement than with any desire to increase our present knowledge of amphibian embryology. Some older observations have been verified, and I believe a few new observations made which perhaps are worth recording. From many points of view I think the development of the frog is better adapted to the need of students beginning the study of embryology than the classical chick. Certainly this seems to be true if a clearer knowledge of the phenomena of development in general is desired, and not merely an introduction to human embryology,—the best excuse offered for presenting the hen's egg and chick, with its mystifying yolk and white and its incomprehensible (to the beginner) larval membranes. On the other hand, the ease with which the young chicks are to be obtained at all seasons makes a very strong argument in their favor. Correspondingly, the difficulties of removing the younger stages of the frog's egg from the surrounding jelly has been a great drawback to its study. Appreciating this last difficulty, I have experimented for several years on methods of removing these

¹ Edited by Dr. T. H. Morgan, Johns Hopkins University, Baltimore, Md.



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