IN A SNAILERY.

BULIMUS, CYCLOSTOMA AND OTHER TROPICAL SNAILS.

TWO-THIRDS of the persons to whom I show the little land and fresh-water mollusks in my snailery either start back with an "Oh! the horrid things!" which causes me some amusement, or else gaze straight out of the window, saying languidly, "How interesting!" which hurts my pride. I confess, therefore, that it is contrary to experience to attempt to interest magazine readers with an account of

> "Ye little snails, with slippery tails,
> Who noiselessly travel across my gravel."

Yet why not? Snails are of vast multitude and variety, ancient race, graceful form, dignified manners, industrious habits, and gustatory excellence; *quod est demonstrandum.*

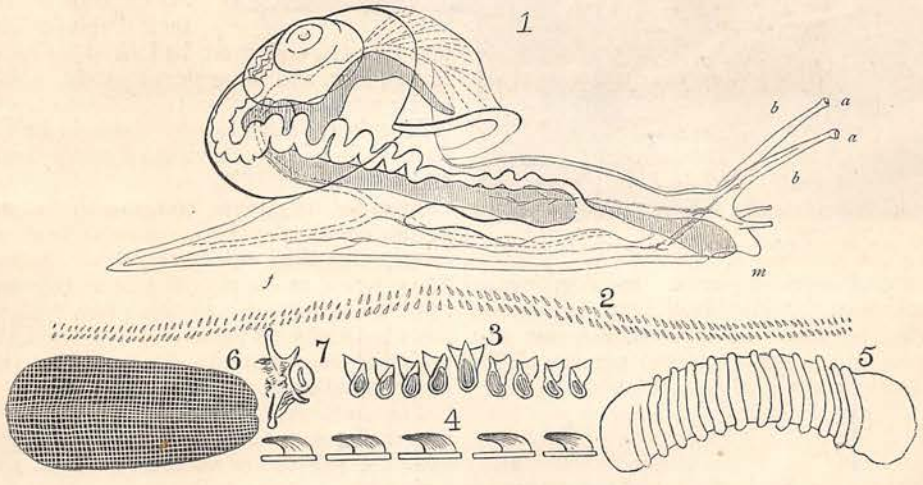
Snails differ from other gasteropodous mollusks chiefly in that they are provided with lungs, and thereby are fitted to live in air, instead of water. Hence all true snails are terrestrial. As the snail crawls upon a cabbage leaf, all that you can see of the body is the square head bearing two long and two short horns, with the muscular base tapering behind. There is an oily skin, and on the back is borne a shell containing the rest of the body, twisted up in its spiral chamber. Extending along the whole under surface of the body is the tough corrugated disk upon which the animal creeps.

This foot is the last part of the body to be withdrawn into the shell, and to its end, in a large division of pulmonate as well as marine mollusks, is attached a little horny valve which just fits the aperture of the shell and completely stops it up when the animal is within. This is called the operculum. The foot secretes a viscid fluid which greatly facilitates exertion by lubricating the path, and snails may often be traced to their hiding-places by a silvery trail of dried slime. So tenacious is this exudation that some species can hang in mid-air by spinning out a mucous thread; but, unlike the spider, have not the power to retrace their way by reeling in the gossamer cable. The slime also serves the naked species as a protection, birds and animals disliking the sticky, disgusting fluid; and serves others as a weapon, seeming to benumb whatever small creature it touches. The *Oleacina*, of Cuba, thus frequently is able to feed upon mollusks of twice its strength.

The snail possesses an elaborate anatomy for the performance of all the functions of digestion, respiration, circulation, and reproduction. A collar of nervous matter encircles the throat, whence two trunks carry nerves throughout the body, and filaments pass forward to the "horns," the longer and superior pair of which end in minute eyes and are called "eye-stalks," while the shorter pair are only tactile organs, and hence "feelers." These tentacles are as expressive as a mule's ears, giving an appearance of listless enjoyment when they hang down, and an immense alertness if they are rigid, as happens when the snail is on a march. The eyes are of little real use, being excelled for service by the senses of smell and taste, and it is doubtful whether the nerves generally are very sensitive, since a slug will be eaten without manifesting pain.

It is not surprising, perhaps, to find great tenacity of life in so lowly an animal, but Spallanzani, whose experiments with bats are celebrated, was the first to ascertain that not only parts of the head, but even the whole head might be reproduced, although not always. The shell is easily and frequently repaired, though hastily and not with the fine workmanship of the original.

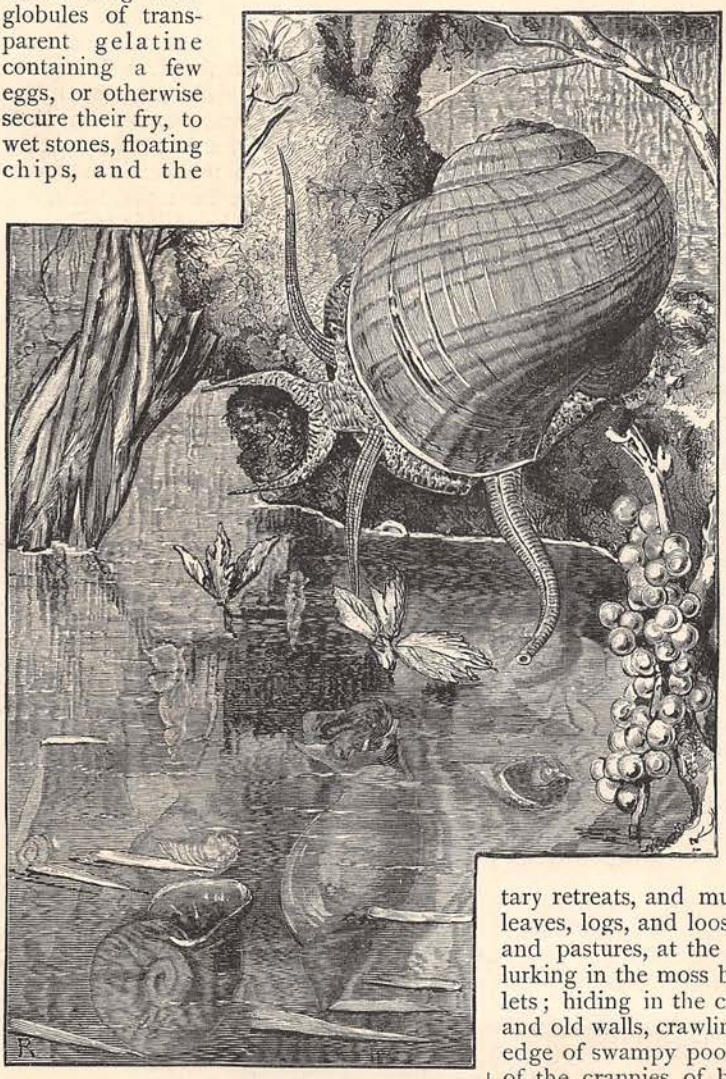
The pulmonates unite both sexes in one individual, but it requires the mutual union of two individuals to fertilize the eggs. The eggs are laid in May or June, when large numbers of snails gather in sunny places. When about to lay, the snail burrows into damp soil or decaying leaves, underneath a log or in some other spot sheltered from the sun's rays, and there drops a cluster of thirty to fifty eggs looking like homeopathic pills. Three or four such deposits are made, and abandoned. This is the ordinary method of the genus *Helix*, but some of the land and all the pond snails present variations. The ova of slugs are attached by the ends in strings, like a rosary, and many deposits are made during the year. *Bulimus* and other South American genera isolate each egg, which sometimes is as large as a pigeon's. *Vitrina* and *Suc-*



ANATOMY OF THE COMMON WHITE-LIPPED HELIX.

1. *a a*, eyes; *b b*, eye-stalks; *f*, foot; *m*, mouth. 2, a double row of teeth. 3, teeth highly magnified 4. same—side-view. 5, jaw. 6, tongue showing the surface covered with rows of teeth. 7, mouth.

cinea glue them in masses upon stones and the stems of plants, while the tropical *Bulimi* cement the leaves of trees together to form nests for their progeny. The pond-snails hang little globules of transparent gelatine containing a few eggs, or otherwise secure their fry, to wet stones, floating chips, and the leaves of aquatic plants. In *Neritina*, a brackish water inhabitant, the eggs, immediately upon being laid, become attached to the surface of the parent's shell, and when the embryo hatches the egg splits about the middle, the upper part lifting off like a lid. Lastly, the eggs of the stout *Paludinæ* of our western lakes and rivers are not laid at all, but the embryos hatch out in the oviduct.



THE HOME OF THE POND-SNAIL; EGGS OF THE APPLE-SNAIL.

Under the microscope the translucent egg-envelopes present a beautiful appearance, being studded with glistening crystals of lime, so that the infant within seems to wear a gown embroidered with diamonds. Ordinarily the young snail gnaws his way out in about twenty or thirty days after the laying of the egg; but eggs laid in the autumn often remain unchanged until spring; and, indeed, may keep many years if they remain cool or dry. The vitality of snails' eggs almost passes belief. They have been so completely dried as to be friable between the fingers, and desiccated in a furnace until reduced to almost invisible minuteness, yet always have regained their original bulk upon exposure to damp, and the young have been developed with the same success as from eggs not handled.

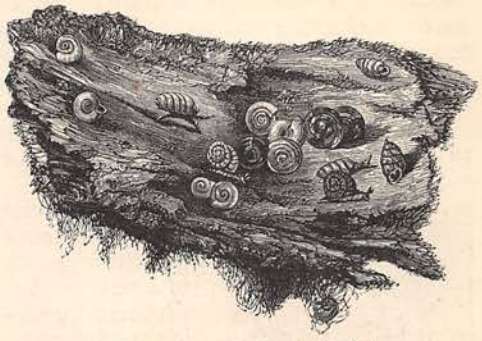
More or less wholly dependent on moisture, the young snails at once seek out their habitual solitary retreats, and must be looked for under leaves, logs, and loose stones in the woods and pastures, at the roots of fern-tufts and lurking in the moss beside mountain brooklets; hiding in the crevices of rocky banks and old walls, crawling over the mud at the edge of swampy pools, creeping in and out of the crannies of bark on aged trees, or clinging to the under side of the leaves. Some forms are so minute that they would not hide the letter o in this print, yet you will soon come to perceive them amid the grains of mud adhering to the under side of a soaked chip.

For fresh-water species, various resorts are to be searched. Go to the torrents with rocky bottoms for the paludinas and periwinkles (*Melania*); to quiet brooks for physas and coil-shells; to stagnant pools in the wet ooze and the reeking swamps for lim-

neas. I know no better place in the world for pond snails than the tule marshes of the Pacific slope, where hundreds of the great graceful *Limnea stagnalis* lie among the rotting vegetation, or float upside down at the surface of the still water. But some of the fresh-water mollusks remain most of the time at the bottom, coming to the surface only to breathe now and then, and to get their shells it is necessary to use a sieve-bottomed dipper, or some sort of dredge. When the water becomes low they bury themselves in the mud; it is therefore always profitable, late in the summer, to rake out the bottom of mud-holes where the water has entirely disappeared. Another plan is gently to pull up the water-weeds by the roots, and cleanse them in a basin of water. You will thus secure many very small species. Experience will quickly teach the collector where he may expect to find this and that kind, and that some caution and much sharpness of observation are necessary, since some species by their naturally dead tints, and others by a coating of mud, assimilate themselves so nearly to their surroundings as easily to be overlooked.

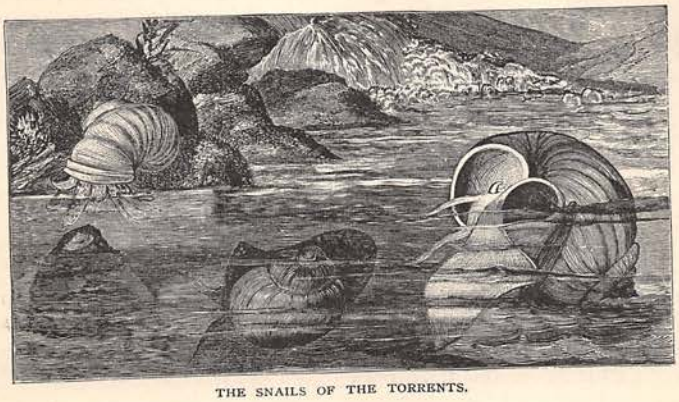
The shell is increased rapidly for the first two or three years, and the delicate lines of increment, parallel with the outlines of the aperture, are readily visible on all the larger specimens. Various other signs indicate youth or adult age in the shell.

Mollusks prosper best, *cæteris paribus*, in a broken landscape, with plenty of lime in the soil. The reason, no doubt, why the West India islands, the Cumberland mountains, and similar regions are so peculiarly rich in shells of every sort, is that a ravine-cut surface and a wide area of limestone rocks characterize those districts; on the other hand, it is not surprising that I found nine-tenths of the Rocky Mountain species to be minute, since the geology is represented by sandstone and volcanic rocks. Hot springs are very likely to be inhabited by mollusks, even when the temperature exceeds 100° Fahr., and the waters are very strongly impregnated with mineral salts.



THE UNDER SIDE OF A WET CHIP.

Snails are mainly vegetarians, and all their mouth-parts and digestive organs are fitted for this diet. Just beneath the lower tentacles is the mouth, having on the upper lip a crescent-shaped jaw of horny texture, with a knife-like, or sometimes saw-like, cutting-edge. The lower lip has nothing of this kind, but in precisely the same attitude as our tongue, is arranged a lingual membrane, long, narrow and cartilaginous, which may be brought up against the cutting-edge of the upper jaw. This "tongue" is studded with rows of infinitesimal silicious "teeth," 11,000 of which are possessed by our common white-lipped helix, although its ribbon is not a quarter of an inch long. All these sharp denticles point backward, so that the tongue acts not only as a rasp, but takes a firm hold upon the food. On holding the more transparent snails up to the light it is easy to see how they eat, and you can hear a nipping noise as the semi-circular piece is bitten out of the leaf.



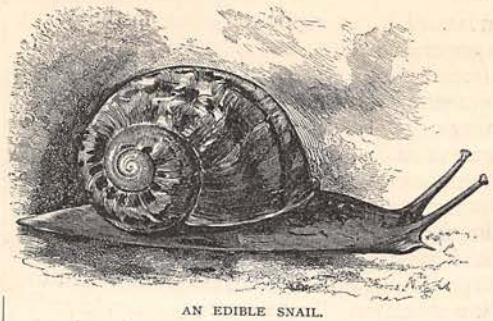
THE SNAILS OF THE TORRENTS.

Their voracity often causes immense devastation, particularly in England, where the great gray slugs will ruin a garden in one night, if the gardener is not daily on the watch. Our own strawberries sometimes suffer, but a border of sawdust, sand or ashes around the bed is an adequate protection in dry weather. In trying to cross it the marauders become so entangled in the particles adhering to their slimy bodies, that they exhaust themselves in the attempt to get free. They also are very fond of fungi, including many poisonous kinds.

SPORTIVE SLUGS.

At the first hint of frost our snail feels the approach of a resistless lassitude, and, creeping under some moldering log or half-buried bowlder, it attaches itself, aperture upward, by exuding a little glue, and settles itself for a season of hibernating sleep. Withdrawing into the shell, the animal throws across the aperture a film of slimy mucus, which hardens as tight as a miniature drum-head. As the weather becomes colder, the creature draws itself a little farther in, and makes another "epiphragm," and so on until often five or six protect the animal sleeping snugly coiled in the deepest recesses of his domicile.

This state of torpidity is so profound that all the ordinary functions of the body cease, —respiration being so entirely suspended that chemical tests are said to discover no change from its original purity in the air within the epiphragm. Thus the snail can pass without exhaustion the long cold



AN EDIBLE SNAIL.

months of the North, when it would be impossible for it to secure its customary food. The reviving sun of spring only interrupts this deep slumber, and the period of awakening is therefore delayed with the season, according to the varying natures of the different species. At any time, however, an artificial raising of the temperature breaks the torpor, the warmth of the hand being enough to set the heart beating. Extreme drouth also will cause snails to seal their doors hermetically, without even hanging a card-basket outside. This is to shut off the evaporation of their bodily moisture, and happens in midsummer; hence it is termed æstivation. Certain slugs *(Testacellidæ)* which have no shells are able to protect themselves under the same circumstances by a gelatinous appendage of the mantle, which, in case of sudden change of temperature, can be extended like an outer mantle, so to speak, from its place of storage, under the "buckler," and having wrapped themselves, they burrow into the soil. These carnivorous testacelles are the fiercest of all their race, and one might be excused for quoting:

> "But he lay like a warrior taking his rest
> With his martial cloak around him."

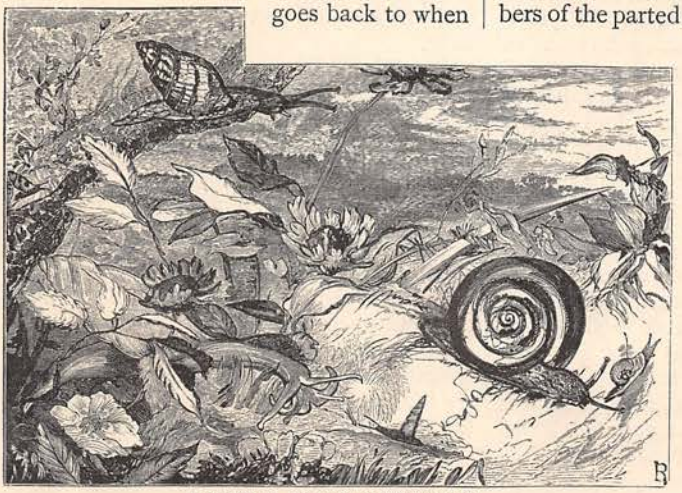
Snails are found in the most barren deserts and on the smallest islands all over the globe, reaching to near the line of perpetual snow on mountains, and restricted only by the arctic boundary of vegetation. There is a great difference between the snails of the tropics and those of high latitudes,—size, number of species in a given district, and intensity of color decreasing as you go away from the equator. But this statement must be taken in a very general sense.* Different

* Mr. A. R. Wallace's late work, "Tropical Nature," contained a long series of observations upon the colors of terrestrial mollusks among other animals. In two articles in "Science News," Vol. I., pp. 52 and 84, Mr. Thomas Bland studies Wallace's principles in their application to American snails, and finds that color is a matter of less account than it has hitherto been considered to be.

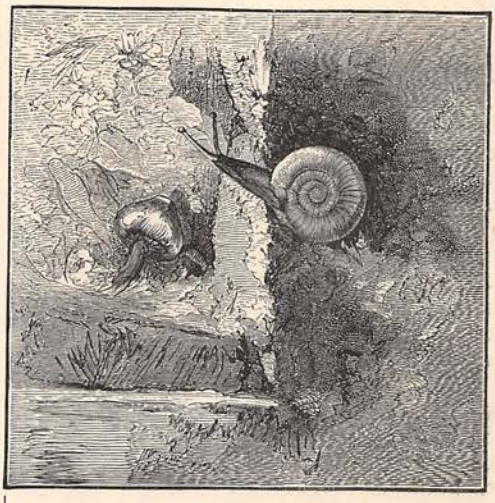
quarters of the globe are characterized by special groups of land mollusks as of other animals,—thus, *Achatinella*, with 300 species, is confined to the Sandwich Islands. But *Helix*,—the true snail,—with its many subgenera and 2,000 species, is absolutely cosmopolitan. The fresh-water forms, also, are spread everywhere, except in Australia, and flourish in cold countries, *Pupa* having the hardihood to live nearer the north pole than any other known shell. Yet it is a remarkable fact, that, however erratic and extensive may be the range of the genera to which they belong, the majority of the species of pulmonates of all sorts have an extremely limited habitat, in some cases comprising only a few square rods. A second noteworthy fact, obtaining in no other extensive group of animals, is, that many more species of land shells exist in the islands than on the continents of the world. Mr. A. R. Wallace accounts for this curious fact by explaining how certain influences make islands—particularly if long insulated—more productive than continents, and at the same time liable to be deficient in enemies to snails.

How has this curious distribution come to pass? How have seemingly impassable barriers been overcome, so that closely related forms are now found at the antipodes?

Snails are of domestic tastes—Appelles painted them as types of the praiseworthy housewife—and slow of pace, as a list of poetical persons are ready to stand up and testify; but they have had a long time in which to "get a good ready," first to start, and afterward to accomplish their travels, since their existence as a race goes back to when



HELICES IN HUMBLE CIRCUMSTANCES.



AN ALIEN IN THE CELLAR.

dark forests of ferns waved their heavy fronds over the inky palæozoic bogs. Distance disappears in the presence of such prodigious time. Lands like our Western plains, now an arid waste impassable to mollusks, in bygone ages were clothed with dense and limitless verdure, where every form of terrestrial life abounded. Between the present and even the laying down of those cretaceous sandstones that make the soil of our level plains, the Rocky Mountains have been elevated from an altitude at which any mollusk could probably have lived upon their summits, until now they may be a barrier to many species. Such changes may have happened anywhere, again and again, and thus the two halves of a community been divided. In succeeding centuries the members of the parted sections may have diverged in their development, until on this side of a mountain range, or desert, or sea, we now find one set of species and on that side another set, which belong to the same genera, and may in some cases be proved, as well as surmised, to have had an identical origin.

But the main explanation of their dispersion is undoubtedly to be found in a land connection once existing between the different islands of present archipelagoes, and between these and the

neighboring mainlands. It has been pretty satisfactorily demonstrated that during the glacial period the oceans must have been drained of water representing a universal depth of 1,000 feet, in order to construct the enormously thick ice-caps which covered the polar hemispheres. This would expose a vast area of shallows, before and since deeply submerged, across which snails might easily migrate to other latitudes; when, at the end of the glacial period, the melted ice reclaimed the shallows, the snails would be left colonized upon the high points now widely separated by water.

More casual circumstances have always contributed to this world-wide distribution. Snails frequently conceal themselves in crevices of bark, or firmly attach themselves to branches and foliage, and thus might be drifted long distances, since they are able to resist starvation for an immense period, and protect themselves against injury from salt water or excessive heat by means of opercula and epiphragms. Violent storms might frequently transport living shells a considerable distance; aquatic birds carry them or their eggs from pond to pond attached to feet or plumage.

The astonishing vitality of the snails in every stage of existence favors the theory that they endure such accidental means of travel and thrive at the end of it. Professor Morse records that he has seen certain species frozen in solid blocks of ice, and afterward regain their activity; and enduring an equal extreme of heat, where the sun's rays crisped the leaves for weeks together, without any bad effect. They have been shut up for years in pill-boxes, glued for years to tablets in museums, and yet a trifle of moisture has been sufficient to resuscitate them. They survive so well being buried in the ballast of ships that at every seaport, almost, you may find species imported in that way, which came to life when the ballast was dumped at the time of unloading. That birds occasionally carry them about is well verified.

Such are some of the methods of dispersion. Yet students are obliged to confess that the causes of the present puzzling geographical distribution of land shells are so complex that we can hardly hope to determine them with much exactness.

Snails, being great eaters, meet their just reward in being eaten. The paludine forms are sought after by all sorts of water birds, particularly ducks and rails; while the thrushes and other birds crush the shells of the land snails and extract their juicy bodies. The woodland birds, however, will not eat the naked-bodied slugs: the slime sticks to their beaks and soils their feathers; but the ducks seem to have no such dainty prejudices. Some mammals, like the raccoons and wood-rats, also eat them; insects suck their juices, and the carnivorous slugs prey upon one another. Lastly, man, the greatest enemy of the brute creation, employs several species of snails for culinary purposes. By the Romans they were esteemed a great delicacy, and portions of plantations were set apart for the cultivation of the large, edible *Helix pomatia*, where they were fattened by the thousand upon bran sodden in wine. From Italy this taste spread throughout the Old World, and colonies are yet found in Great Britain where the Roman encampments were. They are still regarded as a delicacy in Italy and France, the favorite method of preparation being to boil in milk, with plenteous seasoning. Frank Buckland says that several of the larger English species are excellent food for hungry people, and recommends them either boiled in milk, or, in winter, raw, after soaking for an hour in salt and water. Some of the French restaurants in London have them placed regularly upon their bills of fare. Thousands are collected annually and sent to London as food for cage-birds. Dr. Edward Gray stated, a few years ago, that immense quantities were shipped alive to the United States "as delicacies"; but I am inclined to consider this an exaggeration. The same author records that the glassmen at Newcastle once a year have a snail feast, collecting the animals in the fields and hedges on the Sunday before the feast.

Mr. W. G. Binney, for whom a sirup of snails was prescribed by two regular physicians in Paris in 1863, points out how old is the belief that land mollusks possess valuable medicinal qualities. In the Middle Ages the rudimentary shell of the slug acquired a high rank among the numerous bezoars and amulets which were supposed to protect the body from evil influences, and to impart health and activity. The accounts of these virtues, copied from one author to another, have perpetuated the early superstitions until it is difficult to overcome them by the light of the present day, when even in England, snails are supposed to possess curative properties in cases of lung trouble. A full relation of all the absurdities which gained credence, would form a curious and

marvelous page in the history of credulity. They have also, from very early times, been used in the preparation of cosmetic; and the water procured from them by distillation was much celebrated and employed by ladies, no longer than two or three centuries ago, to impart whiteness and freshness to the complexion.

In this country no such fanciful notions have ever gained credence. The snails are too habitually hidden to attract the attention of any but a few, and even when their existence is known, they are unfortunately regarded with such a disgust as would preclude any acceptance of them, either for food or medicine.

Yet why this disgust? Snails are of ancient race, vast variety, graceful shape, dignified bearing, industrious and peaceful habits, edible and curative properties; *quod erat demonstrandum.*

HOLY RUSSIA.

HAVE you heard how Holy Russia
Is guarded, night and day,
By saints gone home to the world of light,
Yet watching her realm for aye?—
Nicholas, Vladimir, Michael,
Catharine, Olga, Anna;
Barbara, borne from her silent tower
To the angels' glad hosanna;
Cyril, Ivan, Alexander,
Sergius, Feodor;
Basil, the bishop beloved,
And a thousand, thousand more.
They walk the streets of the city,
Waving their stately palms,
And the river that runs by the Father's throne
Keeps time to their joyous psalms.
But they do not forget, in their rapture,
The land of their love below;
Blessing they send to its poorest friend,
Defiance to proudest foe.
So in cloister, and palace, and cottage,
Cathedral, and wayside shrine,
We cherish their sacred Icons,
Token of care divine;
And with beaten gold in fret and fold,
And gems the Czar might wear,
And costliest pearls of the Indian seas,
We make their vesture fair.
We set them along our altars
In many a gorgeous row,
The blessed Savior in their midst,
And the Virgin, pure as snow;
And lamps we hang before them,
Soft as the star that shines
In the rosy west, when the purple clouds
Drift dark above the pines.
The deep chants ring; the censers swing
In wreaths of fragrance by;
And there we bend, while our prayers ascend
To their waiting hearts on high;
And our Lord, and Mary Mother,