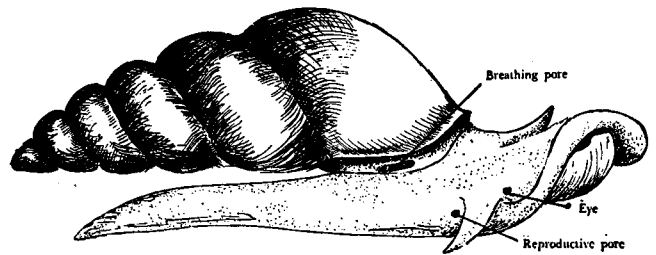


PARTS OF A LAND SNAIL



PARTS OF A POND SNAIL

# Mollusks of Land and of Fresh Waters

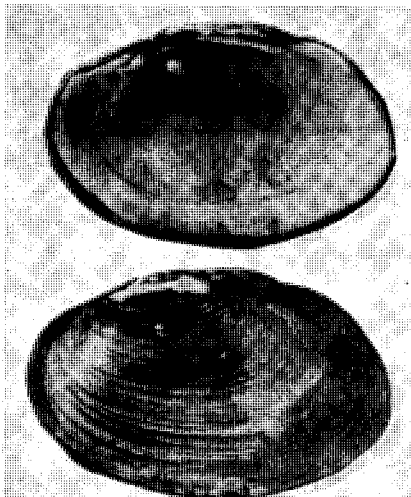
By E. LAURENCE PALMER

*This is the fifty-ninth in NATURE MAGAZINE'S series of educational inserts.*

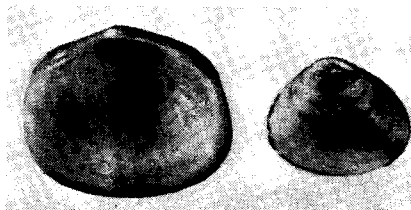
WHILE we hope that most of the inserts in this series will find a wide usefulness by persons of varied interests and over a wide geographic area, we deliberately try to consider the season in which the particular insert will first appear. Since this unit will appear in the winter it is appropriate that we consider some subject the illustrative material of which may be found in winter. Since it has been some time since we have had an insert dealing primarily with invertebrate animals, it is reasonable that we consider them at this time. Thus an insert on the mollusks of the land and of fresh waters meets our needs.

We have no thought of making the treatment of this subject primarily academic. It is probable that everyone who is reading these words is using parts of a land or fresh-water mollusk right now, or has used one recently. It is probable that everyone who reads this has seen some of these animals at some time, either in the markets, in streams, on sidewalks or elsewhere. Really, then, this insert will merely widen to a degree what you already know about some part of your environment.

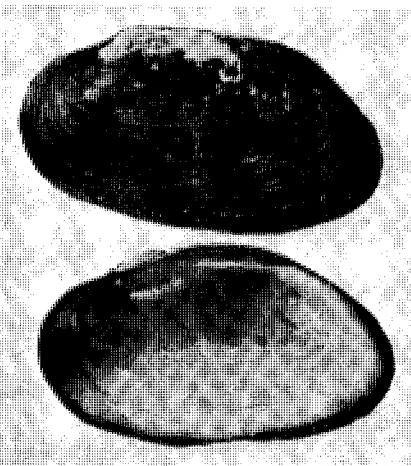
Surreptitiously or otherwise, examine the buttons that are on your shirt, or that hold your underwear to your body. It is possible that these "pearl" buttons show no sign of being composed of layers of material, that they are really made of some plastic or other artificial material. The chances are also good



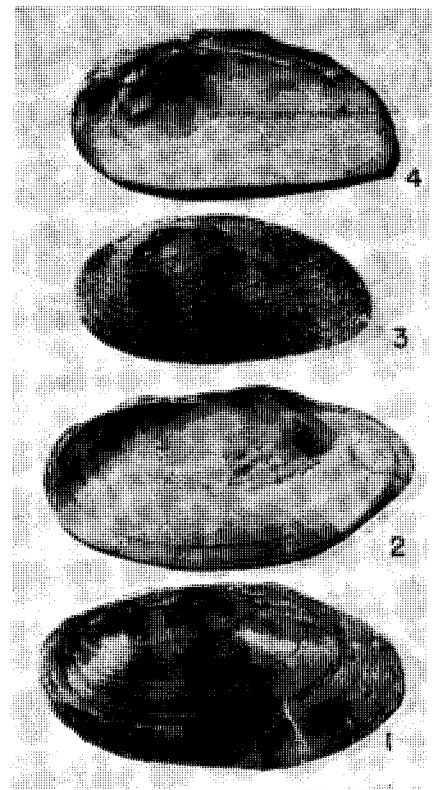
Fresh-water mussel, *Lampsilis siliquoidea*.



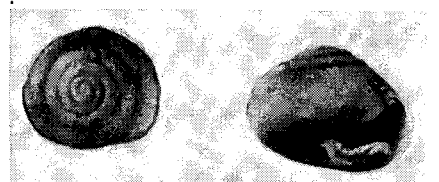
Fresh-water mussel, *Sphaerium fallax*.



Fresh-water mussel, *Strophitus rugosus*.



Fresh-water mussels. (1 and 2), *Anodonta grandis*; (3 and 4), *Elliptio dilatatus*.



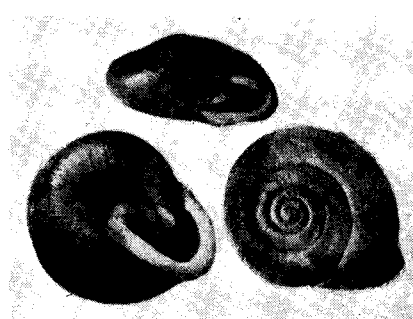
Land snail, *Ventrides ligera*.



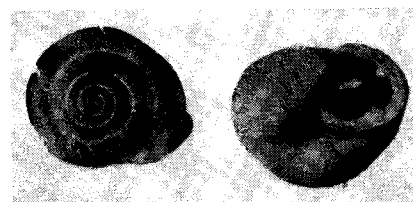
Land snail, *Haplotrema concavum*.



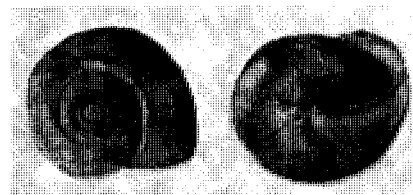
Land snail, *Allagona profunda*.



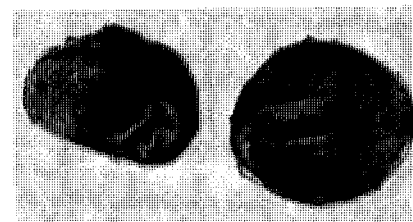
Land snail, *Mesodon zaletus*.



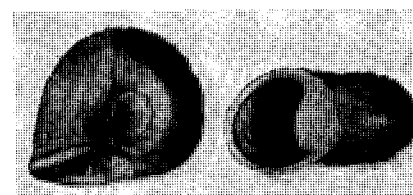
Land snail, *Triodopsis tridentata*.



Land snail, *Mesomphix inornatus*.



Land snail, *Stenotrema hirsutum*.



Pond snail, *Helisoma trivolvis*.

that the buttons may have been cut from the shell of some fresh-water mollusk that lived a most interesting life in the bed of some mud-bottomed stream that made its leisurely way through our countryside.

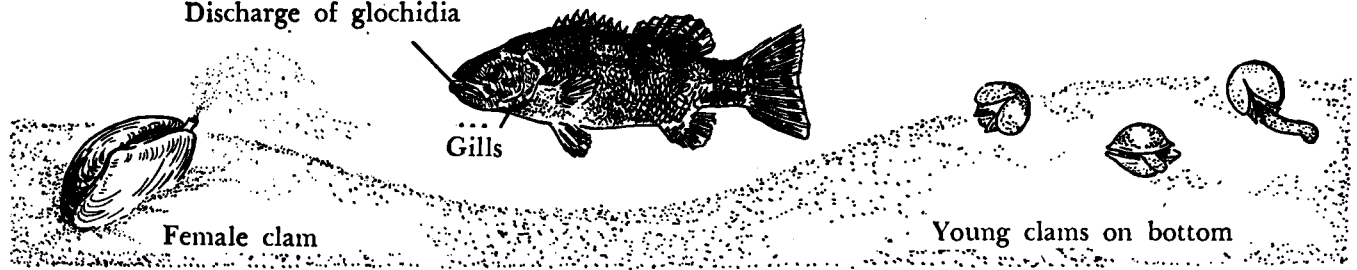
Sidewalks in summer are almost invariably netted with the gleaming trails of mucus left by slugs that prowled during the cool and moist night in search of their food. Muddy bottomed streams and lakes often show the trails of snails and mussels that made their way, with the help of a single foot, in the direction that may have suited whatever fancy they may possess. Markets in some of our larger cities may display baskets and trays well filled with good-sized, coiled snails that are roasted and eaten by those who have a taste for such things. If we become acquainted, directly or vicariously, with life in some of the areas where our soldiers had to go in World War II, we learn of the slugs and snails that swarmed through moist jungles, frequently seriously injuring human beings over whose bodies they crawled. We even may have learned that the disease schistosomiasis may be contracted through contact with snails closely related to some that live in our own environment. And so, whether we limit our interests to the places where we may live, or expand them to the places where we think we might want to live, there is reasonable certainty that a fresh-water snail or a land snail may enter your life. There is even some possibility that it may shorten your life, or the life of domestic animals that are valuable to you. We cannot, then, shove these animals aside as unworthy of our attention. Some of the world's happiest hobbyists center their spare time largely around collecting and studying these animals. Reference to these persons has been frequently made in my writings because my wife is a shell collector of the first water, and I have frequently learned the hard way that the best shells may be found in the most outlandish parts of the world, and that enough of them piled into a pack sack may pose a real problem for a weary hiker.

To a farmer a land mollusk may be a serious pest, and this holds whether the farmer raises food crops or is the type of farmer who belongs to a garden club and raises posies. Each may fight the pests by using poison or by making the pests exhaust their mucus by using barriers of dust or fine ashes over which the little beasties cannot crawl. A liver rot of sheep in some parts of the world is traceable directly to some right-handed pond snails that harbor parasites whose life history calls for an existence in the sheep and in the snails. You who listen to the radio know how widely the role of the shells of mollusks is emphasized as a part of a diet for chickens. Also you know that some of the soft parts of some fresh-water mollusks are used in chicken feed, being obtained as by-products of the industry that uses the shells of the animals to make the pearl buttons that hold your clothing together.

Mollusks of the land and of our fresh waters play an important role in the success of wildlife found on the land and in water. Teals, mallards, black ducks and even grouse feed freely on mollusks of land and water, even though in so doing some of these meals may be the means of introducing gapeworms and tapeworms into the systems of grouse, at least. The food of suckers that some of us may eat may at times be ninety percent mollusks, and even the common pumpkinseeds that youngsters young and old like to catch on worms or flies may depend on mollusks for at least half of their diet. Raccoons, skunks, shrews, muskrats, or minks may eat mollusks now and then, and some of these, of course, are important fur-bearers and important checks on the mouse population. Even frogs and snakes have been known to eat these animals, and one snake — the relatively common red-bellied snake — may feed largely on slugs such as attack a number of our garden plants.

In spite of the fact that man can find on land and in fresh waters mollusks that are edible we do not suggest a free experimentation in this realm. Too many of the waters may be too highly polluted to yield animals that may make safe food for us. Zoologists find that the bodies of our fresh-water mollusks serve as hosts for flukes, mites, worms and other creatures whose introduction into our bodies might probably best be avoided. Great concern is felt by health authorities lest the disease schistosomiasis spread and become established in the

Discharge of glochidia



Reproductive story in a fresh-water mussel

United States. The causal organism lives in pond snails closely related to the wheel snail or disc pond-snail, which has wide distribution in our waters. Infected snails free small animals that attack man, affecting seriously, or even fatally, the blood, spleen, liver, bladder and large intestines of the unfortunate human. There is some indications that snails bearing the organisms that cause this disease do not thrive in waters high in lime content. For this reason the addition of lime to waters in which suspected snails may live has been suggested as a control measure.

One should not conclude from what has just been written that the role of pond snails in our waterways is wholly bad so far as our health is concerned. Most pond snails have powerful appetites. They may consume great quantities of water plants, thus permitting a great penetration of sunlight to the lower levels of the water. This sunlight in itself may serve to reduce the dangerous qualities of the water involved. Certainly in some cases snails serve a most valuable function in reducing plants on drinking water supply reservoirs, and if it is true that, to a slight degree, they may contribute to pollution it ill behooves man to criticize the snail on this point.

While it is possible that plastics may well supplant fresh-water mollusks as a source of material for buttons, nevertheless the shells of these animals still are important to the button industry. A relatively recent survey of 45 stations in Michigan shows that when, in 1948, the shells were selling at \$40 a ton fishermen collected an average of 92 pounds an hour, which earned them a wage of \$1.84 an hour. In favorable situations yields as high as 247 pounds an hour were reported. While it is true that these fresh-water mussels may yield valuable pearls, the percentage of animals yielding pearls is so small that it is hardly economical to consider pearl seeking in mussels as a stable occupation. As is so often true in most lines of business, the greatest return in the long run comes not from the rare, high-priced unit but from the abundant sources of supply.

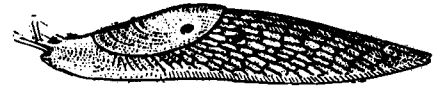
At times it has been proposed that one might enter into the culture of fresh-water mollusks useful in the button industry. Unfortunately this is not practicable, largely because of the manner in which these animals establish themselves in a given area on a stream or pond bottom.

The life history of at least one of the more important fresh-water mussels has been suggested in the chart section of this insert. Typically the mussel may free from its gills into the water a swarm of little mussels. These, by opening and shutting their shells, move rather freely through the water. When one of these larval animals finds itself, by luck or otherwise, on some fish it may attach itself to the fish and live on the animal as a parasite for a while. One of the most interesting things about this is that the different kinds of mussels may show a high preference for special kinds of fish. If, then, a larval mussel finds itself on the wrong kind of fish it does not develop as it should and may drop off and die.

Also interesting is the fact that some of the most valuable producers of shells important as button sources live as parasites on such fishes as gar pike, which to many fisherman are considered despicable inhabitants of their favorite waterways. This is only one of many bits of information that show us how important it is that we reserve judgment on the value of almost any plant or animal with which we may share space on the globe. Efforts have been made by research biologists to develop some way whereby the (Continued on page 32)



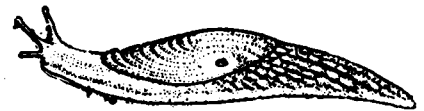
Slug, *Limax flavus*.



Slug, *Deroceras reticulatum*.



Slug, *Philomycus carolinianus*.



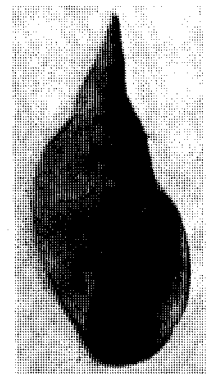
Slug, *Deroceras laeve*.



Slug, *Arion circumscriptus*.



Pond snail, *Physella gyrina*.



Pond snail, *Lymnaea stagnalis*.



Pond snail, *Pleurocera acuta*.



Land snail, *Anguispira alternata*.



Pond snail, *Campeloma decisum*.

PHYLUM	MOLLUSCA		
CLASS	Pelecypoda. Animals without heads but with two shells. Any movement of adults from place to place is by thrusting of single foot from between shells and from between parts of the mantle.		
ORDER	Prionodesmacea. Interior of shells with mother-of-pearl but in some species like porcelain. See exception below.	Teleodesmacea. Interior of shells like porcelain usually, never like mother-of-pearl.	
SUBORDER or further order characters.	Some members of the order do not have shells lined with mother-of-pearl but these are fastened to supports by flexible fastenings. Most of the fresh-water clams and mussels are free to move about at all times as adults and belong to the family <i>Unionidae</i> . The order included such well-known salt-water animals as the mussels, scallops, oysters, jingle shells, ark shells or blood clams. Some forms may be found in fresh water, in brackish water and in salt water.	As in the preceding order members of this order may be found in fresh water, brackish water or salt water. While some of the fresh-water forms in the preceding order may be attached to the bottom by means of a tough flexible thread (byssus) none of the fresh-water forms of this group possess that structure as adults. The order includes such well-known organisms as clams, cockles, angel-wings, ship-worms, razor clams, soft-shelled clams. While the sexes in members of the order are usually separate they are not in the species here considered.	
RELATIONS	For illustrations and descriptions of related marine forms see inserts 10 and 34 of this series in NATURE MAGAZINE.		For illustrations and descriptions of related marine forms see inserts 10 and 34 of this series in NATURE MAGAZINE.
FAMILY	Unionidae. Fresh-water pelecypods. In most members of this group eggs are carried in the gills of adult female. Eggs fertilized in late season may be freed following spring and may spend winter developing to free-swimming larvae that attach selves selectively to fish and develop as parasites on fish. In <i>Lampsilis</i> , described below, parasitic stage may last 3 weeks. Then animal assumes adult form, deserts fish and lives in mud. May require to 2 years to reach mature reproductive animal of 2-3 inch length from 1/100-inch animal that leaves the fish. Shells are valuable in making buttons and in chicken food and flesh may be used in chicken food. Essential role is that of scavenger and food for larger animals.	Cyrenidae. Most of these fresh-water clams have shells that are thin, usually greenish and the animals bear proportionately long, flattened feet, one foot to an animal, of course. Eggs are borne in the inner pair of gills and develop there until free to make their own way. This omits parasitic stage characteristic of preceding family and order. Young clams freshly freed from parent may have a byssus by which they suspend themselves to a handy support but this is lacking in adults. Animals often thickly crowded on stream bottom the shells of dead animals making the bottom almost white. Food is strained from water passing over the gills much as is the case in the preceding order.	
GENERA	The many genera in the family include at least 1,000 species of which about one-half are found in United States. Possibly reach greatest abundance in slow, mud-bottomed rivers such as are found in the Mississippi system.	While this is a relatively small family the genus <i>Sphaerium</i> , which may be common, may have over 70 species. Two of the genera, <i>Sphaerium</i> and <i>Pisidium</i> , here figured differ superficially in the shape of the shells as suggested below.	
SPECIES	<i>Lampsilis siliquoidea</i> . Mussel. Mucket. About 2" by 4". Shells nearly equal, with those of female more inflated to rear and generally shorter and heavier. Young may show greenish rays over yellowish cover. Old shells brown, smoothly polished.	<i>Anodonta grandis</i> . Shell to nearly 5" long or, rarely, more. Color, green to black with rays that are usually faint. Eccentric growth rings and irregular wrinkles near hinged region. Shell rather plump.	<i>Sphaerium fallax</i> . The swellings at the hinge (umbo) are directed away from the foot or at the shell middle. Shell is about 1/2 inch across, is fragile, clean-looking and with a suggestion of being triangular.  <i>Pisidium compressum</i> . Shell is minute, an adult not ordinarily exceeding 1/5 inch at greatest diameter. Species is brown or yellow and may be found in suitable environments in almost any part of the United States.
OTHER RELATIVES	In <i>Lampsilis</i> outer shell covering is bright colored. In <i>Elliptio</i> outer shell covering is dull and the outer gills alone carry eggs.	<i>Strophitus rugosus</i> . See illustration. Yellowish with dark rays outside and distinctly bluish white on inside.	These animals on occasion enter into diet of fishes and other animals of the environment.  There are about 60 species of the genus of worldwide distribution. About 20 of these are to be found in America.

MOLLUSCA

Gastropoda. Animals with a single, broad, flat foot, and usually a single, spirally coiled shell, with a distinct head bearing 1 or 2 pairs of tentacles.

Prosobranchiata. Shell opening usually closed.

Pulmonata. Easily characterized by presence of lungs and absence of gills. Both sexes in one animal. Shell opening not usually closed with an operculum.

Animals usually have heavy shells, one pair of tentacles, one pair of eyes and some bear a long, useful proboscis. Fresh-water representatives of Viviparidae bear living young.

Suborder Basommatophora. Fresh-water Snails. Animals with a single pair of tentacles that are hollow and do not retract. Eyes at base not at tip of tentacles. Reproductive pores usually on right side with male near tentacle and female near breathing pore further to rear. Shells delicate while preceding order were substantial. In next suborder there is one reproductive pore and it bears both sex organs. Fresh-water snails lay jelly-covered eggs; land snails shell-covered eggs. At least a dozen families of fresh-water snails including over 4,000 species. Some "fresh-water" snails may be found in brackish or even in salt water. See next page for treatment of land snails in related suborder.

See 10th and 34th insert for further help here.

We elect to present here representatives of 4 of the dozen families, each of which has a distinctive, easily recognized type of shell with variations that challenge the specialist.

Viviparidae. Shells conical or globose. Whorls rounded. Eyes on short stalks beside stout tentacles. In many, operculum that closes opening and protects animal is horny and sometimes this has a concentric sculpturing. Young remain in parent shell awhile after hatching. Members of family are widely distributed over the world.

Ancylidae. Shells thin and appear as cones rather than as spirals. Tentacles triangular and bear eyes at bases. Animals remain more or less fixed, apparently. Shell opening oval. Three jaws each covered with fine structures that assist in getting food. Animals easily overlooked on bottom of streams in which they live.

Planorbidae. Shell coiled disc or with greatly flattened spire. In reproduction, there is reciprocal exchange between sexes of two individuals. Eggs jelly-covered, laid in masses on supports under water and in typical species and under good condition hatch in 2-3 weeks. Growth continues to 5 years and life history is slow.

Physidae. Shell opening to left when spire points upward. Large opening in shell oval. Reproduction reciprocal. Numerous eggs laid in clear jelly masses on supports under water, hatch in 2-3 weeks. Growth slow, maturity being reached in 2 to 3 years. May be active in winter in representative species.

Lymnaeidae. Shells usually thin long-spined, with opening to right when spire points upward. Shell often expanded around opening. Foot rounded and flat. No covering over shell opening. Spherical eggs laid in jelly masses under water on support. Hatching takes place in few weeks and development is slow.

There are a dozen genera and over 200 species to be found in fresh water.

In the genus *Ferrisia* represented in North America there are at least 16 species.

There are some 170 species in the family with species here considered common east of the Rockies.

Over 150 species of wide distribution with some 20 or more known in the United States.

Several hundred species in the family in fresh waters in all parts of world and half hundred found in United States.

*Campeloma decisum*. One of 6 North American species. Just over 1 inch long, with solid cone and spire as long as opening. Surface shines. Dark green outside. Blue inside. Common in eastern and central United States.

*Ferrisia rivularis*, a horny, cone-shaped shell whose tip leans towards one side and is blunt. Length about 1/5 inch. Shell white on inside. River Limpet. Common in streams and ponds clinging to bottom.

*Helisoma trivolvis*. Wheel Snail. Disc Pond Snail. Shell yellow to brown, composed of 4 whorls. Opening large, with v-shaped angle above, to 1 inch wide and to 2/5 inch high.

*Physella heterostropha*. Left-handed Pond Snail. Tadpole Snail. Bladder Snail. Genus formerly known as *Physa*. Shell to 1/2 inch long and to 1/3 inch through usually with 4 unequal whorls, yellow to black. Reproductive notes above apply to this species.

*Stagnicola palustris*. Right-handed Pond Snail. Great Pond Snail. Shell to 1-1/5 inches long and 1/2 inch through. Color varies with lime content of water. Less active than members of Physidae usually.

Related *Viviparus* has thin shell of some 5 whorls. Over 100 species of worldwide distribution.

*Ferrisia parallelus*. Blunt ends, twice as long as wide, dark green. Parallel sides give name.

Some related species and genera may serve as host for organisms causing schistomiasis, but this species does not so function.

May be host to trematode worm (*Distomum atriventre*) that parasitizes frogs and toads. Serves as general scavenger of waterways.

May serve as intermediate host for some parasites such as *Distomum retusum* but major role is that of scavenger and fish food.

<b>PHYLUM</b>	MOLLUSCA			
<b>CLASS</b>	Gastropoda. See preceding page.			
<b>ORDER</b>	Pulmonata. Fresh-water and Land Snails. See previous chart. About 19,000 species. Members of the order possess lungs and lack gills.			
<b>SUBORDER</b>	Stylommatophora. The Land Snails. Land Snails differ most conspicuously from the water snails by their land habit and in the fact that they bear two pairs of tentacles all of which may be withdrawn into the body of the animal. The larger or longer pair is to the rear of the shorter pair and each tentacle bears at its tip an eye. Group includes about 15,000 known species of land snails belonging to some 20 families. Here we consider members of three families that lack a shell or conceal it, the Limacidae, the Arionidae and the Philomycidae and on the next page the families in which the snails possess external shells that are not hidden by the soft animal but may rather at times conceal the soft parts wholly or in part. Our snails are both native and introduced and the native species vary considerably in different regions. See next page.			
<b>GROUPS</b>	The Slugs. These animals lack or conceal their shells. Two of the families considered are represented by American species while the third contains species to be found in the Old World and in the New World.			
<b>FAMILY</b>	Arionidae. Members of this family show no external shell but a small shield-like structure (mantle) that appears forward on the back, contains a small, hidden, flat shell at its rear or numerous granules of lime. Breathing pore is at right margin of mantle in front of middle area. Foot has marginal furrows which are not to be found in members of Limacidae (next column).	Limacidae. There is no external shell but a small thin plate in the mantle. Mantle does not extend beyond the middle of body to the rear. Large breathing pore opens near rear right margin of mantle. Foot lacks marginal furrows. <i>Deroceras reticulatum</i> a typical slug has both sexes represented in an individual, reciprocal mating, lays 500-800 eggs per slug, each 1/8-1/16 inch long, white, laid at roots in bunches of to 50, hatch in 3 weeks to over winter with wintering slugs laying eggs that develop mature slugs by first October. Largely nocturnal, detecting food by scent. Can suspend selves by mucus threads from supports. May secrete great quantities of mucus and leave slime trails on sidewalks abundantly.	Philomycidae. Mantle covers length of body or at least 3/4 length. Breathing pore is on right side to front of mantle. Eyes borne on balls at end of longer tentacles. No mucus pore to the rear. Short tentacles are immediately below the eye-bearing tentacles which themselves are very short.	
<b>GENERA</b>	There are 6 genera in the family and some 15 American species. We consider here two genera, <i>Arion</i> and <i>Ariolimax</i> .	There are 20 genera and several hundred species in the family of which 6 genera are American. Two genera here considered are <i>Deroceras</i> and <i>Limax</i> .	There are 2 genera, <i>Philomycus</i> and <i>Pallifera</i> here considered. These include at least 5 American species.	
<b>SPECIES</b>	<i>Arion</i> is an Old World genus of some 25 species. Back is not keeled but bears rows of elongate tubercles. <i>A. conscriptus</i> is 1 1/2 inches long, is shown in illustration and is often common in gardens usually under loose stones. <i>A. hortensis</i> is to 2 inches long, gray, yellow or black.	<i>Deroceras reticulatum (agrestes)</i> is 1 to 2 inches long, rather stout, with pale brown or yellow body with pale gray border around pore, black eyes, with dark line behind each to mantle. Rests as creamy ball under grass on damp ground but extends body and head readily when taken into hand. An Old World species.	<i>Limax maximus</i> is to 6 inches long when extended, with keeled back ashy gray to light brown, with black or brown stripes or blotches, with foot dirty white. Mantle large, oval, with breathing pore to rear on right side. Tentacles short and blunt. Eyes on swellings on tentacle tips. Relatively common.	<i>Philomycus carolinianus</i> . To 4 inches long, with flattened body rounded to rear, with white or yellow back with irregular brown or black spots. Characteristically gives off very sticky mucus when handled. Found in forested areas often with many individuals near each other. Foot is whitish. Mantle covers practically whole body.
<b>OTHER SPECIES</b>	<i>Ariolimax columbianus</i> , to 6 inches long, often blotched with black. Found in damp forests of the Northwest.	<i>Deroceras laeve</i> , a native species is under 1 inch long, bluish to brownish, slender, with black eyes on ends of slender tentacles.	<i>Limax flavus</i> to 4 inches long, narrower than <i>L. maximus</i> , with long slender tentacles bearing eyes, yellow brown, with bluish head and narrow yellow foot.	<i>Pallifera dorsalis</i> is under 1 inch long. Mantle covers rear 3/4 of body instead of whole body as in <i>Philomycus</i> or front part of body as in <i>Deroceras</i> .

MOLLUSCA

Gastropoda. See preceding pages.

Pulmonata. See preceding pages.

Stylommatophora. The Land Snails. On the preceding page we gave the general characters of this suborder together with a treatment of representatives of three families of slugs. In wet seasons slugs may be serious pests in gardens. Fine ashes about plants cause them to secrete mucus even to death or they may be poisoned by stale beer or Paris green. On this page we consider five families of land snails out of at least twenty which include some 15,000 species. An excellent though restricted reference on land snails is "Fieldbook of Land Snails" published by Illinois Natural History Survey. Some land snails are carnivorous but most are scavengers or plant eaters. Some carry flukes and other parasites dangerous to man but have a limited distribution. The nature of the shell may vary with the amount of lime available. Most serve as food for some birds and mammals such as shrews and some mice.

The Land Snails here considered include the Polygyridae of some 30 genera and some thousands of species, the Endodontidae with 4 American genera, the Haplotrematidae with 12 American species all but one from the West Coast, and the Zonitidae of 65 American species and the Succinidae of 6 genera.

<p>Polygyridae. Shell with lip swollen and reflected at edge. Body capable of being completely withdrawn into shell, granule-covered and 2 times as long as shell diameter. Shell has 5 to 7 whorls. Opening has or lacks teeth. Foot lacks marginal grooves. Young and immature lack recurved lip of shell characteristic of adults. Shell diameters in family vary from 1/2 to 1 1/2 inch.</p>	<p>Endodontidae Lip of shell not reflected or swollen as in Polygyridae. Shell dull, opaque, brown, in some cases there being streaks that are vertical or bands or sometimes uniform coloration. Eye-bearing tentacles are long and slender and other pair short and inconspicuous. Shell-size varies in species from 1/16 to over 1 inch in diameter. Sculpture usually like ribs across whorls.</p>	<p>Haplotrematidae. Lip of shell not reflected as in Polygyridae. Shell polished and smooth as in Zonitidae but unlike Endodontidae. Spire flattened rather than rounded as in Zonitidae. Shell has 5 whorls when mature, a relatively large opening and is carried well to the rear of the extended animal and shows reddish-orange mantle cover at edge. Body gray forward and orange to the rear.</p>	<p>Zonitidae. Lip of shell not reflected as in Polygyridae. Shell with a smooth surface unlike Endodontidae which is dull. Spire is rounded unlike the practically flattened spire of Haplotrematidae. Color varies but surface sculpture is fine. Shell may cover animal completely though extended animal is twice as long as shell is wide. Shells vary from 1/16 to 1 inch diameter.</p>	<p>Succinidae. Amber Snails. Shells thin, with small spire, large opening, higher than broad, without recurved or thickened opening margin. Opening occupies at least 1/2 length of shell. Animal cannot be contained within the shell and is blunt forward and tapering to the rear. Body is yellow to black, mottled or streaked and varying in season being darker in spring or even after a rain. Leaves strong slime trail in its train.</p>
<p>Of over 30 genera we elect to consider two, <i>Triodopsis</i> sometimes included in <i>Polygyra</i> and <i>Helix</i>.</p>	<p>Of 4 American genera we consider two, <i>Anguispira</i> and <i>Helicodiscus</i>. Other genera include <i>Discus</i> and <i>Punctum</i>.</p>	<p>Of a dozen American species all but one are limited to Pacific Coast areas. Family is essentially American.</p>	<p>Over 100 American species in this family that has world wide representation.</p>	<p>Of some 200 species about 25 are to be found in North America. Related family <i>Bulimulidae</i> has brown marked surface and more southern range.</p>
<p><i>Triodopsis albolabris</i>. White-lipped Land Snail. Shell 1 1/2 inch of 1 1/2 low whorls with lip much whiter than brown shell. Small spherical eggs laid in moist places in May may hatch in 20 to 30 days and develop into mature individuals in 2 years. Avoids sun.</p>	<p><i>Anguispira alternata</i>. Striped Wood Snail. Shell about 4/5 inch in diameter, conspicuous because of irregular dashes of brown on light yellow background. Found in wet or dry places under bark sometimes up to 15 feet above ground in standing timber. Banded Snail.</p>	<p><i>Haplotrema concavum</i>. Shell about 3/4 inch in diameter, whitish when mature but greenish when young or almost transparent. Most common as solitary individuals on ground of hardwood forest. Carnivorous and has thorn-like teeth on tongue. Tiger Snail.</p>	<p><i>Ventridens ligera</i>. Shell diameter to about 1/2 inch with height about 3/4 the diameter, either with teeth at shell opening or lime deposits inside shell. Shell yellow, horn-colored. Body black or slate-colored above and paler to rear and beneath.</p>	<p><i>Succinea ovalis</i>. Marsh Snail. Amber Snail. Shell about 3/8 inch long, pale yellowish olive, with opening to right resembling a sugar scoop. Found in wet spots on plants, near but not commonly in water, under sticks, stones and logs or on plant stems above ground. Eggs laid where sun cannot reach them.</p>
<p><i>Helix aspersa</i>. Edible European Spotted Snail. Shell 1 1/2 inch, brownish yellow with irregular spots. Roasted in shell and eaten from it.</p>	<p><i>Helicodiscus parallelus</i>. About 1/8 inch in diameter, with very low spire of 4 whorls, with parallel ridges following direction of whorls.</p>	<p><i>Haplotrema vancouverense</i>. Western. Yellow with a shell diameter of about 1-1/5 inches.</p>	<p>In this family the eye-bearing tentacles are remarkably longer than the other pair.</p>	<p><i>Bulimulus dealbatus</i> in related family is about 1 inch long, white and often found in great concentrations on the ground.</p>

(Continued from page 27) mussels could be raised without the necessity of going through the stage as a fish parasite. If this could be done, a farmer controlling a mud-bottomed slough might conceivably plant in it a crop of mussels much as he now plants his corn and potatoes. When this planting must be left to the vagaries of the wanderings of some fish the technique smacks of the haphazard. As such it will not ordinarily be considered as either practicable or popular.

One should not assume from what was just written that all two-shelled mollusks found in fresh waters depend on fish to move them far from their parents while they live on the fish as parasites. As the chart section will show, some produce young by nursing them in their own gills, freeing the young clams when they are proportionately larger than their parasitic relatives. Naturally, when this takes place, the number of young produced is smaller than is the case with the fish-parasitic group. Few of these fresh-water clams attain any considerable size, and none could be used as a basis for button making. Since they are not widely distributed when they leave the parent, they often find themselves living closely with their relatives. Sometimes this means that the bottom of the stream where these animals may be found may be thickly crowded with shells of the living and of the dead animals. Some of these small clams may enter into the diet of some fishes, but on the whole they probably play an insignificant part in the economy of their environment. This does not mean that they lack interest for the inquisitive biologist, however.

We have in the illustrations here two sketches showing the important external features of pond snails and of land snails. The land snails, of course, include the slugs, whose shells may be absent, rudimentary or only slightly developed. We cannot here consider extensively the many kinds of mollusks you may find in your neighborhood, although we do show you pictures of representatives of a few important groups.

Fundamentally the land snails and pond snails necessarily differ from each other in their respiratory apparatus. The animal that lives on land naturally must breathe air and it therefore has lungs. The animal that lives in water may, by the same token, be expected to use lungs. They do not challenge this simple logic. But the possession of lungs and of gills may not be recognized easily by a superficial examination of the animal. What you can observe easily is that the land snails have two pairs of tentacles, while the water snails have but a single pair. One pair of the tentacles borne by the land snails holds the eyes at the tips. Since these tentacles may be raised or lowered, the eyes, too, may be raised or lowered, making it unnecessary for the animal to rear any other part of the body to extend its range of vision.

Since the pond snails lack one pair of tentacles it is not surprising to find that, in these animals, the eye is borne at or near the base of the tentacles. One might assume with some safety that sight may not be so important to a snail as may be some other senses, and it is quite probable that the set of tentacles to be found in

both the pond snails and the land snails may be sensitive to stimuli other than light. It is also quite probable that sensitivity to these other stimuli is what is really important to the snails.

An examination of the sketches here, or of some land or pond snail, will show that the breathing pore in each is relatively close to the shell. In the same region, close to the edge of the shell, may be found a "mantle collar" that produces the material that adds to the size of the shell. You probably will best learn about the feet of snails by direct observation. Since the animals may crawl freely on glass in air or underwater, you can usually look through the glass and get some idea of what is going on. Not a few of the snails may lay great importance on mucus that they secrete. This may make a trail and provides a suitable medium in which the muscles of the single foot may be put into play. In the land snails this mucus may be used to suspend the animals from trees. In pond snails it may be used to suspend the animal from water plants, or even, at times, from a float of mucus that is left at the surface of the water. If you have never watched the movements of the muscles of a snail through glass I have no desire to spoil your pleasure by attempting inadequately to describe it.

Some of our snails possess a conspicuous structure with which they plug the opening in their shell when they withdraw to its protection. This "operculum" is most conspicuous in some of the snails that closely resemble the periwinkles that cover rocks at the tide lines on our sea coasts. Interestingly enough, many of these reproduce not by laying eggs but by giving birth to living young that have developed in the parent to such a point that they can maintain their independence as soon as they leave the parent. Among the snails that lay eggs there is, as one might expect, a relatively common difference between the land snails and the pond snails. Since the eggs of the pond snails will be surrounded by water there is no need for a shell that will prevent them from drying up. Usually the eggs of these pond snails are surrounded by a mass of jelly, one purpose of which may be to protect the young snails from attack by some of their enemies. The land snails needing to have their eggs protected from the dry air may well have shells that help them provide this safety.

In this story of land snails and other mollusks we have not touched on the fun that can be derived from the collection of the creatures. Some of the tree snails of the warmer regions are truly things of beauty, and there are those who find even greater satisfaction in collecting shells from trees than in the collecting of the beach-comber branch of the guild. So you may see, whether your interest is in wildlife, in farming, in health, in industry, in food, or in fun, these animals have something worth while to offer. Here is hoping that you do not pass up the opportunity to know them better. It is quite probable that sometime we will have another insert dealing with this group, and when that time comes we may well emphasize the tree snails.