rent. Most of the inorganic colloids move toward the positive electrode, and Biltz has discovered that colloids of opposite polarities precipitate each other.

Like the true suspensions, again, most inorganic colloids are precipitated by salts. Salts of trivalent metals (alum, ferric sulphate) are eight times as effective as salts of bivalent metals (barium chloride, copper sulphate), and fifty times as effective as salts of univalent metals (common salt, potassium iodide). The clarifying property of iron and aluminium salts has long been known and utilized. The Mississippi, Nile, and other rivers carry in suspension immense quantities of solid matter which the salt sea water precipitates at their mouths as bars and deltas. Schloessing suggests that the humus layer of the soil would be quickly washed away by rain but for the decomposition of organic matter with the formation of carbonic acid, which, like other acids, possesses great clarifying or precipitating power.

The gelatine-silver emulsion with which photographic plates are coated is comparatively insensitive until it has been "ripened" by prolonged heating, which agglomerates the very fine particles of silver salt into larger ones. In my opinion the process would be greatly accelerated by the addition of a salt of a bivalent or trivalent metal.

Most organic colloids differ from inorganic colloids and suspensions in remaining unaffected by salts of univalent metals—at least, by the mere traces, often not to be detected chemically, that suffice to precipitate suspensions. Some are not affected even by salts of bivalent metals. Organic colloids also present a different appearance under the ultramicroscope, an albuminous solution showing a mass of connected particles, which separate, diminish, and finally vanish only after fermentation or copious dilution. This agrees with the theory advanced by Quincke, thirty years ago, that organic colloids form a sort of network, like a sponge or a mass of foam, and consist of dilute solutions imprisoned by walls formed of concentrated solutions. Buetschli has extended this theory to protoplasm and applied it to the explanation of vital processes.

Neisser and Friedmann, as well as the writer, have shown that bacteria in suspension behave like organic colloids, being precipitated only by such salts as precipitate albumen and unaffected by common salt, barium chloride, etc. The bacterium was found to have an albuminous envelope which protected it from precipitation, and certain inorganic colloids which behave like organic ones were found to be similarly protected —for example, Paal's "bismuthose."

The albuminous envelope of the bacterium is susceptible of a curious modification. Serum from an animal infected with typhus bacilli precipitates typhus but no other bacilli, and similar laws hold for cholera and dysentery. This phenomenon, known as "agglutination," forms the basis of Vidal's diagnostic test for typhus. Now, Bordet has discovered that this agglutination and precipitation occur only in saline solutions, showing that the effect of the serum has been to make the bacilli more closely resemble inorganic particles in suspension. In a similar way, serum from a rabbit previously inoculated with bovine serum forms a precipitate with bovine, but with no other serum. A similar specific "precipitin" reaction exists for each warm-blooded species, but the precipitation occurs only in saline solutions.

We see, therefore, that the precipitation of colloids and suspensions by salts, a phenomenon whose importance has only lately been appreciated, plays a prominent part in the formation of the earth's surface and the life process of the organic cell.

"THE SCIENTIFIC AMERICAN BOY."

Every typical American boy is pretty much of a "Yankee genius," no matter what part of our great country he hails from. He can always be depended upon to provide his own diversions, even out of the most limited resources. This is an excellent trait, and should be developed to the fullest extent because of its bearing on the future career of the boy. "The Scientific American Boy," by A. Russell Bond, has been written for the purpose of stimulating this resourcefulness in boys. Genius is not a subject that can be taught, but is rather a faculty that must be developed. "The Scientific American Boy" is, therefore, not a book of instruction, but is rather a story of the doings of a club of boys, written in such a manner as to awaken the interest of the readers and induce them to emulate their example. The scene of the narrative is an island on the Delaware River, where the club spends several vacations in camp. Under the leadership of "Bill," who is the "Scientific American Boy," and with the occasional assistance of Bill's Uncle Ed, who takes a great interest in the boys, the club proceeds to develop the resources of the island, providing for their needs out of the materials at hand, and building the greatest variety of useful devices and contrivances for their own amusement and diversion. All the acts of the club are chronicled in detail, complete working drawings being given in every case, so that they can, if desired, be exactly reproduced by any American boy of average intelligence. The subjects covered are quite varied. The boy campers' needs are supplied by directions for making tents, straw huts, log cabins, caves, and the like, and a chapter is devoted to camping outfits. Complete instructions are given for making half a dozen different kinds of skate sails, and a large number of snow shoes and skis, besides sledges, toboggans, ice boats, and scooters. Among the miscellaneous subjects may be mentioned scows, canoes, land yachts, and the like. A number of subjects may be classed under the head of Engineering. These are surveying, bridge building, heliographing, wigwagging, how to build a gravity railroad, a windmill, and a waterwheel. Considerable space is devoted to bridge building, simple directions being given for making six different types of bridges, including a simple cantilever bridge. The latter is illustrated with photographs showing a full-sized cantilever bridge of 12-foot span, which was actually built by four young boys, according to the instructions given. The volume is handsomely bound, and contains 320 pages, well illustrated with 320 drawings and 18 half-tone page plates.

SOME CURIOUS USES OF AMERICAN WOODS.

BY L. LODIAN.

The giant sequoias of California, thousands of years old, have been preserved to this day because of their enormously thick bark. From time to time, in the course of ages, forest fires have swept through the big-tree lands, destroying everything, yet only scorching for a couple of inches' depth or so the almost fireproof bark. The flames having carbonized that much of the bark, could not penetrate farther; for the carbonized portion formed an absolutely fireproof covering for the remainder of the interior bark.

In the felling of the giant redwoods for timber, tons upon tons of the foot-thick bark would accumulate as a result of the cutting up of the giants. It was often found seriously in the way, interfering with the removal of the logs; otherwise, it would have been allowed to remain on the ground until it rotted. So there was nothing to do but burn the unsightly heaps.

But one day many years ago, a shrewd Connecticut Yankee named Atkinson, a woodturner by trade, began to think about this waste a bit, during his prolonged residence in his new home on the Pacific slope. True, the bark was too soft to make wooden nutmegs out of it, but it might do for something else. So he thought and thought; and in the course of time had produced a whole variety of useful articles from the hitherto wasted bark; dubbed it "atkinsos," or vegetable asbestos, and made an honest living for years therefrom. The industry spread; and now redwood-bark articles are—in fact, always have been—common property for anybody to make in the West or East. Almost all Pacific State homes have examples in their rooms of the useful articles made from this bark, of which there are two kinds, soft and hard.

Some of these redwood-bark articles are pin cushions, pen wipers, table mats (for receiving hot plates), flatiron mats (to prevent scorching), bathroom non-absorbent mats, fishing floats, temporary corks, life-buoy filling, "cork" jackets, cold-storage insulation, house sheathing, heat insulation (will burn under great heat if attacked both sides, but is about six times a more efficient heat-insulator than woven asbestos). Also coin mats, moisture-proof match safes, bicycle handles, silk-hat brushes, chair-seat mats, sound-deadening insulation, mattress fillings, cork-carpet substitute, and a variety of other uses.

The bark is entirely odorless, of a rich brown color, and is singularly non-absorbent. A piece kept under water for a month will absorb no more moisture than a piece of cork. It has a short, brittle fiber—cork has no fiber whatever—and is consequently not so liable to brittly snap as is the *Quercus suber*. It lacks, however, the elasticity and local toughness of cork, and is slightly heavier in its specific gravity, but is much more easily worked in manufacturing into articles.

Curious Natural Brushes.—These are produced from one of the palmetto species on our southern coasts. The "bristles" of the brush and the solid wood portion thereof are all one. No "coming out" complaint with those bristles!

The brushes are made in two ways. The extreme root of the tree is a mass of fibers. These are cut off close up to the trunk, which is sawn off about an inch up, and the slab is cut up into simple brushes for the bath, toilet, hair, etc. Another couple of inches will be sawn off the trunk, well soaked, and the pithy wood jagged out from between the fibers by a crude kind of steel or jagged comb. Once the pith is thoroughly dried and hard, it will stand immersion in hot bath waters without softening.

These curious natural-made brushes are only locally known, and are occasionally sold to tourists. They are unknown to commerce in the American brush trade. No attempt has ever been made to establish any industry in them. Yet they are possibly the longest-lived brushes extant. A bath brush used for half a dozen years looked, true, as if it had had plenty of use, but was good enough for another half dozen years.

The fibers and wood are of a bright sandy hue, and, if kept clean, almost preserve throughout their agreeably slight odor, reminding one of dried corn leaves.

SCIENCE NOTES.

The sweet wines generally produced in this country are those in which none, or only a part, of the sugar in the grape has through fermentation been converted into alcohol, the fermentation being prevented or checked at any desired stage by the addition of grape brandy. This adding of alcohol to stop fermentation is called "fortifying." Of the sweet wines, ports and angelicas are the two kinds most largely produced and consumed in this country.

The symbiotic relationship of fungus and root to *Mycorhiza* offers a fine opportunity for careful investigation. The studies which have already been made serve only to put the reader in a state of hopeless confusion. The universal phenomenon of irritability as manifested by tropic phenomena has been a fruitful field of investigation. The general methods of irritable response have been determined; and the best work of such investigators as Haberlandt, Noll, Czapek, Newcombe, MacDougal and others has more recently been directed to the deeper problems relating to the internal mechanism of response and to the exact methods of transmission of the stimulus, as well as to the immediate changes in the cells affected.

The U. S. Biological Survey is engaged in mapping the natural life zones and crop belts of the country for the primary purpose of aiding the farmer to decide what crops are likely to prove a commercial success in his locality. The work is done by studying the geographic distribution of native animals and plants in all parts of the country, and plotting the results on maps showing the distribution of each species. In order to obtain the necessary data the status of the various species must be determined by office study and their ranges laboriously worked out in the field. The progress already made is gratifying, and a large number of maps are now approaching completion. The individual-species maps serve as the basis of a composite map showing the natural transcontinental belts and their more important subdivisions.

The development of viscous flow is largely on the experimental side, particularly for solids, where Weber (1835), Kohlrausch (1863, *et seq.*) and others have worked out the main laws. Stokes (1845) deduced the full equations for liquids. Poiseiulle's law (1847), the motion of small solids in viscous liquids, of vibrating plates and other important special cases, has yielded to treatment. The coefficients of viscosity defined by Poisson (1831), Maxwell (1868), Hagenbach (1860), O. E. Meyer (1863), are exhaustively investigated for gases and for liquids. Maxwell (1877) has given the most suggestive and Boltzmann (1876) the most carefully formulated theory for solids, but the investigation of absolute data has but begun. The difficulty of reconciling viscous flow with Lagrange's dynamics seems first to have been adjusted by Navier.

The overcrowding of the medical profession in Germany is a matter of grave concern. There are now in the empire 29,200 physicians, which doubles the number found in 1876. In other words, there is one physician in Germany for every 1,700 inhabitants. In the city of Berlin 46 per cent of all the physicians have an income of less than $700, and five per cent of the whole number do not have a sufficient income to return it for taxation. On the other hand, in the legal profession in Germany 80 per cent of the lawyers have an income exceeding $2,000. It is estimated that the preparation of a man for the duties of a physician in Germany costs about $6,000, and thus it is seen that the income is often less than 10 per cent of the fixed charge on the capital invested. This leaves practically nothing for the reward of his own personal services, nor for wear and tear.

Within the last decade there has been an enormous increase in our manufacturing interests, so that it is not surprising to find that the output from the factory now constitutes 65 per cent of our annual production of wealth. A study of the figures presented to us in the annual reports of the Department of Agriculture and other branches of the government dealing with agricultural development alone, without reference to statistical matters shows that coincident with the development of factories in a community there has been a corresponding increase in the value of farms and farm lands, as well as of the products of the farm. The great era of manufacturing upon which this country is now entering is bound to have a beneficial effect upon agriculture, for aside from the great possibilities of other industries, it is clear that as factories continue to increase in number and enlarge their output, agriculture must necessarily grow to meet these conditions.