

rectly on the rollers, dispenses with all auxiliary devices. The apparatus is designed for use in large stores, offices, factories and the like, and is also adapted to record the rounds of a night watchman.

#### PORTO RICO AND THE REDUCTION OF SAN JUAN.

Last week it was our pleasing duty to chronicle the decisive victory of Manila Bay, we are now able to announce that the reduction of San Juan, the fortified capital of Porto Rico, by Admiral Sampson was attended by few casualties and no injury to the fleet. The squadron, consisting of the flagship "Iowa," the "Indiana," "New York," "Terror," "Amphitrite," "Detroit," "Montgomery" and the "Porter," in search of the Spanish fleet, arrived at San Juan, Porto Rico, at five o'clock in the morning, May 12. The "Detroit" led the squadron to the harbor, and the "Iowa" fired on Morro fort and the "Detroit" followed at short range, and the others in the order named, with the exception of the "Montgomery," steamed in an ellipse before the forts. The first round of the firing was aimed too low, but in the second round the ships got the elevation and silenced the guns of Morro. They also fired upon the town and repeatedly drove the Spaniards from their guns. The forts mounted seven good guns, but their marksmanship was wretched. They fired hundreds of shots, but they only hit the "New York" and the "Iowa" once each, doing no damage except to kill one seaman and wound six others. The bombardment lasted three hours and the fortifications were completely reduced, and havoc was wrought in the city by the shells of the fleet. Admiral Sampson retired to Mayaguez after the bombardment, as he had no intention of capturing the town, his intention now being to engage the Spanish fleet.

We will now consider the island of Porto Rico and will glance briefly at its history. Our engravings are made from photographs recently taken in the island and show some of the scenes in this tropical land.

Porto Rico, the fourth in size of the Greater Antilles, lies 70 miles west of Hayti and it is about a thousand miles, as the crow flies, from Havana to the harbor of San Juan du Puerto Rico. It forms an irregular parallelogram, 108 miles long and 37 miles broad; its area is 3,550 miles, which is less than that of the island of Jamaica, or about seven-tenths that of the State of Connecticut. The northern coast is rugged, and at the eastern end of the island it is very high and the cliffs extend in almost an unbroken line from Cape San Juan to the port of the same name. Porto Rico is traversed from east to west by a range of hills which are so situated that the streams flowing north are much longer than those flowing to the south. The highest part is near the northeast corner, and the highest peak, Yunque ("Anvil"), is 3,600 feet high and can be seen for a great distance out at sea. The mountain ranges serve to divide the island into two parts as regards climate. As the hills and mountains intercept the northeast trade winds with their rain clouds, there is sometimes almost a superabundance of moisture in the lowlands of the north, while in the south severe drouths occur and the land demands artificial irrigation, which is, as yet, carried out with very little system. The island is, on the whole, well watered. Over 1,300 streams have been counted, of which 47 are considerable rivers. The island is rather beautiful in appearance, forests still covering all the highest part of the hills, but the interior seems to be one vast system of mountains, and from the deck of the steamer there seems to be a limitless sea of hills with rounded summits and with such gentle slopes as to be susceptible of cultivation to their very summits. In reality, however, it is level compared with the other West Indian islands. It is strange that few of the rivers are navigable even at their mouths, and vessels of small burden can ascend them only for a few miles.

The climate is such that foreigners are easily acclimated, and fevers there have the reputation of not being as contagious or as dangerous as in Cuba and San Domingo.

The residents are acclimated to fever and do not suffer much, but the casual visitor in the summer is in danger. The climate is divided generally into two seasons, the wet and the dry, or there may be two brief rainy seasons, when the sun passes over the earth in the vernal and autumnal equinoxes; and in the latter the hurricanes occur. The dry months are usually from November to April inclusive, and the wet are from May to November. The longest day scarcely exceeds thirteen hours, and the difference between the maximum and minimum of heat is much less than with us; in summer the annual mean being about 75° to 80°, with the daily range of not much more than 10° and an average winter temperature of 70°. Then there is the daily alternation of sea and land breezes, the former setting in about nine in the morn-

ing and continuing through the day, the latter beginning soon after sunset and holding until an hour after sunrise, the hottest times being in the intervals between the two. The worst natural characteristic of the island is the tremendous hurricanes that sweep across it between the months of July and October.

Porto Rico was discovered by Columbus, in November, 1493, and in 1510 Ponce de Leon founded the town of Caparra, which was soon after abandoned, and with more success in 1511 the city of San Juan Bautista. The native inhabitants were subdued according to the usual methods of colonization which were adopted by the Spaniards, by sweeping them entirely away, and from that time on, the island was left to fill up with Spanish and slaves. It has therefore been very nearly a detached section of Spain itself, and has kept in closer sympathy with the Spanish government than has any of her other colonies in the western hemisphere. In 1595 the capital was sacked by Drake, and in 1598 by the Duke of Cumberland, and it had other sieges, for in 1615 Baldwin Heinrich, a Dutchman, lost his life in an attack on Castillo del Morro. The attempt of the English in 1678 was equally unsuccessful, and Abercromby in 1797 had to retire after a three days' siege, though in the same campaign he captured Grenada, Demerara and Trinidad. In 1820 a movement was made toward a declaration of independence on the part of Porto Rico, but Spanish supremacy was completely re-established in 1823, and the last traces of slavery were abolished in 1873 by the abrogation of the system of forced labor. In 1870 Porto Rico was made a province of Spain instead of a colony. Recently, when the so-called system of autonomy was offered to Cuba, Porto Rico received the same. It now has a premier and a house of representatives and all the other forms and shapes of a representative government, but they are all in the hands of the Spanish

tence with the minimum of labor, Porto Rico may well be termed an earthly paradise; but while nature has done everything for this island, the race whom the accident of discovery placed in power have done worse than nothing toward its development. Poverty exists everywhere, since the taxes are so oppressive, administered as the government is by alien office holders assisted by foreign soldiers. The island has 470 miles of telegraph and 137 miles of railway, besides 170 miles which is under construction.

San Juan is the capital of Porto Rico and has about 28,000 inhabitants. It is on the northeast shore of the island. The harbor, as will be seen by our map, is one of the finest in the West Indies, being large, sheltered and capable of accommodating any number of the largest ships, having anchorage in it from three to seven fathoms. It bears a striking resemblance to Havana Harbor, to which it is but little inferior. Its entrance toward the north is invitingly open to the vessels of our great republic. Its entrance is over 2,000 feet wide and is defended on the west side by forts erected on two small islands. On the east side of the harbor is an extensive sand bank, but the entrance to the harbor has no sand bank. The harbor is big and deep, but the coral formation makes it impossible for ships of any great draught to get close up to the wharves. The city occupies all of what is generally supposed to be an island, but it is not really built on an island at all, but on a coral reef at some distance from the shore for a great part of its length and joined to the main island at the eastern end by a short bridge. The town is completely inclosed within massive walls of stone and mortar, which rise to a height in some places of from fifty to one hundred feet. Like Havana, which has its "Morro" or citadel (literally a round Moorish tower), it has, or rather had, fortifications on an extensive scale, with bastions and drawbridges, with sentry boxes

hanging over the sea and grim, gray walls towering threateningly. One may find a very counterpart on a small scale in the old fort at St. Augustine and every way similar to those at Havana before her walls were torn down.

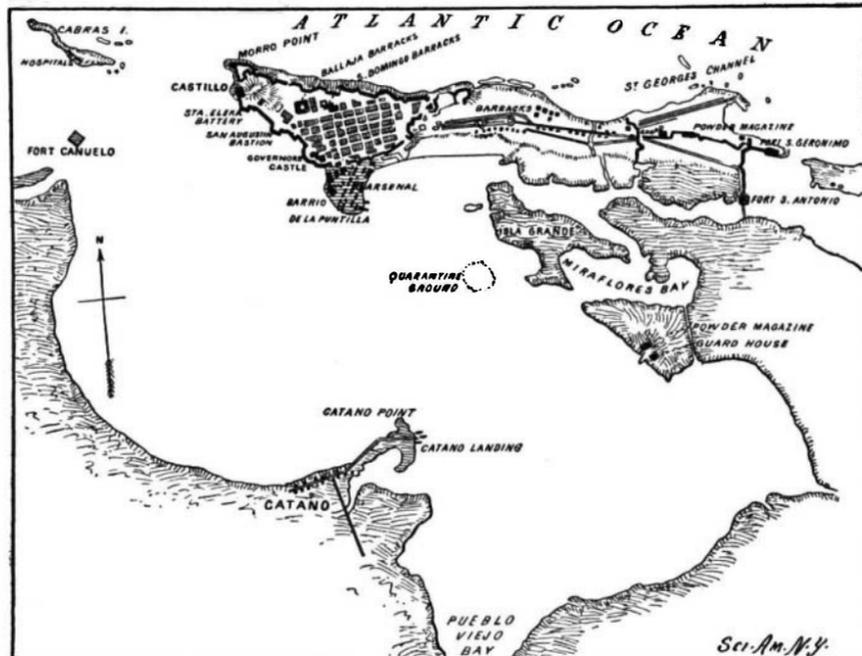
The peninsula upon which Morro and the lighthouse stands is thrust out into the sea, one side breasting the thundering surges of the Caribbean Sea and the other guarding the placid waters of a beautiful and almost landlocked harbor. The old forts suffered terribly from the shells of Admiral Sampson's fleet and offered but little effective resistance to the fire of the modern rifles. They had an advantage over a fleet in being at a considerable elevation, thus enabling them to deliver a plunging fire. Until early in last year the only battery of any consequence was placed toward the east coast, designed specially to protect the city from an anticipated attack on the land side. The battery has several Krupp guns of medium caliber. It is believed several more of these were mounted in Morro Castle at the other end of the town.

The remainder of the ordnance in San Juan along the walls was, until very recently, of an obsolete pattern and unserviceable against the armor of modern ships. A large number of rifled guns were sent to San Juan from Spain about three months ago, and recent reports indicate that they have been mounted. There are forts and batteries all along the outer edge of the reef.

Though the main portion of San Juan is inclosed within the walls, through which entrance is obtained only by well guarded gateways, yet there is a small town by itself in the Marina between the fortifications and the wharves. Here is a fine public garden and pleasure space for booths and restaurants as well as the public cockpit where battles royal are frequently waged. The buildings of the inner city are of stone, massive and substantial like those of Havana and the city of Mexico, and are of the old world type, which would not furnish much food for a conflagration in case of a bombardment. Here the captain-general and chief officials reside. Many of the wealthy inhabitants have summer residences at Bayamon, and the very poor live in the huts shown in one of our engravings. The "Morro" is an interesting place with its deep dungeons and covered ways.

San Juan is not a very attractive city under its present conditions, owing to its filthy streets and lack of attention to sanitation. The only thing that saves the city is its being built on a declivity and it is therefore fairly well drained. Yellow fever is quite prevalent. That the city is not a healthy one is shown by the frequent funeral processions that pass through the streets to the cemetery, which lies between the sea wall of the fort and the shore, the interments being in columbarie. San Juan is only one port of the islands, and there are some harbors that are as fine, if not as large and land-locked. The other most notable city is Ponce, having a population of about 35,000.

The total revenue for 1894-95 was \$5,454,958, while



MAP OF THE HARBOR OF SAN JUAN.

oligarchy that controlled the island while it was still a colony. Like Cuba and the Philippines revolutionary parties existed in Porto Rico; its leaders are exiles living in Europe and the United States. The discontented elements of the population, which are by no means small, have not dared to fight, lest Spain import a greater army and sweep them off the face of the island, the military roads making concentration of troops easy. The insurgents are in no shape to battle with the 40,000 troops Spain keeps on the island, but they are hoping for some good to come to them as a result of the war over Cuba. The inhabitants of Porto Rico numbered, in 1877, 813,937, the negroes being over 300,000.

In Porto Rico the entire land has the appearance of a picturesque and continual chain of habitations, the land being under good cultivation, with fields of sugar, plantains, coffee, patches of rice, etc. There are some sixty towns and villages on the island, but it is really a land of fertile farms between the innumerable hills and mountains and rich valleys. The soil everywhere is very fertile and cultivable, even to the mountain crests, the pastures of Porto Rico being famous for the succulent qualities of their grasses, upon which feed cattle and horses. These are shipped in great numbers, and constitute the chief wealth of a great many people engaged in the business. Among the hills also are thousands of coffee plantations, for here the soil is good and the climate is adapted for its perfect development. In the valleys also grow the sugar cane, cocoa, bananas, plantains, in fact, all sorts of tropical fruits. The banana industry has been vastly increased in the island of Jamaica during the past five years and it has rescued many a planter from ruin. This will also be the case in Porto Rico, which has everything for its profitable cultivation, provided proper attention is given to growing them. With its wonderful range of vegetable products and consequent facilities for subsis-

the expenditure was \$3,905,667, very little going for public improvements. The principal exports in 1896 were coffee, valued at \$2,500,000; sugar, \$3,500,000; tobacco, \$425,000, etc. The total exports in 1895 amounted to \$15,799,000, and the imports to \$17,446,000. In 1895 1,077 vessels of 1,079,036 tons entered Porto Rico. From a commercial point of view the acquisition of Porto Rico would be important to the United States.

#### Recent Archaeological News.

The finds of old gold and silver coins at Santiponce, near Seville, have brought many antiquarians to the spot. The excavations have been continued with great zeal, and among the latest finds are a Roman marble statue in complete preservation, an amphora and some fine mosaics. But more interesting still is the location of the walls of ancient Italica, a portion of which has been laid bare. They were made of roughly formed stone and mortar without battlements, but a truncated square tower in a perfect state of preservation is the latest discovery. Santiponce is among the hills that bound the valley of the Guadalquivir on the west and is about three miles from Seville, which is across the river on the other side of the valley. The town of Italica was founded by Scipio Africanus in the Second Punic War. It was the birthplace of the Roman Emperor Trajan.

The Forum of Augustus is the cats' home of Rome. There the superfluous felines are dropped over the wall to join their numerous fellows in the Forum below. Every day charitable people throw scraps of food into this open prison, and, as seen from above, its inhabitants seem to be plump and happy—so happy, indeed, that they make no attempt to escape. A few years ago the Forum of Trajan was also used as a depositing place for cats that were not wanted, but as it does not present the same facilities of retreat and hiding as the Forum of Augustus, street boys and others took every opportunity of stoning the unfortunate animals. Finally, the authorities, after many complaints, refused to allow any more cats to be thrown there, and, in order to get rid of those already living in the Forum, presented one to each sentry box on the walls of the city. They all, however, speedily disappeared from their new homes, some returning to the foot of Trajan's Column, where they were either killed by the street boys or transferred to the Forum of Augustus.

The Institute of France has formally entered into possession of the Château of Chantilly, says The Builder, and the collections included in what is now to be called the Condé Museum, the contents of which have been inventoried in five volumes, with indications of the arrangement of the various classes of objects according to the intention of the Duc d'Aumale. The museum contains 557 pictures, without counting the pictures, engravings and drawings which adorn the Château d'Enghien; 30 enamels; 282 miniatures; more than 200 gems and precious stones displayed in glass cases; and in addition to the equestrian statue of Condé, by Paul Dubois, about 50 statues and busts in marble, among which are three by Chapu ("Jeanne d'Arc," "Pluto" and "Proserpine"), a "Hebe" by Dezeine, the statue of Bossuet by Guillaume, two bas-reliefs by Jean Goujon, and animal sculptures by Gardet and Auguste Cain. Among the 12,600 drawings are 111 original drawings by Nicholas Poussin and more than 500 by Raffet. Besides these are 5,000 engravings, a collection of 3,685 medals and a library containing 24,000 printed volumes, 1,493 MSS. and 272 parchments. The château includes besides more than 500 pieces of furniture and other objects of great value—armor, tapestries, etc. There is also a collection of autographs and historical documents of great interest.

Herr Ernst Berger, in his "Contributions to the History of the Development of Painting," describes the way the colors of the ancients are examined by chemists as follows: The color layer is first carefully scratched off with the knife in order to separate the colors from the lower ground. A portion of the color powder thus obtained is dissolved in water and heated in a retort; then the binding materials, dissolved in water, are separated from the color pigments by filtration. The filtrate is evaporated, and from the residuum the binding agent present is determined, according to whether it contains organic substance or not; ashes which turn brown with a burning smell point to organic binders, likewise the presence of ammonia (ammonia is recognized by the odor or by means of turmeric paper, which is dyed brown by ammonia vapors). A second portion of the scraped-off powder is treated with boiling alcohol, which dissolves the fatty resinous substances; the mass is filtered as above, and the filtrate is evaporated in like manner; from the residuum, which takes on a dark color, an oily or resinous binder results, which can be determined more closely by the odor. In order to recognize the presence of lime, a drop of hydrochloric acid suffices, which causes effervescence. The color substances remaining in the filter are then tested by means of different reagents for the presence of metals, earths, etc., and conclusions are drawn accordingly. In exactly the same manner the foundations on which the painting was are tested.

## Correspondence.

### The Naval Supplement.

To the Editor of the SCIENTIFIC AMERICAN:

I desire to express to you my appreciation of the excellence of the NAVAL SUPPLEMENT your paper has recently issued, and especially so because, instead of representing, as is so often done, our vessels as superior to anything else afloat, it frankly calls attention to certain of their limitations, e. g., the low freeboard of the "Indiana" and "Kearsarge" classes, and also to the doubts regarding the desirability of the superposed turrets of the "Kearsarge" class.

It is only by teaching our people regarding the shortcomings of their present vessels that a demand for better ones can be created, and nothing short of the best at the time of construction should satisfy us.

Furthermore, exaggerated ideas as to the excellence of our vessels, as compared with those of other nations, may lead to unpleasant consequences.

Permit me also to express the hope that you will follow the publication of this NAVAL SUPPLEMENT with one on United States ordnance, both that of the navy and of the army, including in the latter the armament for coast defense.

May I suggest that in such a supplement especial attention should be given to the subjects of rapid-fire guns, projectiles and smokeless powder, and that should you, on investigation, conclude that we are behind any other nation in adopting useful inventions, or have failed to keep our ordnance up to the highest standard, either in the matter of guns or that of ammunition, you should frankly say so?

Comparisons such as have appeared in various publications, e. g., between the efficiency of the armament of our "New York" and that of the Chilean "Esmeralda," or that of our "Kearsarge" and the Japanese "Fuji," of the muzzle energy of our guns as compared with those of the same class in the English, French and German services, etc., would, I think, be of interest if published in such a supplement.

EDMUND M. PARKER.

Boston, May 11, 1898.

### An Electric Railroad for Freiburg.

To the Editor of the SCIENTIFIC AMERICAN:

The city of Freiburg, a town of 55,000 inhabitants, with most beautiful surroundings, many large villages near by and romantic valleys into the heart of the Black Forest, is contemplating the building of an electric railroad system and a central power station for electric light and locomotive power.

Competition for these new enterprises is open to the world, and as United States consul I consider it my duty to call the attention of American manufacturers to the same, and feel that your valuable publications are the best medium for that purpose; hence send this note to you.

Freiburg is a busy little city, very conservative and slow but sure in whatever it undertakes, and whatever is constructed here is built, not for a day or lifetime, but for an age.

"Rapid" transit they have here, but it is the old-fashioned omnibus. Electric light is seen nowhere but in several factories with private motors and dynamos. Hence the need of these new enterprises and the call for bids for the same, such bids to be in the hands of the Committee on Underground Structures (Tiefbauamt) before July 1, 1898.

I mail you under separate cover the circular letter, plan of the city, plans and profiles of the projected enterprises, etc., such as the above-mentioned committee sends to parties interested, and shall be glad to procure any further information for you or other Americans who may take an interest in this matter.

E. THEOPHILUS LIEFELD,

United States Consul.

Freiburg, Baden, Germany, April 29, 1898.

### The Current Supplement.

The current SUPPLEMENT, No. 1168, contains articles of general interest to our readers. "The Use of Aluminum in Bicycles and Light Machinery" describes some of the latest advances in the use of this metal as a substitute for brass, steel and iron. "The Report of the Building Committee of the Scientific Alliance of New York" outlines an interesting plan for the co-operation of scientific societies. "The Great Shore Battery of Krupp Guns at Cuxhaven" is a subject of a splendid full page engraving. "Recent Work in the Princeton Psychological Laboratory" is the subject of an interesting article by Prof. J. Mark Baldwin. Papers of this nature in which psychology is treated in a popular yet clearly scientific manner are rare. "Malay Life in the Philippines," by W. G. Palgrave, is continued from the last number. It is one of the most important contributions ever made to the literature of travel in the Philippines.

THE French mint, besides coining money for the home country and her colonies, has also last year received and filled orders for Abyssinia, Bolivia, Chile, Morocco, and Russia.—La Science en famille.

## Science Notes.

M. Phisalix announced to the Académie des Sciences, Paris, some time ago, that cholesterine injected into the blood of animals made them resist the venom of vipers. Doubts were thrown on his results, because he had used cholesterine of animal origin. Since then he has repeated his experiments with crystallized cholesterine extracted from carrots, and found it as effective as that from animals. Moreover, he has obtained similar results with crystallized tyrosine extracted from the dahlia and even with the sap of the dahlia.

Mr. W. H. Wheeler draws attention in Nature to the effect of gales on tideless lakes and seas, which he says is at times so marked as to cause considerable inconvenience and anxiety to mariners. Thus in the Caspian Sea a gale will raise the water on one side six feet and depress it on the other as much, making a total difference of level of twelve feet. In the Baltic easterly gales will alter the level upward of eight feet. In Lake Erie depressions and elevations of from two to four feet are common, while occasionally heavy gales have produced a difference of level of upward of fifteen feet.

When drawing attention, about a year ago, to the bipedal movements of certain Australian lizards, notably the comical little chlamydasaurus, or "frilled lizard," whose photograph is now familiar, Mr. Saville-Kent referred to an unconfirmed rumor that the Mexican iguanoid lizard also possesses the power of running on its hind legs, being led to this by the correspondence in general structure of the creatures, especially the abnormal length of the hind limbs. In Nature he publishes a letter from a gentleman living in the West Indies, which shows that there also all the lizards, from the large tree iguana, five feet long, down to the tiniest mites which scamper about among the stones, are accustomed to run erect on their hind legs when hurried. The correspondent adds the interesting information that on the rocks about the watershed of the Guiana are old drawings of lizards running erect. Mr. Saville-Kent points out that this peculiarity, which a year ago was doubted by many naturalists, but which has now been shown to be common to so many different species of lizards, deserves attention as pointing to bipedal locomotion in some remote ancestor.

Mr. F. G. Jackson's account of his three years' exploration in Franz-Josef Land is the prominent feature of The Geographical Journal for February. The main result of his adventurous journeys seems to have been the mapping of the southern part of the archipelago, and, it may be added, the conviction that it is "one of the worst" routes to the pole. A study of the geological collections brought back by the expedition appears to show that the islands are fragments of a vast basalt plateau, probably the "grandest example of volcanism in the world." On account of the absence of warm southwesterly winds, the flora is "more scanty and stunted on the whole than that of almost all the other Arctic regions." There are certain plants, however, as poppies and four species of mosses—brilliant green, red and golden yellow—which give color to the landscape. The only land mammalia are the bear and the fox, but three new species of birds were discovered. The northern lights were disappointing, though occasionally they were brilliant enough "to cast a shadow and to eclipse stars below the third magnitude." The highest registered temperature was 43° Fah.; the lowest, -54°. The Journal also contains Dr. Mills' elaborate classification of geography with arbitrary symbols, presented at the Toronto meeting of the British Association.

The chemical and toxic properties of the poison of the honey bee have been a subject for long study by a German scientist, Dr. Joseph Zanger. During his investigations Dr. Zanger employed 25,000 bees. He found that the fresh poison is clear, like water, of an acid reaction, bitter taste and of a fine aromatic odor. On evaporating and drying at a temperature of 100° Centigrade (212° Fahrenheit) a gummy residue is left. It is soluble in water; with alcohol it forms an emulsion-like mixture. The aromatic odor is due to a volatile substance, which disappears on evaporation, and is not poisonous. The poisonous constituent is not destroyed by short boiling, nor by drying and heating the residue to 212° Fahrenheit, nor by the diluted acids or alkalies. Dr. Zanger has proved the existence of formic acid, but he has also proved that that is not the poisonous principle. The latter is an organic base, soluble with difficulty in water, but kept in solution by an acid. On the healthy skin neither the bee poison nor a two per cent solution of the poisonous principle has any effect, but they act as powerful irritants on the mucous membranes. His tests made on rabbits and other animals show that when the poison is brought in contact with the eye there follow lachrymation, hyperemia, chemosis and croupous membrane on conjunctiva. The general condition is also affected; the animals become melancholy, take no food, but are very thirsty, and the urine shows small amounts of albumen.