fine adjustment is generally sufficient to keep it constantly in focus, and I have no doubt that it might be adjusted well enough to use satisfactorily as high a power as a long-focussed quarter-inch objective.

Indeed, the instrument has proven to be all that could have been expected of it as an orienting microscope, and, at the same time, its value for ordinary work is is no way decreased, unless the slightly less rigidity of the stage is an objection.

Plans have already been completed for a dissecting microscope for use in my laboratory embodying the same principal but involving greater changes from instruments now in use. The new stand will consist of a stage which remains horizontal, so that insects may be dissected on it under water. The arm is jointed and the lower section bent so that the axes of the two hinges are at right-angles to each other. There will be the necessary arrangements for so adjusting these axes as to make them intersect, and the tube will be fitted with a nose-piece adjustment.

The base will be clamped to the desk for sake of rigidity. The focussing will be all done at the stage, though the tube will move to accommodate the varying focal-lengths of the objectives.

It is expected to use the objective under water, providing it with a hard-rubber shield having a cover-glass on the end. This kind of instrument should be also very useful for the study of aquatic forms.

SUMMER WORK IN MARINE ZOÖLOGY AT NEWPORT.

BY W. E. CASTLE.

OUT on the extreme southwestern point of the Island of Rhode Island, in Narragansett Bay, is Castle Hill, the comfortable residence of Mr. Alexander Agassiz. Against this point the waves of the Atlantic break with full force as they sweep round the east end of Long Island past Point Judith. This is the one rough spot in the trip from New York to Boston by boat.

As the tide comes in at Castle Hill and passes the narrow entrance of the bay, it makes a bend and carries its rich pelagic life into a little cove on the north side of the point. On this cove is Mr. Agassiz's laboratory.

It is a modest-looking little structure, modelled after a Swiss cottage, but within it is a very paradise for the marine zoölogist.

Aquaria, tanks, and glassware it contains in abundance, while fresh and salt water are carried in pipes to all parts of the laboratory. Fresh, salt water, and air to aërate the aquaria are pumped in by a wind-mill.

Mr. Agassiz carries on his own investigations in the smaller room at the west end of the building. The larger room of the ground floor each summer he generously puts at the disposal of a certain number of students from the Museum of Comparative Zoölogy at Cambridge, Mass.

Any day through the summer you may see half a dozen men here industriously bending over their microscopes, studying animals in their living form or preserving material for future study. On account of the extreme moisture of the atmosphere, little balsam mounting or clearing can be done at the sea-shore, so that work of this kind is usually postponed to be done at Cambridge during the fall and winter months.

Each morning at nine o'clock a hack from the boarding-house in town puts the men down at the laboratory door. It calls for them again at five, after their day's work is ended.

About ten o'clock each evening "Thomas," Mr. Agassiz's faithful man-of-all-work, rows slowly up and down the cove skimming the surface of the water with a tow-net. From time to time he lifts the net of fine cheese-cloth carefully from the water, turns it inside out and dips it repeatedly in a bucket of water.

The soup thus obtained is carried into the laboratory, diluted, and poured out into half a dozen glass dishes placed on black tiles.

Around these dishes the men gather upon their arrival in the morning, each furnished with pipettes and watch-glasses of various sizes. Every nook and corner of the dish is carefully scanned with naked eye and with the aid of lens, and in different lights, that no egg or larva, however minute, may escape notice.

After a man has acquired a general knowledge of the pelagic fauna, he usually confines his attentions to some particular group of animals, and the tow is sorted out and divided accordingly.

One man studies the mollusks, another the echinoderms, another the jelly-fishes, and so forth.

The tow is the chief source of material for study. It is supplemented, however, by dredging from the steam-launch, and shore collections at low tide.

The laboratory contains a good library of general works of reference, while literature on special topics is supplied from Mr. Agassiz's private library and from the museum library at Cambridge.

Not least among the advantages afforded to the training investigator are the helpful suggestions of Mr. Agassiz himself, whose long experience in marine work makes him an invaluable adviser.

With such excellent opportunities for advanced work in zoölogy, it is not surprising that in this little laboratory material has been gathered for many scientific papers of a high order, and that here many of the best zoölogists Harvard College has produced have received an important part of their professional training.

BACTERIOLOGY IN THE DAIRY.

BY C. C. GEORGESON, MANHATTAN, KANSAS.

THE bacteria which affect the quality of our dairy products may, for practical purposes, be classed under two heads, namely, those which are beneficial, and those which are injurious, and it is as essential to encourage the one as it is to wage a constant war upon the other. It has been established beyond a peradventure that the pleasant flavor and aroma of good butter are developed by certain species of bacteria present in the cream and instrumental in producing the changes which take place during the process of fermentation usually termed "souring." And it is equally well established that there are certain other species which, if permitted to get the mastery, will, as it were, overpower and neutralize the influences of the former class and give a disagreeable taste and smell to the butter. Both classes are present in all dairies, and the skill and success of the butter-maker depend in large degree on the recognition of this fact and his ability to foster the growth of the beneficial bacteria and to keep the injurious kinds in subjection. His chief weapon against the latter is cleanliness. Filth of every description is their best breeding-ground. But it also happens that the conditions are such, in surrroundings over which the butter-maker has no control, that, in spite of the strictest cleanliness on his part, the injurious organisms propagate too fast and deteriorate his products. Again, it may lie in the health, feed, or other conditions affecting the cows from which the milk is drawn. Under such conditions, what is he to do? It is the solving of this problem which has brought bacteriology into intimate connection with the dairy business; and the honor of solving it and thereby ensuring the production of "gilt-edge" butter under naturally adverse conditions belongs to the Danes.

In practical dairying there are two forms of physical means by which the growth of bacteria may be controlled, namely, cold and heat, relatively speaking. At a temperature at or near the freezing-point the active growth of the bacteria ceases, and hence the reason for keeping the milk cool by the use of ice. The cold produced by the ice does not kill the organisms or purify the milk, it simply retards their multiplication, and thus affords time for the dairy operations to take place before they work injurious changes. Heat, on the other hand, kills the bacteria. At the boiling-point nearly all those forms ordinarily found in milk are destroyed. But, as this high temperature affects the taste of the milk or cream by imparting the characteristic "boiled taste," in practice the temperature is raised to but 75° or 80° C., at which point the taste is not materially affected, and still the greater portion of the bacteria are killed.

This much known, the Danes have gone a step farther. They have isolated and perpetuated "pure cultures" of those forms which they have found to be beneficial to the production of first-class butter, and by impregnating the cream, under proper conditions, with these artificially grown bacteria they give their butter the desired flavor and aroma. It is now between two and three

years since the more advanced creamery owners began to practise this method, and the results have been so uniformly satisfactory that it is adopted in all creameries, when the ordinary methods fail to bring out the desired quality. The creamery owners were not slow to take advantage of this new discovery when they found that it afforded the butter-maker genuine and valuable practical aid. The honor of introducing this important improvement in dairy processes does not belong to any one man. Several scientists isolated and successfully prepared cultures for use independently of each other; though doubtless Professor V. Storch of the Experimental Laboratory, Copenhagen, deserves the lion's share of the credit. He has investigated the subject for some years, and published several important papers on the results of his researches. There are now three or four laboratories from which the prepared cultures are offered for sale to the dairies. They keep their processes secret, each following its own methods, the result of which is that their cultures differ, both in kinds of bacteria and method of treatment. This has brought out the fact that the beneficial species, as indeed also the injurious ones, are quite numerous, and that certain forms coöperate in the production of aroma and flavor, but that it is by no means necessary that a large variety should be present. Thus Mr. E. A. Quist of Skanderborg, Denmark, a young bacteriologist who has become deservedly famous for his successful work in this line, uses but two forms, which singly are ineffective, but together produce a very superior quality of butter.

The "secrets" in this work are, of course, far from impenetrable. They are confined chiefly to the composition of the nutritive fluid in which each laboratory has found it most expedient to propagate the bacteria employed, and this can, of course, be ascertained by experiment.

The value of "pure cultures" has been proven by practical experience. It remains to acquaint our dairy workers with the facts, and for our bacteriologists to take the work in hand. It offers a wide field for fruitful investigation.

INDIAN PAINTINGS IN SOUTHERN CALIFORNIA.

BY DAVID P. BARROWS, POMONA COLLEGE, CLAREMONT, CAL.

The Indian tribes which sixty years ago filled every valley of California have now either entirely disappeared or are represented by mere handfulls of descendants. These tribes left quantities of implements of their daily life to attest their vast numbers and certain remains through which can be traced their beliefs and customs.

An interesting study are their "picture rocks." These are found in many places throughout the coast and some of them have been examined and described.

In several localities in Southern California there are painted rocks to which, we believe, attention has not been called.

In the Perris valley, among the stony hills west of the town, are three rocks from twelve to twenty feet high which are covered, each on one side, with Indian paintings. There is evidence that this hillside at one time was the camping ground of a large number of Indians. About each spring the flat bowlders are filled with holes in which acorns and seeds were pounded, and pestles and *metates* are numerous. Bits of pottery, a portion of a grass basket and a few arrow points have also been found here. Twenty-five miles away on the opposite side of the San Jacinto plains there is now the small village Saboba, of the Serrano Indians.

On the Radec Creek thirty miles east of Temecula is an interesting case of rock painting. A hundred feet above the stream on the hillside there is a small cave formed by huge bowlders piled together. It is evident that the front of this cave was once walled up with brush, stones and earth and that it was used for a *temescal* or sweat house. The cold stream is at hand into which the patients, dripping with perspiration could plunge. The inside of this cave is painted with the same designs and colors as the Perris rocks. A flat rock inside is filled with holes in which it appears that the minerals for making the paints were ground. Digging down a few inches, into the loose soil of the floor, brought up broken pottery, charcoal and ashes, and bits of small bones. The interior of the cave is blackened with the smoke of the fires.

This cave is a quarter of a mile from the site of an abandoned village, which the Indians say was called Sequala. Relics, including a number of arrow points more perfect than are usually obtained in Southern California are here found. In the Strawberry valley in the San Jacinto Mountains there are four more of these painted rocks. The Cahvilla Indians still visit this valley for acorns and piñones.

Doubtless search and inquiry will reveal much more similar work. The designs, which in all cases are much the same, consist mainly of wavy and angular lines, diamonds, and geometrical patterns and figures formed by dots. The print of the open hand is occasionally seen.

There is little remarkable in these paintings unless it be the absense of *pictures*, and the fact that the same designs were adhered to not only by different tribes but by tribes of different stocks, showing that the established forms were wide spread and rigidly followed.

The colors used are red, black and white. They are made from mineral earths found in the mountains around, which are ground, mixed to the consistency of paste, and applied.

The most striking fact in regard to these paintings is this: Among the Cahvilla Indians whose home is in the San Jacinto Mountains, twenty miles from Radec Creek and eighteen from Strawberry valley in the opposite direction, there are two old men, and now only two, who at some feasts perform a remarkable war dance. The dancer is stripped to his breech clout and then girt with a kilt of beautiful brown eagle feathers, and his head is covered with a feathered war bonnet. His face and body are then painted with the same designs and colors which we have noticed. The same mud paints are used and sometimes the hand is daubed and its print struck upon the dancer's broad shoulders, precisely as it appears upon the Perris Rocks. Thus dressed and painted the old warrior proceeds to execute a dance which we venture to say is one of the most wonderful among the strange dances of the North American Indians; a dance which makes the old women shout and cry in excited remembrance, and infirm old braves wave their arms and join in the wild song.

There must be significance in these designs so carefully followed and preserved.

The writer and others are arranging for fuller examination of the rock paintings of Southern California with a view to publication. This note is intended simply to call attention to the double use of these designs upon the rocks and in the dance body-painting.

NOTES AND NEWS.

THE sixth annual meeting of the American Economic Association will be held in Chicago, September 11–15, 1893, in one of the assembly halls of the University of Chicago. It is expected that the general headquarters of the association will be at the university, which has not only permitted the use of one of its halls for the assembly to meet in, but also offers rooms in its dormitories at a moderate rent by the day or week to persons attending such conventions. Two meetings of the council of the association will be held during the session, and the programme as announced includes, besides the annual address by the President, Professor Charles F. Dunbar, the following papers: The Value of Money, by Francis A. Walker; The Relation between Interest and Profits, by Arthur T. Hadley; The Scope of Political Economy, by Simon N. Patten; The Genesis of Capital, by J. B. Clark; The Wages Fund at the Hands of the German Economists, by F. W. Taussig, and Marshall's Theory of Quasi-Rent, by E. R. A. Seligman. Several other societies dealing more or less with economic questions, including the International Statistical Institute, the American Statistical Society, the Social Science Congress and the Labor Congress, are to meet at Chicago at about the same time as the American Economic Association, and, as arrangements have been made to have the scientific sessions of these various societies held at different times, a rare opportunity is presented for the students of economic and social subjects to meet their co-laborers of this and other lands.