SCIENCE.

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Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

A BOSTON "ZOO."[1]

IT is a little strange that a zoölogical garden should be so rare a sight in our country, or, if found, should be so poorly equipped, when there is hardly a European city of any size without one, which is invariably a centre of attraction for all American visitors. We often hear the inquiry, "Why cannot we, too, have a 'zoo'?" and we all know that such a garden in Boston has long been talked of. Indeed, it has been seriously studied for a number of years by our naturalists; but a brief consideration will show that to found and sustain an establishment of the first class, modelled on the best in Europe, would involve an expense very much greater than there, simply from the fact that in no place in Europe where a flourishing and extensive garden exists, are the winters nearly so long or so severe, nor are they accompanied by such abrupt terminations, as here: our winters, in short, would entail a vastly increased expense to keep tropical creatures in health, and presentable to the visitor.

But this is by no means the only difficulty we labor under in Boston: for two things are absolutely essential to an undertaking of this sort, — first, sufficient space; and, second, its accessibility to the public. Now, where are we to look for an unencumbered spot of ground sufficiently extensive for these purposes reasonably near the heart of our city?

The acreage of the gardens in Europe ranges from about half a dozen to half a hundred acres, but hardly one of them has room enough for its animals. The Zoölogical Garden of London, the best and most successful of all, is very crowded, and does not appear to cover more than thirty-five acres, so far as can be told by measurement from a map. Forty acres — somewhat less than Boston Common — is the least we ought to count on here; but we have barely saved for ourselves on the outskirts of the city room for public parks.

The "scientific" and the "practical" man are often set in antithesis. Will you kindly give your attention for a few minutes while I endeavor to show that they may also be named synthetically, by pointing out how the scientific men try to answer a practical question and resolve practical difficulties?

We who have had this matter before us have been on the watch for opportunities long enough to see an immense growth in our city and a rapid occupation of our suburbs. We have seen one spot after another which we had looked upon with envious eyes fall into the hands of the land speculator, until the chances seemed to grow less as the needs appeared greater. But our opportunity at last came with the establishment of the Park Commission, without whose hearty support we should be silent to-night.

The only piece of ground under the control of the park commissioners large enough to have a portion of it set apart for a general zoölogical garden is Franklin Park in the Jamaica Plain district: but there are two insuperable objections to the use of this cite, — first, that it contains no sufficient body of running water for the needs of aquatic animals; and, second, that the segregation of a sufficient territory would absolutely prevent the use of this large section as a country park, one of the most important of the designs of the commissioners, and not elsewhere attainable. The only possible escape from this dilemma is one which, while it certainly involves an additional expense, brings with it compensating advantages. It is the division of the proposed Natural History Gardens into separated sections. The disadvantages of this plan are the extra expense of fencing, and of gate-keepers and superintendence, and that we should have to go to widely distant points to see all that there is to be seen. The advantages are the better selection of sites for special groups of animals, and the important fact that some one of the exhibits would be easily accessible to every inhabitant of the city.

For the purposes of a natural-history garden, — we use this word as more correct than the more limited but more usual one of zoölogical garden, — animals and plants may be divided into those inhabiting the salt water or dependent upon it for means of sustenance, those inhabiting the fresh water or so dependent, and land animals properly speaking. All air animals would find food and shelter within or upon one or other of these media, and therefore we need not consider them as a group apart. One grand factor in life here presents itself, by taking advantage of which we may impress it upon every visitor to our gardens by compelling him, if he would learn all we offer, to pass at some expense of time and labor from one of our exhibits to another. It is our first essay in teaching one of the fundamental facts of nature.

The sympathetic concurrence of the park commissioners enables us to carry out, it has indeed originated, this idea, since they offer us three separate tracts, — one upon the seashore, one which includes a pond of moderate extent and the valley of a small stream, and the third a very attractive bit of rocky woodland and glade. Not one of these spots is all that could be desired for the purposes in view, but they are the very best the park commissioners have to offer; they are the best unoccupied grounds left about Boston; and they cover the two requisites mentioned at the start, — suitable room and sufficient for all reasonable purposes, within easy reach of the people.

Observe for a moment their position on this map of Boston. The Marine Garden, or Marine Aquarium, as we call it, will be situated at that point where Boston stretches its farthest hand to the sea, in the so-called Marine Park, already in its half-finished state thronged by thousands, especially in the summer, and which is more easily reached than

[1] Remarks made at a meeting of the Thursday Club, Boston, Jan. 15, by Samuel H. Scudder.

most of us imagine by the horse-car, soon, no doubt, to be supplanted by the electric railway.

Diametrically opposite, in the near suburbs, is Jamaica Pond. The park grounds almost touch its northern margin; and separated from it only by the highway and the steep banks on either side is Ward's Pond, well known to skaters, and the head waters of a stream with the uninviting name of Muddy River. It is close to the heart of Brookline, Boylston, and Jamaica Plain, and here it is proposed to plant the Fresh Water Aquarium.

Also near to Jamaica Plain, and barely at the outer edge of the multiplying streets and thickly settled districts, on the city side of Franklin Park, reached from the heart of the city itself by two lines of electric cars and one line of steam-cars, hardly more than across the road from one of Boston's crowded resorts for pleasure, is the third reservation, the largest tract of all, known as the Long Crouch Woods, destined for the display of land animals.

But now we meet one of the necessary limitations already alluded to. Marine and fresh-water animals are usually exhibited in series of aquaria and tanks in buildings, which manifestly need but little space. Land animals, on the contrary, especially the larger sort, require a great deal of room; and just here comes in the question of the housing and proper exhibition of tropical beasts. We do not wish to show them in cages, as in a stranded circus. Whatever is exhibited should be shown in circumstances and amid surroundings as nearly natural as possible, and cleanliness is an important condition.

Now, the space at command at this end of Franklin Park — about twenty acres — will in no way permit the suitable and satisfactory display of the numerous hordes of tropical animals; and the enormous expense attendant upon their winter housing in such a climate as ours altogether forbids such an undertaking now; our people are not yet eager enough for such shows to give them financial support; it may be that by and by we shall find that our present plan has outgrown our most sanguine expectations, and be able to secure some cheap waste land not far removed (say the salt marshes north or south of Boston), on which such a general garden could be built up by slow degrees. Such a scheme we may leave to those who come after us. For us, we must dismiss such fond dreams as immediately chimerical, and ask ourselves what we *may* have, what limits we should assign ourselves and yet be satisfied.

When we remember that not one in ten thousand, perhaps not one in fifty thousand, of our city people (not only here in Boston, but anywhere), has ever seen or is in any way familiar with the greater part of the animals and plants that are indigenous to the soil on which he was born and bred; when we further notice, what I believe is the fact, that not a single collection of living animals in the world has ever been made, either separately or in connection with a larger display, to show the native animals of the region where they are exhibited, although natural-history museums of dead nature very often offer this attraction, — we see at once that we have here an opportunity of setting an example to the world, sure to be followed, to the gain of general education everywhere. The advantages and the interest of such an exhibition are plain; more than that, these creatures are the very ones which need least protection and expense, so that the plan is doubly feasible. The only question is, How wide a scope shall we give to the term "indigenous"? What territory shall we draw upon? This we may well leave to future experiment, but we should wish at least to show the animals and plants of a zone across our continent within the latitude of New England. The New England indigenes would then always form the bulk of the collection, and we should have in fact, as well as in name, a New England garden. This fact, this name, would have its value and its significance; and elephants and giraffes, camels and tigers, would not be expected, and the travelling menagerie and the Fall of Babylon be deprived of no monopoly.

The garden thus becomes educational: it teaches as a whole the lesson of our surroundings; it impresses the fact that the range of animals is circumscribed within definite areas, however large. It *should* teach more: it should give some hint, at least, of a wider outlook; it should show how, as we pass beyond the range of our own indigenes, these are replaced by others; it should hint how far we need to go to find this out and the nature of the change. Side by side, then, with our native animals, if we would enlarge the horizon, must we show their kin, even if we go beyond the seas. Such a collection must be limited, to be most instructive. It is now the aim, in the best museums of natural history conducted for educational purposes, to concentrate the attention upon relatively few objects, rather than confuse the mind with the bountiful prodigality of nature. Side by side with our black and grisly bears we might show the brown bear of Europe and the polar bear, and stop there; as a companion to the opossum, we should look to the home of the marsupials and choose the kangaroo—no need of more; for our larger variety of smaller quadrupeds, our squirrels, moles, mice, and bats, and we may also say for our horned ruminants and our cats, not even so much extra-limital material would be necessary: so that, though some of the missing types should also find a place, such as a sloth, an ornithorhynchus, or a monkey, the draught on tropical animals would be exceedingly small, and need not be felt as a matter of concern.

I have instanced here only a few among the quadrupeds. There is no need of enlarging: the story would be the same with the birds, reptiles, and other animals. Such a collection would be of unique interest and attraction; its installation in Long Crouch Woods would be all that could be desired; and it would be easy to add such features to the garden as would make it equally attractive at all seasons. Thus it is not impossible that special exhibits might be made of birds of passage, during the period of their migrations. A winter garden under glass has been suggested, which might well become one of the chief resorts of the people by day or evening, where in a temperate atmosphere, with a varied and soft foliage everywhere, they would find pleasure and profit in looking at flowers and birds, fountains and brooks, and in learning the habits of curious strange creatures at their play.

If I have dwelt on this division of the Natural History Gardens longer than I should, it has been mainly to show how the very limitations to which the scheme is subject have been made to serve a useful purpose. It is not possible, however, that this part of the plan should be brought to successful issue at once. The division of the gardens allows the opening of one section at a time, — a very important consideration, — and this section, as certainly the most expensive, will of course come later. Let us, then, pass for a brief time to the neighboring department, that of the Fresh Water Aquarium at Ward's Pond.

The spot is a sheltered one, protected by encircling hills, most favorable for our purpose. Here will be relegated not only the animals and plants inhabiting fresh water, but

also those which live in or upon its banks; and as the space here seems to be ample,— the ground covers about fourteen acres,— expense would be the only limit; so that, should the returns warrant, we may eventually include not a few subtropical or even tropical animals. The stream will be so turned as to run in winding channels through pond-like enlargements, much increasing the opportunity for the outdoor display of water-fowl and beast. Here will find their place fish-hatcheries where the processes of growth may be observed, and insectaries in which the changes which many creatures undergo in passing from an aquatic to an aerial life will be readily seen. So other significant transformations may be observed in displays which will show how readily certain brine shrimps may change their actual structure to become in a few generations fresh-water shrimps, and illustrate the rarely considered fact that all fresh-water organisms are modified descendants either of marine, or, by retrograde movement, of terrestrial, animals or plants. The broad relations of our three realms of life will thus be indicated. Here, too, will be fine opportunities for the growth of water-plants, both of the temperate zones and of the tropics; for, with proper care, even the wonderful *Victoria regia* can be grown in full beauty.

Many of these things will be seen, of course, under cover, where, in the inclement season, all creatures which live beneath the surface of the water must be housed. Houses must also be fitted for the protection as well as display of all foreign creatures, so that in winter and summer alike this section of the garden shall have its full share of attractions.

But the place of highest interest and usefulness is that which we wish first to undertake, the Marine Aquarium at City Point,— greatest, because of the larger variety of form, of structure, and of color among marine animals ; because, too, some of the most beautiful and most surprising of these creatures are inhabitants of our own seas, but are almost wholly unknown except to naturalists. When the display of the animals of our own waters in all their vivid coloring, lovely or grotesque form, and varied action, is ready, thousands will marvel at the revelation of a new world of their own of which they have not dreamed.

The ground here allotted, covering about eight acres, will be ready for occupation the coming summer, and will have as its chief attraction a building for aquaria, so arranged that almost the only light which enters the halls will be that which passes through the aquaria; and we may thus watch the creatures much as if we were ourselves beneath the sea, without those features which might make such a position disagreeable. The first room to visit, however, would be one devoted to an exposition of the relations of animals and plants to their surroundings, such as would give a clew to much we should afterwards see which would be otherwise obscure. Not only would the differences between the great groups of animals and plants be made clear by proper preparations and other exhibits, but a distinct effort would here be made to show what definite relations the structure of animals bears to their immediate surroundings and to their habits, and how animals are provided with the means to do the precise work they have to perform, for work is a condition of being. The changes that have taken place in the structure of certain descendants of air-breathing land animals, such as whales, in order to fit them for marine life, would be illustrated, and other fundamental laws of organic modification would be made clear by aids known to the expert. A similar introduction would be offered in the other sections of the gardens, modified to suit the immediate situation and multiply the illustration, so that the full value of each exhibit might be attainable on the spot.

In the general exhibition-rooms the individual aquaria are like the cases in a museum : their position or their contents may be altered or shifted at will to illustrate this or that feature. But it is probable that geographical data will always have a large influence on the juxtaposition and distribution of the inhabitants of the tanks, first, because it is possible and desirable to have many sorts — widely differing sorts of animals which do not come into collision — in a single vessel, but also because of the importance which relative depth in the ocean, as well as latitude and longitude, has upon marine life. Our own marine fauna and flora would be displayed by itself in special series of aquaria; while, as every desirable range of temperature would be possible in the different tanks by simply heating or chilling the inflow, or, by convection, the water in the vessel itself, tropical and arctic animals, once obtained, could be kept throughout the year.

Outside in the grounds large and small salt-water basins are planned, within which it is hoped to confine and exhibit some of our smaller cetaceans, porpoises, dolphins, etc., as also seals ; while upon their shores and islands water-fowl and other creatures would disport themselves. It may even be practicable by some device to create, in a basin of smaller extent, an artificial tide, with high water at noon and at midnight by the clock, so that the intertidal animals may find their place, the nimble "peep" scamper in flocks along the beach (their wings clipped, of course), while the margins shall represent at intervals a rocky and a sandy shore. This bit of marine life transplanted to our homes need not end here: we should reproduce also the vegetation of the immediate coast ; even the beach-grass of New England may find its corner and give its lesson, offering shelter and congenial home to the maritime locust, whose complete protection through its colorational resemblance to the sand it dwells upon would give to every one who sought it out a practical lesson in one of Nature's most hidden laws,— the importance of disguise and mimicry.

The finest existing zoölogical garden is controlled by a strictly scientific association, — the Zoölogical Society of London. It remains to be seen whether our Society of Natural History cannot accomplish in America a similar work. We may not be able to rival our transatlantic brethren in the extent of our menagerie,— here we are handicapped by the lack of colonial possessions,— but the wide extent of our country gives us altogether the advantage in a display of native animals ; and, if we rightly seize the opportunity before us, we may have a series of gardens second in educational value and in public interest to none in the world.

MEN WHO ARE WORKING WITH KOCH.

PROFESSOR KARL FRAENKEL, whose highly important experiments with a view to conferring immunity against diphtheria are now one of the chief topics of discussion in the medical world, is a pupil of Robert Koch. According to the *Lancet*, he passed his final examination as a physician in 1885, was appointed assistant in the Hygienic Institute, Berlin, on its establishment, and soon became Koch's first assistant there. In 1887 he established himself as private lecturer in Berlin University. About a year ago he was appointed professor of hygiene at Königsberg. He became generally known in medical circles by the publication of his "Elements of Bacteriology," in 1886. This book has appeared in a third edition, and has the reputation of being the best of its kind. The most important of Fraenkel's special in-