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SOME EXTINCT AMERICAN ANIMALS.

When the theory of evolution began to displace the old theory of specific creation, its opponents were wont to ask triumphantly for missing links. If species are the result of gradual development by progressive variation, they said, we ought to find an abundance of intermediate forms: where are they?

The advocates of evolution could only reply: They will appear when sought for. Darwin even ventured the prophecy that in course of time links would be found connecting the extremely specialized one-toed horse with the normal four and five toed mammals. The readers of the SCIENTIFIC AMERICAN know how completely the prophecy has been fulfilled in the numerous and increasingly specialized horse-like creatures which roamed over our Western plains during the tertiary period of geology. At the beginning of the period the four-toed orhippus was most like the horse that was to be, though it exhibited many unhorse-like characteristics. From that time down to the present the chain of development is complete, the precursors of the horse steadily growing more and more horse-like in head, and foot, and general structure of body and limb. In the middle tertiary, the meshippus had but three toes, a slender splint of bone being the only vestige of the lost toe; and in the mihippus the splint had vanished. Later the three nearly equal toes of the mihippus had become three very unequal toes in the hipparion, the large middle toe being the main if not the entire support of the animal. At the close of the period, the prevailing form was a true horse, in which the dwindled and useless side toes of the hipparion had ceased to exist as toes, appearing only as slender splints under the skin. In the modern horse these splints are sometimes seen, attesting its relationship with the horses of prehistoric times.

Similar, if not as positive, evidence of evolution is borne by the remains of tapirs, rhinoceroses, and other hoofed animals. In eocene times the most prominent of the unequal-toed ungulates were the hyrachyus and the palæosyops, the former allied to the lophiodons and tapirs, the latter to the palæotheriums of the European tertiaries. Both these families embraced animals varying in size from a small rhinoceros to a peccary. In the miocene period, these families attained a great development in form, variety, and size: the group became more distinctly separated from each other, and some of them possessed remarkably specialized character. There were, however, no true tapirs, which afterwards became so numerous. The ascendant forms of this period were rhinocerotid, represented by the diceratherum, with its pair of horns side by side on the nose, and the very interesting genus hyracodon, which furnishes a connecting link between the palæotheroid animals of the eocene and the true rhinoceros of the pliocene. The miocene period also produced several species of a more perfect rhinoceros, still hornless. But more remarkable than any of these, indeed in some respects the most remarkable of all the animals brought to light in the strata of the West, were a number of species of grotesque appearance and gigantic size, resembling the existing rhinoceros in general appearance, but larger, some of them approaching nearer to the elephant in size and length of limb. They have been named titanotheriums, brontotheriums, and sarmorodons, and appear to have died out during the miocene epoch. While they lived they must have played the part of the then extinct uinatherium of the eocene (of which more directly), and that afterwards filled by the mastodons and elephants of later ages.

Very interesting evidence of evolution is also furnished by the equal-toed hoofed animals, represented now by pigs, hippopotami, camels, chevrotains, deer, antelopes, sheep, and oxen. Their remains appear but sparingly during the eocene period, but become abundant in the miocene. During this period the first mentioned family were represented chiefly by huge swine-like creatures, some of which approached the hippopotamus in size. There was also an allied four-toed form, more like true pigs; but all the species were of the peccary type. The sole existing survivor of the form on this continent is the South American peccary, apparently an unmodified remnant of the old miocene fauna. A much more remarkable family was the oreodontidæ, which began in the later eocene, extended through the miocene, when they swarmed enormously, dying out in the early pliocene. In nearly all points of structure, they were intermediate between ruminants and swine, furnishing a complete line of transition between those now widely separated groups. Their remains are found in great abundance, both in species and individuals; and a gradual modification, corresponding with the chronological position, can be traced from the earlier, more generalized forms to the latest and most specialized: thus affording one of the most complete chains of evidence yet found in favor of a progressive alteration of form, not only of specific but of generic importance, through advancing ages.

Exceedingly suggestive, too, is the history of the camelidæ as exhibited in our tertiary strata. Here was apparently the original home of this singular group, now represented only by the llamas of South America, and the two camels of the old world. During the middle and later tertiary ages, transitional forms from the more generalized ruminants—animals increasingly camel-like and llama-like in character—were abundant in North America, whence they probably migrated during the glacial epoch to the present homes of the existing members of the family, along with the horses, tapirs, and peccaries, which disappeared from this country about that time.

Not less interesting is the story told by the remains of those unique eocene monsters to which the names titanotherium, uinatherium, dinocera, loxolophodon, and eobasilæus

have been given: huge creatures intermediate between the orders represented by the rhinoceros and the elephant. Professor Flower compares them to broken piers of the bridge by which the gulf, that now so completely divides the orders of the perissodactyle ungulates and the proboscidea, may have been passed over. They were all elephant-like in bulk and general appearance, yet presented a combination of characters which made them unlike anything elsewhere known. Their feet were five-toed, their legs straight and massive; their necks longer than the elephant's, and their small-brained, narrow heads much more like the rhinoceros's than the elephant's. But their distinguished peculiarity was their frontal armament of three pairs of horns, which, with their enormous size and strength, must have made them formidable indeed. Their end is yet a mystery. It has been suggested that at the close of the eocene period they may have migrated to Asia to lay the foundation of that family which first appears in the old world under the more familiar forms of the typical proboscideans—the elephants, mastodons, and mammoths. None of these appear in America earlier than the pleiocene period, a long time after they had become abundant in the old world.

Among the carnivora which preyed upon the abundant herbivorous fauna of the great plains, forests, and lake regions of the tertiary ages, not a few furnish extremely cogent evidence of specific evolution. There were among them fierce creatures, larger than wolves (synaplotherum and mesonyx) which presented such a combination of characters that it is impossible to rank them with either of the existing families of the order to which they belong. In some respects they were like dogs, in others they were bear-like; in still others they were more generalized than any existing members of the order. Then there were several species of hyænodon, some larger than any of the European forms, and others no larger than a fox: "the last survivors of a group notably differing from any now known." In the character of their skulls they stand intermediate between wolves and opossoms. In the earlier periods, still more generalized types abounded, some of them combining the generic characteristics of half a dozen of our specialized modern carnivora.

Perhaps the most remarkable of these comprehensive types was the tillodontia, which seem to have combined the characteristics of several distinct groups, the carnivora, the hoofed animals, and the rodents. Some of them were as large as the tapir. Their molar teeth were of the ungulate type, their canines small, their incisors rodent-like. Their heads were bear-like, their general structure like that of the ungulates, their feet plantigrade. Two distinct forms abounded: one in which the incisors grew from persistent pulps, like the beaver's, the other having all the teeth rootless.

The dominant type of tertiary flesh eaters, however, were various modifications of felidæ, fierce cats, some of them surpassing our modern lions and tigers in size and strength. Chief among them in the miocene age were the saber-toothed tigers, which seem to have overrun the whole world about that time, and to have lingered in some parts until the human period. It is one of the puzzles of palæontology to account for the extinction of this highly specialized type, apparently the fittest of all the cat family to win in the struggle for existence. Happily for man they did not survive in force, to contest his progress toward the mastery of the earth.

PROSPECT OF NEW GERMAN PATENT LAWS.

A correspondent in Berlin sends us the intelligence that a modification of the present oppressive and illiberal system of German patent law is about to be made: that Prince Bismarck has been investigating the code as now existing, has recognized its defects, and will shortly submit to the German Parliament the draft of a new law, the substance of which we give below. As matters now stand, the German patent is practically but little safeguard to the foreign inventor against German piracy, a fact we have stated in a multiplicity of connections. The government itself takes the lead in "adopting" foreign devices submitted to its examination under applications for patents, and it protects its people when they follow its example. We need go no further than the Centennial Exposition to find a striking instance of this in the Krupp guns, wherein is used the Broadwell gas check ring, an American invention, and a necessary appendage to all breech-loading cannon. This was submitted to the German government for trial, and was unblushingly appropriated, and the inventor virtually told to go about his business. The invention is styled the Broadwell ring even in German official reports. Krupp likewise "adopted" the invention, and has used it on thousands of guns without paying the inventor a cent. The same has been the case notably with other American military inventions.

Of course it needs no argument to show that such a course is not merely detrimental to the interest of foreign inventors, but also highly prejudicial to the best interests of Germany herself; and of this latter fact the astute Imperial Chancellor has doubtless become fully apprised. The main points of the new law which he suggests are that every invention, excepting, of course, such as are opposed to law or good morals, may be patented. Inventors are not bound to give licences except where such are demanded for the public benefit. The specification must be definite, must be published at a certain time after application, and must embody distinct claims. The first applicant is considered the inventor, disputes as to originality are to be settled by the courts, and, in obtaining patents, foreigners are placed on the same footing as Germans, with the exception, however

that the former must appoint an attorney or representative in Germany. Patents may be declared void if insufficiently worked in the German Empire. It is considered a proof of such insufficiency if the articles patented are imported into Germany after a qualified person has offered to work the patent within the Empire. All such patents are to be forfeited if the proprietors allow importation without interfering, provided the laws of the respective patentee's native country contain similar ordinances (France, etc.). In all other respects, there is no special proof of working necessary. Patents are to last fifteen years, and in certain cases extensions may be had. Progressive taxes are to be levied. Prior publication prevents the grant of a patent, the patent right is transferable by deed or will, divided or undivided. A special court is to be provided for patent suits. Patent objects are to be marked, as under the American law. Patents may be declared void if the invention is insufficiently specified, if the foreign patentee maintains no German representative, if taxes are not paid, or if the patent can be proved to have been void from the beginning. There are some other, minor provisions, but the above sufficiently indicate the scope and character of the law, which, so far as Americans are concerned, is but little improvement on the present system. Of course the complete text is necessary before a just opinion of the provisions as a whole can be reached, and we should prefer some experience in its working before hazarding judgment as to its fairness and efficacy as regards foreign inventors. The clauses which require inventors to "give licenses when demanded for the public benefit," those relating to working in the Empire, and the offer by "a qualified person" to do so in the event of the non-compliance of the inventor, seem to open the way to wide constructions adverse to foreigners, and virtually to a continuance of the present injustice. The letter of the law may, it is true, change; but when such constructions are possible, and not only this, but, as past experience shows, have been the rule in Germany, it is not unreasonable to believe that those who interpret the law will be guided therein by the light of precedents.

PROGRESS OF THE MISSISSIPPI RIVER JETTIES.

We have held so firm an opinion that a triumphant success awaited the carrying out of Captain Eads' plans, for opening the Mississippi river to the commerce of the world, that to read the engineer's reports of the splendid progress of the work is but to learn of the fulfilment of confident expectations. The latter report, dated August 18, is now before us, and the results noted must certainly be gratifying to the whole country. The channel between the jetties, we are told, is constantly increasing, and the jetties themselves are built up above mean low tide, and for a great length above average high tide. The last survey, made July 27, shows a channel extending down 1,800 feet from the upper end of the jetties, and within only 250 feet of the deep waters of the Gulf, having an average width of about 350 feet, in which all soundings are 20 feet or more in depth. The line of deepest soundings through the length of 2½ miles averaged over 26 feet, and many single soundings showed over 40 feet. Some idea of the progress of the erosion going on between the jetties may be inferred from the fact that the 20 feet channel, existing on June 17, had increased in average width nearly 100 feet throughout its entire length in the forty days between that date and the last survey.

Captain Eads reviews, in some detail, various objections which the opponents of his project have urged, and devotes himself more especially to the assertion that the earth washed out of the channel would merely form a new bar outside the jetties, and thus render access as difficult as ever. To settle this matter, he had soundings made in radial lines from the end of the jetties; and comparing the results thus obtained with those gained from a like series of soundings made in 1875, he finds that, instead of a bar being formed, there has been actually excavated, out of an area 1,100 feet square immediately in front of the jetties (which area must first be covered with deposit before a re-formation of a bar can occur) a mass of earth equal to 68,400 wagon loads. And this aggregate deepening has occurred while nearly 3,000,000 cubic yards of earth have been taken up, from the bar between the jetties, by the river current, in excess of the ordinary burden of sediment, and transported over this area out into the Gulf of Mexico. If the mass had been deposited over the area mentioned, it would have covered the space to the depth of about 18 feet. In fine, it is conclusively proved that a general deepening has occurred in 490,000 square yards of the area in front of the jetties, comprising the outer slope of the bar and the track of the river discharge, and thus the report of bar advance and shoaling in front of the jetties is shown to be without any real foundation. Captain Eads admits that this favorable phenomenon of deepening immediately in front of the jetties was unexpected to all the advocates of his system, and he ascribes it to the sea current which is induced by the prevailing winds, which blow almost constantly from between the northeast and southeast. The current resulting is driven westwardly beneath the river discharge, and excavates more room for itself as the volume from the jetties becomes gradually stronger. Captain Eads reports in conclusion

"In seventeen months after the passage of the act, and within fourteen months from the commencement of the work, the jetties have solved the problem presented at the mouth of the river. In their unfinished condition, they have withstood with but trifling injury two very severe storms, one surpassing in violence any known in the locality for many years; they have demonstrated the entire ability of the delta formation safely to sustain the works necessary to

control the river discharge; they have not been overturned by mud lumps, nor swallowed up in quicksands, nor undermined by the river current: and although largely over 3,000,000 cubic yards of earth have been swept out from between them into the Gulf, and the channel across the bar has been deepened from eight or nine to twenty-one feet, no evidences of a re-formation of the bar have yet to justify the belief that any extension of them will be necessary."

STEAM ENGINE SLIDE VALVES.

Some of our correspondents seem to have a difficulty in deciding as to the comparative merits of engines with single slide valves, and engines with separate cut-off valves. Take the following letter as a specimen:

"Can you explain clearly and definitely the difference in action between an engine with a single slide valve and one having two slide valves, one being a cut-off valve, there being a throttle in the steam pipe? And what are the advantages of the more modern cut-off engines, in which the governor acts upon the cut-off valve directly? I cannot find the information in any book, and none of the men in our shop seem to have precise information upon it."

If, with a single slide valve, sufficient steam lap is given to the valve to enable it to cut off the steam earlier than when the piston has traveled about three quarters of its stroke, the exhaust becomes cramped at the cylinder exhaust port, as explained in volume XXXII, page 101. Hence, to economize fuel by using the steam expansively during a greater portion of the stroke, the cut-off valves were added; and at the same time, to avoid the loss of steam due to long steam passages, the latter were placed at the ends instead of in the middle of the steam chest. This necessitated the employment of two steam valves and two cut-off valves, it being considered that the power required to operate the valves was more than compensated for by the steam saved by reason of the short ports.

The placing of the throttle valve in the steam pipe had the following defects: In the first place, the action of a governor takes place after the error which it is intended to remedy has actually occurred: or, in other words, the speed of the engine must be greater than it is intended to be before the governor balls will rise and correct the evil. So that there is an element of time between the acceleration of the speed of the engine and the diminution of the steam supply by the action of the governor and throttle valve. Now in order that the initial pressure of the steam supplied to the cylinder shall be as near that of the boiler as possible, a supply of steam is provided close to the cylinder, that is to say, in the steam chest; and when the engine is running at her proper speed, the pressure of this steam approximates to that in the boiler; and if the engine speed increases and the governor closes to a corresponding degree the throttle valve, there is nevertheless a supply of steam at full pressure which has passed the throttle, and is already in the steam chest; and its action is, to a great extent, to offset the effort of the governor.

Secondly, the throttle valve, by reducing, at the necessary times, the pressure of the steam in the steam chest, correspondingly reduces its temperature, inducing in the steam chest a certain amount of condensation of the re-entering full pressure steam, admitted when the throttle valve reopens wide. When, however, the governor is attached to the cut-off valve direct, the pressure (and temperature) of the steam in the steam chest is not affected by the governor, and continues, therefore, to be nearly that of the boiler. The advantage due to this will perhaps be more readily perceived if we suppose that the throttle valve is the steam pipe, and that the engine load having suddenly lightened, the throttle partly closes, thus reducing the pressure of the steam in the steam chest and cylinder. If, then, the engine load suddenly augments, and the throttle opens wide, the inflowing steam is required to restore the pressure in the chest before it can restore it in the cylinder. In other words, the space requiring its steam pressure to be increased is the contents of the steam chest as well as of that part of the cylinder in open communication with the steam chest.

The action of a governor attached directly to the cut-off valve is that, so soon as the engine load lightens, the supply of steam to the engine cylinder is lessened by cutting it off earlier in the stroke: and there is hence a direct relation existing, at all times, between the engine duty and the consumption of steam, the engine speed being reduced by the extra degree of expansion employed, instead of by wire-drawing the steam. In addition to these advantages, most of the modern cut-off devices are given a motion which opens and closes the steam ports very suddenly, inducing a greater initial pressure of steam in the cylinder and obtaining a more sharply defined point of cut-off.

MORE CENTENNIAL AWARDS.

Another lengthy list of Centennial awards has been published, and the New York Times has still better ground for its witty suggestion that people will before long begin to seek for exhibitors who did not receive honors, under the idea that the true mark of distinction lies in failing to obtain any judicial notice whatever. Meanwhile it is amusing to notice the efforts which many of the successful exhibitors, and most especially the sewing machine and piano men, are making to convince the public that each and every one of them obtained the first and best and highest premium. Four piano firms are lavishly advertising the fact, and reinforcing their assertions with extracts from the judges' reports, which quotations, when considered together, show that the judges avoided an obvious dilemma by characterizing all the pianos as excellent, as doubtless they were, and leaving the rival makers to wrangle over their grammars and dictionaries in determining the exact comparative signification of the high sounding adjectives employed. Of

course (and every one who has taken the trouble to comprehend intelligently the system of awards knows it) there are no "first premiums," and it is only uselessly to infer ignorance on the part of the public to blazon forth any claim to such. The regulations of the Centennial Commission on the subject are as follows: "Fourth: Reports and awards shall be based upon inherent and comparative merit. The elements of merit shall be held to include considerations relating to originality, invention, discovery, utility, quality, skill, workmanship, fitness for the purpose intended, adaptation to public wants, economy, and cost. Fifth: Each report will be delivered to the Centennial Commission as soon as completed for final award and publication. Sixth: Awards will finally be decreed by the United States Centennial Commission, and will consist of a diploma with a uniform bronze medal and a special report of the judges on the subject of the award."

The cardinal object of the system is to avoid gradation. The judges simply write reports on exhibits which they deem commendable, and the Centennial Commission thereupon decides which out of the exhibits so reported upon are entitled to the medal and diploma. From the length of the lists, it is safe to believe that few if any of the objects commended by the judges were denied the distinction: and inquiry among several exhibitors in this vicinity reveals the further fact that, in most cases, those who did not receive judicial notice and a report owe it to their own neglect and misapprehension in not entering for competition, or in failing to send in the required description to the judges, or in some other wise not complying with the regulations of the Exposition.

We do not think that any one will regard the medals and diplomas as of any especial importance. Some system of the kind had to be devised, else exhibitors would be dissatisfied at being denied their usual stimulus. The defects of the old anonymous jury system, with its multifarious gold and silver medals, are well known, and the present plan was adopted as a better substitute. It gives everybody a premium, and that is excellent, and likely to cause universal gratification. The real distinction, however, lies in the reports; and when an exhibitor receives a document signed by such experts as Dr. John Anderson, or Professor Reuleaux, or Dr. Nordenskjold, or Captain Eads, all of whom are judges besides many other eminent gentlemen, pointing out the merits of his device, showing wherein it excels, and thus lending the weight of their high authority in his support, then he has something worth any number of meaningless medals; and if he fails to publish that report, and to advertise the fact that he has received it, and the object he received it for, over the whole land, he simply neglects his best interests and throws away the greatest benefit which the Centennial Exposition can secure to him. And this we strongly advise our readers to do: Do not claim "first premiums," for that is nonsense; but procure a copy of the report (and every exhibitor is legally entitled to that), and publish it along with such a description of the invention that the public may see what has been accomplished, and what the accomplishment has earned.

We give below some further names of manufacturers and inventors well known to our readers, who have received favorable reports and awards: H. W. Johns, for asbestos and its adaptations to roofing, paint making, engine packing, boiler covering, cement, etc.; Dixon Crucible Company for graphitic crucibles; Morris, Tasker & Co., gas works machinery; Charles Pratt & Co., petroleum products; General M. C. Meigs, for hydrodioptric light; Odorless Excavating Company, for cesspool cleaning machine; W. D. Andrews & Brother, for centrifugal pumps; Lathrop Anti-Friction Company, for lubricant; Jerome Wheelock for automatic cut-off engine; George B. Brayton, for hydrocarbon engine; and Professor R. H. Thurston, for metal-testing machine.

A Remarkable Fish Dinner.

The fish culturists who have recently been in session at the Centennial Exposition treated themselves, during their stay in Philadelphia, to a fish dinner, which is certainly extraordinary and unique in its way. The bill of fare embraced fifty-eight different kinds of fish, and in its entirety is much too long for publication here. Some of the delicacies, however, are remarkable. Under the head of *hors d'œuvres froids*, (the *menu*, by the way, is organized with the utmost elaboration) we find Norwegian pluck fish, Portuguese conger eel, and Spanish conger eel with tomatoes, Turkish botargoes or mullet roes, Japanese shake or dried salmon, crayfish from the Cape of Good Hope, French tunny fish, Chinese white and black shark fins, Alaskan oolachans, Portuguese sword fish and squid, Russian caviar, Chinese dried fish maws, and, most astonishing of all, "desiccated octopus eggs." Noted scientists are honored by having their names applied to the various sauces. Thus we have *filet* of English soles à la Buckland, sheepheads, Agassiz sauce, aspice of eels à la Huxley, and *bisque* of lobster, Seth Green style. It was a memorable feast, and taxed the culinary skill of the cooks at the Centennial to the utmost. One particular dish seems to have puzzled even the most ingenious chefs, and that was kanten (Japanese seaweed) à la Sekizawa Akeio. The aid of the Japanese cook in the employ of the Japanese Commission was at last invoked, and he proved equal to its toothsome preparation.

AN agricultural society in Massachusetts, desiring to encourage tree planting and the re-forestation of poor lands in that State, have offered prizes for the best plantations of larch, pine, ash, and other trees suited to different localities and soils. The prizes range in amount from \$400 to \$1000, and special instructions are published to guide competitors.