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(Illustrated articles are marked with an asterisk.)

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ANIMALS ARE AUTOMATA.

One of the most interesting features of the recent meeting of the British Association was the address of Professor Huxley on "The Hypothesis that the Animals are Automata, and its History." This title at once arouses a lively interest, since, among other things, it holds out the promise of a solution of those curious phenomena of sagacity or instinct in the lower animals, which sometimes lead us to question seriously whether the reasoning faculty be totally absent.

And this is susceptible of apparent experimental verification. Professor Huxley mentions the case of a frog in which the anterior portion of the brain is destroyed. The animal may live for years, and yet it is certain that it neither sees nor hears. It will sit forever in the same spot; and yet when urged against obstacles, it will turn to avoid them. It will swim in water or balance itself on the hand, as that member is slowly revolved. Something evidently passes through the sensory nerve, acts upon the frog's machinery and the nervous system, and causes it to adapt itself to the proper position.

A still more curious instance cited is that of a French soldier wounded in the left parietal bone. Although he recovered from the lesion, the man leads two distinct lives. For two days in the month he neither sees nor smells, and, in fact, is destitute of every sense except that of touch. Yet he avoids obstacles, eats (though he is utterly destitute of any discrimination in point of taste), performs a large number of actions on mere suggestions, and, stranger still, shows a totally different moral nature; as, while at other times he is inflexibly honest, when affected he becomes an inveterate thief.

With this brief reference to his illustrations we may at once come to Professor Huxley's conclusion, in which, however, he fails to concur wholly with Descartes. He says: "Taking into account the incontrovertible fact that the lower animals which possess brains at all possess (at any rate, in rudiments) a part of the brain, which we have every reason to believe is the organ of consciousness in ourselves; then it seems vastly more probable that the lower animals, although they may not possess that sort of consciousness which we have ourselves, yet have it in a form proportional to the comparative development of the organ of that consciousness, and foreshadow, more or less dimly, those feelings which we possess ourselves." In other words, an animal is, according to Professor Huxley, a sensitive, conscious automaton; its sensations, its volitions, and its thoughts are but the products and consequences of mechanical arrangements. A certain molecular change in the nervous system determines a sensation; the emotions thereby excited leave in the brain, in turn, molecular changes which constitute the physical foundation of memory. These changes give rise to volitions, which, in the animal, will be simply states of emotion which precede its actions; it is a conscious machine. And this, Professor Huxley says, "applies in its fullness and entirety to man;" and he expresses no fear of the logical consequences. Yet he does not—indeed, we fail to see how he could—avoid the admission that these very logical consequences of his doctrine, rather than the theory per se, will excite controversy and the imputation that he is speeding toward fatalism, atheism, and materialism.

It strikes us as a remarkable fact that Professor Huxley, by an entirely different road—a tunneling through the depths, as it were—brings us face to face with one result which Dr. Hammond, in his discussion of morbid impulse, reached by a surface path. A man, for example, commits a murder. If we turn to the morbid impulse theory, we may defend him on the ground that there is a flaw in his brain organism, which leaves him in a state when "he is impelled, consciously, to commit an act which is contrary to his natural reason and to his normal inclinations." This is "conscious mechanism," pure and simple. There is no will employed in the matter. Huxley's doctrine, however, carries us further, and allows the accused to plead the broader defence of "unconscious cerebration." He was injured, he may say, he struck, he killed; the power which impelled him to strike was the same which caused him to raise his arm to guard himself, a purely involuntary action. Practically, of course, no such defence would be admitted; but it leads us, from both the doctrines above referred to, to a closer investigation of how far man is responsible for his own actions.

PROFESSOR TYNDALL'S ADDRESS.

There are utterances which mark epochs in human history: not because they give voice to anything new, not because they suggest any original line of thought or investigation, but because they strike, so to speak, the intellectual key note of the age, announcing from some high position the irrepressible conflict of the coming years.

Of such a nature is Professor Tyndall's address before the assembled scientists of Great Britain. It contains no new thought, it announces no new truth; yet in asserting the irresistible sweep of Science upon the remaining strongholds of religious dogma, it is calculated to stir up a grand commotion, not merely in the class so neatly described by the senior Draper as the only example, in the fauna of the world, of that non-development which they so loudly affirm, but among progressive scientists themselves. The timid can no longer blink the fact that the drift of scientific thought, certainly in the minds of its highest representatives, is toward the complete subversion of the fundamental doctrines taught by the ecclesiastical world. It is no longer a question of the earth's form, or position, or age which marks the conflict of Science and religion; no more is it a question of man's place in Nature, his relation to other forms of life, or the origin of his physical frame; these outposts have been carried, and the citadel itself is entered; the distinction between mind and matter, or matter and spirit, is denied, and with it the personal immortality of man, the personal dominion of the universe, and all that these involve.

In the words of this spokesman of British Science, we may see the workings of British thought: "Trace the line of life backward, and see it approaching more and more to what we call the purely physical condition. We reach at length those organisms which I have compared to drops of oil suspended in a mixture of alcohol and water. We reach the protogenes of Haeckel, in which we have 'a type distinguishable from a fragment of albumen only by its finely granular character.' Can we pause here? We break a magnet and find two poles in each of its fragments. We continue breaking; but however small the parts, each carries with it, though enfeebled, the polarity of the whole. And when we can break no longer, we prolong the intellectual vision to the polar molecules. Are we not urged to do something similar in the case of life? Is there not a temptation to close, to some extent, with Lucretius, when he affirms that 'Nature is seen to do all things spontaneously of herself, without the help of the gods?' or with Bruno, when he declares that 'matter is not that mere empty capacity which philosophers have pictured her to be, but the universal mother who brings forth all things as the fruit of her own womb?'"

In its unexpected frankness, Professor Tyndall's answer to these questions reminds one of the reply given by a canny Scotchman, on being asked by a tourist if he did not sometimes feel sorely tempted to forget the "sawbath day" and go salmon fishing in the river that flashed by his cabin door.

"Na, na," gravely responded Sawney, "I's no temptit; I joost gang!"

So with Professor Tyndall. Where men of less resolution pause and shut their eyes to the inevitable, he "joost gangs." "Abandoning all disguises," he says, with a fearless honesty that will command respect if it fails to command assent, "the confession that I feel bound to make before you is that I prolong the vision backward across the boundary of the experimental evidence, and discern in that Matter which we, in our ignorance, and notwithstanding our professed reverence for its Creator, have hitherto covered with opprobrium, the promise and potency of every form and quality of life." In other words, we are what we are, all things are what they are: not because it has been the pleasure of an artificer, "fashioned after a human model and acting by broken efforts, as man is seen to act," to so create us, but because of the potency of what we are wont to call lifeless matter, whose nature it is to evolve all that we see around us or feel within us, all things that have been or will be, through the play of molecular force. We live because matter lives. We think and feel because it is the function of material combinations such as compose us to think and feel, all the phenomena which we distinguish as physical or mental having their unsearchable roots in what he ventures to call a cosmical life.

To those familiar with the history of human thought, there is nothing startling in this confession. Precisely the same view of the potency of matter has been widely accepted in Germany. "Consciousness itself is nothing but an attribute of matter," says Moleschott, and others are equally outspoken. But for a philosophically conservative body like the British Association to listen to such assertions from its president is something altogether unexpected, something which will not end with the hearing.

VIVISECTION.

The question of how far we have the moral right to torture and mutilate the lower animals in the course of scientific investigation is again brought to public attention through a letter addressed by Mr. Henry Bergh, President of the Society for the Prevention of Cruelty to Animals, to Dr. Austin Flint, of the Bellevue Medical College of this city. This subject has been in controversy for nearly two centuries, and through its recent agitation in England has elicited the published opinions of many of the ablest British physiologists of the present day; so that we have abundant authority to guide us in drawing the line between that sacrifice of brutes which is both justifiable and proper through the magnitude of the ends which are secured thereby, and the wanton cruelty which impels the destruction of life uselessly.

We have so great an admiration for the philanthropy of Mr. Bergh, and so high an appreciation of the results of his efforts in behalf of the long-suffering animals, that it is with difficulty that we can bring ourselves to the task of pointing out the errors into which he falls through a laudable zeal in his self-imposed labors. But we cannot admit his assertions that "the most eminent physiologists have pronounced vivisection a scientific failure," or that "lifeless bodies furnish all necessary evidence."

Harvey owed the demonstration of the truth of the circulation of the blood to experiments upon living animals—experiments which he details with great minuteness in his famous work. John Hunter studied the terrible disease of aneurism, and perfected the surgical operation for its cure upon brutes. Sir Charles Bell gave us our knowledge of the nature of the sensory and voluntary nerves, and their double origin in the spinal cord; and Marshall Hall demonstrated the equally important discovery of the excitatory action of the nervous system, through the same means. In both of these last instances, it was impossible to use anesthetics, and they sink into utter insignificance beside the weapons which they placed in the hands of the physician wherewith to combat the pain and suffering of millions for ages hereafter. We might continue and adduce scores of cases similar to the above. Majendie's investigations, and the new remedies which they gave to Science; Blake's studies on saline matter in the blood; Gadden's localization of the cerebral function; the labors of Ferrier, Goltz, Michael Foster, Lewis, Hitzig, Fritz, Brown-Séquard, Bert, Dalton, and the recipient of Mr. Bergh's letter, Dr. Flint, are well-known examples which occur as we write.

But while Mr Bergh is, perhaps, as we have endeavored to show, too sweeping in his wholesale condemnation of vivisection, he is undoubtedly right in inveighing against the infliction of unnecessary torture on the unfortunate brutes; and in this respect we earnestly endorse the ground which he takes. It is a common practice in many medical colleges to sacrifice scores of animals yearly for the repetition of experiments which have proved well settled and thoroughly understood facts. The insertion of a canula into a dog's stomach, in order to submit a bit of meat to the prolonged action of the gastric juice, or the placing of bullets in a pig's leg to show the growth of the bone, are common examples, which, since they are useless, are certainly cruel. Nor is there any necessity of following the practice of a distinguished physiological lecturer in this city, of interrupting the thread of his explanations to seize a wretched cat, cut its throat, and composedly hand the reeking viscera about his class for examination. For such unnecessary torture there is no excuse.

A committee of the British Association, in 1870, considered this subject quite fully, and produced the following report, which we would recommend to faculties of medical colleges throughout the country, and incidentally to the notice of Mr. Bergh.

1. "No experiment which can be performed under the influence of an anæsthetic ought to be done without it.
  2. "No painful experiment is justifiable for the mere purpose of illustrating a law or fact already demonstrated; in other words, experimentation without the employment of anæsthetics is not a fitting exhibition for teaching purposes.
  3. "Whenever, for the investigation of new truth, it is necessary to make a painful experiment, every effort should be made to ensure success, in order that the suffering inflicted may not be wasted. For this reason, no painful experiment ought to be performed by an unskilled person with insufficient instruments and assistance, or in places not suitable to the purpose, that is to say, anywhere except in physiological and pathological laboratories, under proper regulations.
  4. "In the scientific preparation for veterinary practice, operations ought not to be performed upon living animals for the mere purpose of obtaining greater operative dexterity.
- "Signed by M. A. Lawson, Oxford; G. M. Humphry, Cambridge; John H. Balfour, Arthur Gamgee, Edinburgh; William Flower, Royal College of Surgeons, London; George Rolleston, Secretary, Oxford."

AMERICAN BEACON LIGHTS.

It might naturally be supposed that the United States, with its immense coast line, and the reputed enterprize of its citizens, would be likely to occupy a prominent position among the nations in respect to the scientific construction and management of its beacon lights. But from all the facts that can be gathered, it would appear that we are considerably behind the age. We hope the members of the Light House Board will read the SCIENTIFIC AMERICAN hereafter, and so keep posted in respect to all new and useful improvements in the production of lighting apparatus.

Major G. H. Eliot, United States Engineers, Secretary of the Light House Board, has recently published a report, which is the result of careful examination of the light house systems of European countries. For this labor the writer was afforded exceptional facilities by and through the English authorities, in return for the same courtesy afforded to a representative of the latter in this country, lately charged with the inspection of our fog signals. Major Eliot points out that, while the English and French systems closely resemble our own, there are points in which we may take them as models with advantage. Among these, he mentions the use of gas and the electric light in positions of importance, the use of azimuthal prisms in certain localities, the use of fog signals and revolving lights on light ships, the character of the lamps, and, lastly, the class of keepers, who are retained in service until superannuated, who are eligible for promotion, and whose lives are insured by the Government for the benefit of their families. The English and French lamps, it seems, are superior to ours, in that their light may be governed by the keeper to suit varying conditions of the atmosphere—whether foggy, more or less dark, etc. It is stated that the first order sea coast lights of England may be raised from an equivalent of 342 (their minimum) to 722 candles, while the maximum power of our first class light is uniformly the equivalent of only 210 candles. While the English and French lights have been in recent years increased in power, the actual consumption of oil per unit of light has been decreased by improvements in the supply of oxygen to the flame; and it is suggested that if the modifications described in detail should be adopted, the illuminating power of our lighthouses would be augmented by more than fifty per cent, thus vastly increasing their efficiency in thick and obscure weather.

Mineral oil is rapidly replacing vegetable and animal oils, and by every nation (with the exception of ourselves) the lamps are being changed for its use. It is more cleanly than the lard oil at present used, and not affected by cold; while the lamps do not require trimming during the longest nights, thus leaving much less to depend upon the vigilance of the keeper. It is estimated that we could import a fine quality of Scotch oil (though there is no reason why our own refiners should not make a sufficiently good article), and save \$50,000 a year, besides gaining more valuable lights, by substituting mineral for the oil now in use.

It would seem that the suggestions made are quite practicable, and if carried out would render our lighthouse system probably the finest in the world. As it is, vessels can cruise for 5,000 miles along the Atlantic and Gulf coast without losing sight of a light; and there is a large number of houses on the remaining 5,000 miles of our seacoast. Our present Lighthouse Board controls 591 lighthouses, 35 fog signals, 363 day beacons, and 2,838 buoys.

ALASKA AND THE ICELANDERS.

When Mr. Seward completed his bargain with Russia for that out-of-the-way corner of this continent now known as Alaska, there was a general expression of opinion, that \$7,200,000 of national money, while ordinarily a rather low figure to pay for 580,107 square miles of territory, was nevertheless an excessive price when that territory was, to all appearances, unfit for any but seals and Esquimaux to exist upon. This rather unfavorable impression at the outset was hardly of a nature to engender any widespread public interest in our new acquisition, so that the far-off addition to our domain has heretofore received little attention from any one save from a few hapless government officials who may have been ordered to duty in cold, rainy, and generally disagreeable Sitka. An expedition was sent thither in 1865 to survey a route for a Russo-American telegraph; but the completion of the first Atlantic cable caused the abandonment of the project. Then the territory has been made a military and collection district. Frederick Whympers in England has pub-

lished a book about it, and Mr. W. H. Dall, to whom we are indebted for valuable archæological investigations among the Aleutian Islands, has produced a similar work. From these volumes the public has read all about Alaska that it cares to, has tossed them aside, and has straightway again consigned the territory, with its seals and its bears, its mountains and its glaciers, and its thousands of square miles, explored and unexplored, to further oblivion.

Nevertheless, to a few thoughtful people the question continues to present itself: "What are we going to do with a political division with a population of 29,097 souls, of whom only 1,300 pretend to have fully acquired the blessings of civilization; where there are 150 rainy days in a year at most places, and sometimes 285 days of incessant downpour at Sitka; where the temperature descends to -70° Fah., and averages about +44° throughout the year? The productions are an abundance of timber, some coal, a little gold and silver, ditto copper, plenty of sulphur, and furs worth about \$85,000 per annum. In such parts of the country as we know anything about—and that is only along the coast line of 4,000 miles—it appears that there are resources well worth development, but immigrants are very scarce, and capital would doubtless consider any investment in this direction precarious.

It would be an odd coincidence if the inhabitants of one out-of-the-way country, as little thought of as Alaska until the recent celebration of its one thousandth birthday drew the attention of the world to its bleak and rocky shores, should be the means of reclaiming our far northern purchase—should discover its mines, hew its vast forests, and populate its towns—perhaps some day ask for its admission into our family of States. The Icelanders are gazing toward Alaska. Four or five hundred immigrants have arrived in Canada and the United States; and already a petition, signed by fifty Icelandic names, has been forwarded to the President, asking for Government cooperation in exploring the territory with a view to its colonization. The reasons why they thus turn to the most uninviting portion of our domain are cogent, forcible, and convincing. It is too far north and too cold for any civilized person but an Icelander to exist in comfort. Its climate is excellently suited to the raising of hardy Icelandic cattle, allowing of an abundant supply of beef, butter, and cheese to the Pacific coast; its fisheries and timber production would supply a large portion of the country. The Fish Commission tell us that our Eastern fish are getting scarce, while that there is a general feeling of uneasiness at the widespread destruction of our forests is well known. May not the sturdy fishermen and lumbermen of Iceland aid us in supplying the deficiency from sources now undrawn upon? May not shipyards appear in Alaska as well as in Maine? The Icelanders say that their colony would supply seamen for the naval and merchant marine, and thus they offer both ships and men to aid in restoring our now depleted carrying trade.

We think that this proposition should meet with favorable consideration from the Government. The Icelanders are a hardy, brave, loyal people. Education among them is prized to a degree greater than among any other mass of people on earth, and we know of no nation whose emigrants could be incorporated in our own people with greater advantages to ourselves. In case they meet with no encouragement from our Government, the nucleus of the coming colony will probably be formed in Canada, and the advantage of increased population will accrue to England instead of to ourselves. There seems to be little question as to the expedience of affording the moderate national aid asked by these people, when considered in connection with the probability, on the other hand, of leaving our territory virtually in the hands of savages for an indefinite period to come.

QUEER RAINS.

An ant rain recently happened in Cambridge, England. *The Chronicle*, a journal of that city, in detailing the circumstance, says that at about six o'clock in the evening, shortly after a rise in temperature had taken place, a shower of ants in countless millions settled in the streets, covering the pavements. The insects were the small winged male ant (*formica fusca*), together with two other varieties, one large without wings, and another of intermediate size with wings. It appears that the creatures must have taken wing or emerged from ground nests; but how far they had traveled, or by what atmospheric phenomenon they were transported, remains an interesting subject for investigation.

It is said that in the early part of this century similar showers occurred in various parts of England and in the Pyrenees, and a few months ago a dense cloud of the insects was seen passing over Cambridge; but there is believed to be no record of an ant rain of such magnitude as this last one.

In examining into this subject of queer rains, we have found a large number of singular cases of downfalls of fish and other animals from the sky, a reference to which will be of interest in the present connection. Showers of fish have been numerous, and are generally explicable by the occurrence of water spouts, which draw them up into the clouds, whence they are carried by strong gales to the land. In Scotland rains of herrings have frequently occurred, the fish in some instances falling far inland, miles from any body of water. A shower of frogs fell near Toulouse in 1804, and in 1827 an immense number of black insects appeared in the midst of a snow storm at Pakroff, Russia. There is a tradition in Lapland that mice of a particular kind have been known to fall from the clouds. The rat shower of Norway has passed into a historical fact. This was a most extraordinary though perfectly explicable occurrence, since it was traced to a whirlwind, which, overtaking an enormous army

of the rodents during their annual journey from a hilly region to the lowlands, whisked them up and deposited them in a field at considerable distance.

Immense showers of dust have repeatedly happened in the South of Europe, covering, in one instance, the entire surface of Italy and Sicily, or about 100,000 square miles. Darwin states that a rain of this kind, which took place in 1824, covered the enormous area of 1,648,000 square miles in Northern Africa. Ehrenberg has found the dust to consist of infusoria. It is of a reddish color, and upwards of 320 distinct organisms have been recognized in it.

THE FAIR OF THE AMERICAN INSTITUTE.

The forty-third annual exhibition of the American Institute was formally opened on September 9, in the same building (on Third avenue, between 63d and 64th streets, in this city) in which it has been held for several years past. The ceremony consisted in the usual chorus of hammers, mingled with other noises indicating busy labor, with which the voice of Mr. Nathan C. Ely, Chairman of the Board of Managers, endeavored, though somewhat unsuccessfully, to compete for a brief interval in an effort to deliver an address. The latter, which the speaker, evidently in deference to the strain upon his vocal organs, cut as short as possible, was merely a setting forth of the advantages of industrial exhibitions, followed by the formal declaration of the opening of the Fair. Then the band pitted itself in an heroic struggle against the hammers, and the visitors wandered around and admired the extent and variety of the packing boxes and the broad vista of unoccupied tables.

So far as we are able to judge of the Fair, in its present chaotic condition—and we have long since despaired of ever finding it otherwise on the opening day or during the fortnight following—there are indications that the exhibition will be a very interesting one. The machinery department is again superintended by Mr. John T. Hawkins, a gentleman who won well deserved praises for his ability and energy in the same position last year. This portion of the Fair, mainly through the efforts of Mr. Hawkins, is much the furthest advanced. Both of the main engines—one by Hampson, Whitehill & Co., of 100 horse power, and the other by William Wright & Co., of 75 horse power—started promptly on time, and the shafting throughout the building was in motion at the hour fixed, although not a tithe of the machines were connected therewith. The list of entries in the department shows about the same number as at the Fair of 1873, with not very many novelties. Two exceptionally large and fine displays of machine tools, by the New York Steam Engine Company and Messrs. George Place & Co., respectively, are the prominent features. These include the latest mechanical improvements and refinements, and, as they will be exhibited in actual operation, will be well worthy of study. We shall allude in detail to the new inventions in these collections, in a subsequent article, adding here only a word of credit to both exhibitors for their promptitude in having such heavy goods in position and (with some exceptions) in running order, which is in marked contrast with the tardiness which characterizes the proprietors of the woodworking and other light tools.

Of the numbers and variety of the goods to be exhibited in the main hall, no satisfactory idea is yet possible. The arrangement of the tables, we notice, has been altered from that in previous Fairs so as to render articles more easily found, while affording them a better chance of display. The addition of a very large and elegant fountain in the center of the hall is a marked improvement. As a work of art it is worthy of the highest praise, while it serves as a grateful relief to the eye, which is disgusted at the scenic atrocities which still remain in the arches at each end of the building.

There is an alarming eruption of red, white, and blue paper muslin rags all over the roof, which reminds us partly of the colored tissue paper stuck on the ceilings of lager beer saloons for the benefit of flies, and partly of the festoons on a political stump platform. The taste which dictates the obscuring of the noble arches which span the area by such cheap and ugly so-called decorations is simply execrable; while the presence of such inflammable stuff in such quantities, situated high up above the innumerable gas flames and in close proximity with the thoroughly dry wooden beams, above which is a tar and gravel roof, seems to us to offer a premium on a wholesale conflagration. This part of the Fair will, or at least should, excite the interest of the Fire Department.

For the present, we leave the exhibition to extricate itself from the reigning disorder, deferring our usual comments on the novelties displayed until the show is complete.

THE hay in some parts of Iowa is so very abundant and cheap that it has been found more economical as a fuel for steam purposes than peat or any other substance. One enterprising inventor writes to us to know if he can obtain a patent for the idea of using hay for fuel in steam boilers. He thinks it new in the annals of steam engineering to use hay for firing.

THE attempt to export young American shad to Germany for stocking the rivers, has proved a failure. Although abundantly supplied with fresh Croton water, all of the hundred thousand fish died of starvation before the end of the journey.

A CORRECTION.—In the description of the vapor burner of Mr. F. A. Sawyer, page 122 in No. 8 of our current volume, the statement that the burner tubes are provided "with pans to catch the drip" should read "pans to prevent cold air rushing up and chilling the tubes." The error exists in the patent specification.