fifty-one plates, quarto. The contents are, 'Lucifer: a study in morphology,' with eleven plates, by W. K. Brooks; 'The development of Renilla,' with sixteen plates, by E. B. Wilson; 'The life-history of the Hydro-Medusae: a discussion of the origin of the Medusae, and of the significance of metagenesis,' with eight plates, by W. K. Brooks; 'Report on the Stomatopoda,' with sixteen plates, by W. K. Brooks. Only one hundred copies in all will be issued. The price is fixed at seven dollars and fifty cents net, delivered by mail, postage paid, or by express at the expense of the purchaser.

— The Smithsonian institution has received notice from Col. J. H. Wood of St. Paul that he has shipped to them the bodies of five persons — a man, woman, and three children — taken from a cave in the Bad Lands of Dakota by a miner. The bodies are simply dried up, and are not petrified, but are in a remarkable state of preservation. Scientific men who have seen them say they belong to a race which existed two thousand years ago. This will be a very important addition to the collection of desiccated bodies now on exhibition in the national museum.

— Dr. Baker, secretary of the Michigan state board of health, has found that in that state small-pox has been comparatively epidemic every five years. In 1872 there were 302 deaths from that disease, in 1877 there were 102, and in 1882 there were 100. He looks for its appearance in the state again this year.

— The statement is made that supernumerary toes and fingers are very often met with among the negro tribes living beyond the Orange Free State. Dr. Stoekly mentions the case of a Caffre, eighteen years old, who had six fingers on each hand. His father, mother, four sisters, and a brother had the same. His mother had also a double series of toes on both feet.

— The January meeting of the Michigan state board of health was especially noteworthy by reason of a report of a special committee which had been appointed to confer with the regents of the university relative to the establishment of a laboratory of biology and hygiene at that institution. As a result of the agitation of the subject, the legislature of the state has been memorialized to establish such a laboratory.

— An unnamed fever is said to be very prevalent in Jerusalem, the patients being so numerous as to fill a large hospital camp. As quinine is said to be greatly in demand, we presume the fever is of malarial origin. It is thought that the spread of the disease is due largely to polluted drinking-water and unwholesome food.

— Reference was made in a recent number of *Science* to the deaths which occurred in January of the present year in the city of Troy, N.Y., from the inhalation of fuel-gas. The *Medical news* contains a history of these cases from the pen of Dr. Bontecau, who assisted at the autopsies held on the victims, and attended others who recovered. The occupants of a row of dwellings were almost all seriously overcome by the gas. When the cause was discovered, the police aroused those who lived in these houses, many of whom were found sick. All the occupants of one flat were dead. At the autopsies the solid tissues and the blood were found to be of a cherry-red color, which is characteristic of poisoning by carbonic oxide. The composition of the fuel-gas which was used in these houses is said to be, hydrogen 56, and carbonic oxide 44, parts in 100.

LETTERS TO THE EDITOR.

****Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On certain electrical phenomena.

IN *Science* of Feb. 18, Dr. Shufeldt relates some interesting instances of accidental electrification. He seems to imply, in his description of the phenomena, that there is something mysterious or unusual in such occurrences. If he will critically examine his facts, possibly eliminating a few of them, I think he will find nothing which is not easily accounted for, and which has not been long recognized. I have amused myself and many of my friends with this sort of thing for many years. The electrification of a man or a woman in moving about a room is a phenomenon in which the individual is not to be counted, as it depends entirely on the conditions existing at the time. Everybody is 'susceptible' if the conditions are favorable. As Dr. Shufeldt states that he had never observed such exhibitions in Washington, I may remark that in two different houses in which I lived in that city I observed them on innumerable occasions. In one of these I arranged a couple of bent wires in such a way that the spark passed between them directly over the opening of a gas-burner, and for several weeks matches were a useless luxury. In another house that I know of, dancing-parties were especially gotten up by the young people, that they might be amused by the passage of the spark in touching hands. In the latter instance the phenomenon was strongly marked during nearly all of a continuously cold winter. During the present winter, in the house which I now occupy, accidental electrification has several times reached such a point as to be positively disagreeable. In moving across a room to turn a water-faucet, or to touch a poker or any other fairly good 'ground,' a long spark and an uncomfortably strong shock would result. But this was confined to no person or persons; any one who happened in was affected in the same way, provided the conditions were equally favorable.

The necessary conditions are simply those which are required for the successful performance of any

experiment in 'frictional electricity'—so called. Given a house heated by a hot-air furnace or by steam, a floor covered with soft carpet which, in virtue of the furnace heat, is dry and warm, a man the soles of whose shoes are thoroughly dry, and electrification will probably result from every brisk movement of the man over the carpet. These conditions are most likely to be met with during cold winter weather, and it is then that the phenomena are generally noticed. It is not probable that Dr. Shufeldt's two friends can perform the feat of lighting gas in this way 'at all times and under all circumstances.' His statement that the "electrical discharge was considerably greater from the tip of the index finger than from any of the others of the hand, and gradually diminished in regular order as we proceeded to the little finger," is interesting, but needs confirmation. I am sceptical as to the charging of his entire system 'with this animal electricity,' and the results which followed such a condition, and particularly so as to the origin of the "sense of the most profound relief, as if it were that all the electricity of my system had been completely withdrawn by the act," which he experienced when his hand touched the back of the young mulatto girl. Is man one of the extremely small number of animals having specialized electrical organs? T. C. M.

Terre Haute, Ind., Feb. 22.

Inertia-force.

The importance of clear elementary ideas on the teaching of dynamics justifies me, I think, in asking space for a further discussion of Dr. E. H. Hall's 'inertia-force.'

In his letter published in *Science* of Feb. 18, Dr. Hall expresses the opinion that our difference with regard to 'inertia-force' is based upon a difference of interpretation of the term 'force.' That, I think, is not the case. With all his statements as to force in general I agree; and the passage which he quotes from Maxwell, as expressing his view of force with sufficient accuracy, expresses also my view with complete accuracy. Dr. Hall, indeed, says that this passage meets many of the points raised by me; and it would thus seem that it must be inconsistent with many of my positions. But I am unable to detect the inconsistency, and Dr. Hall merely asserts it without giving any proof.

I am in full agreement also with Dr. Hall, not in opposition to him as he supposes, when, passing from force in general to a particular case, he says that a ball swinging in a circle at the end of a string acts upon the string with a force directed from the centre. The ball certainly does exert such a force. I think it misleading to call that force centrifugal force, as he and many writers do; but that the force which he calls centrifugal force is an actual force is undoubted.

But when Dr. Hall proceeds to expound his 'inertia-force,' we seem to part company, perhaps because he has not given a complete specification of this force. He has told us its magnitude and its direction, but its place of application, the body on which it acts, he has left us to infer from the context, and my inference he calls in question. It would be useless for me to justify my inference, because in Dr. Hall's letter he modifies the statement of the pamphlet from which it was drawn, saying that what he meant was that "the inertia-force works [or acts] with the smaller applied force *against the agent which* exerts the greater force." From this modified statement I could not, of course, have made the inference referred to,—in fact, I could have made no inference at all; for it is couched in language which is not the current language of dynamics, which is not defined, and which I must confess I do not understand.

Let us, however, take Dr. Hall's new illustration, and see what light that throws on the place of application of inertia-force. "A train is being started by a locomotive. The forces *applied* to the train are the pull of the locomotive, and the smaller, opposing, force of friction. The pull of the locomotive prevails, but in prevailing it must deal not only with the resistance due to friction, but with the reaction (which also I call resistance) due to the inertia of the train," in other words, the inertia-force. Here, again, Dr. Hall uses terms not current in dynamics, and I do not understand what he means by the locomotive 'dealing with' both the frictional resistance and the inertia-force. Whatever may be the exact meaning of that phrase, however, it seems clear that if the inertia-force acts on the train, and if the pull of the locomotive has to deal with this force in moving the train, it must be expected to have some effect on the motion of the train. Yet if F is the pull of the locomotive, R the frictional resistance, M the mass of the train, and a its acceleration, we have undoubtedly, by Newton's second law of motion,

$$a = (F - R) \div M;$$

and hence the inertia-force is quite without effect on the motion of the train. It would seem, therefore, that the inertia-force cannot act on the train. Does it then act on the locomotive? If so, it can only be the force which the train exerts on the locomotive, which is of course equal and opposite to the above force F. But it cannot be this force; for if the brakes be put on the train, though the pull of the locomotive on the train—and therefore the force exerted by the train on the locomotive—may be kept constant, the acceleration of the train will change; and, according to Dr. Hall, the inertia-force must be proportional to this acceleration. Thus even this new illustration does not enable us to determine on what body the inertia-force acts.

This difficulty in determining the place of application of the inertia-force would be at once accounted for if it should be found to have no place of application at all, and I strongly suspect this to be the true conclusion. Dr. Hall seems to me, in fact, to have postulated a hypothetical force to account for the supposed resistance of a body to the action of an applied force, and to have thus fallen into the error referred to by Poisson in the following sentences:—

"Concevons qu'un corps soit posé sur un plan horizontal, et qu'il n'y soit retenu par aucun grottement. Si je veux le faire glisser sur ce plan, il faudra neanmoins, à cause de l'inertie de la matière, que j'exerce un effort quelconque. . . . J'aurai, dans chaque cas, le sentiment de l'effort que je serai obligé de faire; mais je ne devrai pas en conclure que la matière oppose aucune résistance à cet effort, et qu'il existe dans les corps ce qu'on appelle très improprement une *force d'inertie*. Quand on s'exprime ainsi, on confond la sensation que l'on a éprouvée, et qui resulte de l'effort qu'on a exercé, avec la sensation d'une resistance qui n'existe réellement pas" (*Traité de mécanique*, tome i. § 120). J. G. MACGREGOR.

Halifax, N.S., Feb. 22.