

The Uses of Theorizing

Physics

W. F. G. SWANN, in *The Journal of the Franklin Institute* (August, 1929).

We sometimes hear the question asked, "What is the use of theorizing in physics—in trying to find out how nature works? Let us get down to something practical, something which will show immediate results." The complete answer to this question would take a lot of time, but I may perhaps say that there are two types of discovery, one in which somebody discovers by accident or otherwise, some new phenomena, or substance, which over night revolutionizes some process or branch of science. Then there is the other type of discovery whose significance I can perhaps symbolize in this way.

Suppose that I should go into a new country, with whose laws I were unfamiliar. I should proceed to violate the traffic regulations and get locked up. I should seek to buy a house, and should make many mistakes, and finally muddle my way to a completion of the transaction. I should seek to raise a loan and should encounter many embarrassing and

time-wasting considerations. And then, perchance, I should sit down and say to myself, "It is about time that I found out what the laws of this country are." Suppose that the situation were such that I could not inquire as to this matter from the local authorities, but were compelled to find it out for myself. On the basis of my experience of being arrested for speeding, and of buying a house, and of a dozen other things, I might formulate some system of laws for that country which would correlate those things which had happened to me. These laws would then suggest other things which might be true—they might suggest that prohibition would be likely to exist in this country, or that smoking were prohibited, or possibly required; and if the theory I had formulated were a good one, it would not lead me into error in these speculations. There is a very good chance that if I had pinned it down to known facts at the places where I knew those facts, it would be faithful and tell me no false story at other places where I asked information of it. Now, on the basis of

the more complete knowledge of the laws of this country thus obtained, I should be in a very much better position to make use of them and develop the resources available to me as a result of this more complete sensitivity to the way in which things happened. There would, in the course of five, ten or fifteen years, arise railroads in that country, there would arise telephones, there would arise huge factories, and various other things, so that in comparison with the situation which existed at the beginning of that time, we might in all verity say that a miracle had happened; and yet these things would have arisen in such manner that there was no particular occasion on which anyone would go to bed at night, and arise on the following morning to find things appreciably different from what they were the night before. It is in some such sense that a great generalization in mathematical physics can serve a practical use in the realms of science.

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Lady Hecate

Natural History

BARBARA HASTINGS, in *Grand Canyon Nature Notes*.

Lady Hecate was my pet for several days at Phantom Ranch during May. She was one of the small red bats—*Myotis californicus*—which can be seen in great numbers circling and swooping in Bright Angel Canyon just at dusk.

As I was walking along one of the trails before dark I noticed that there were several bats flying low over the dust to catch any insects which might be there. I found a large, soft switch and soon brought one of them to the ground, stunned. Just as it was reviving I picked it up. Viciously she bit and clawed me, but her teeth were too small to puncture my skin. And how she did squeak and chatter! She was in a perfect frenzy to get away. I put her in my handkerchief, however, and brought her to my cabin where I liberated her.

Very peevishly she fluttered around, swooping back and forth, miraculously avoiding walls and furniture. Finally she stopped on one of the screens and began to crawl nimbly across it. Thinking she might be

thirsty I caught her very gently in a handkerchief to give her a drink. She was "madder than hops" and bit the cloth time and again. She did condescend to take a drop of water from the tip of my finger, but was too provoked at her predicament to be grateful for it.

Then I caught several moths for her to eat. At first she did not understand that they were for her, but I shoved one into her mouth when she was preparing to bite me and she gobbled it down. After that she did not hesitate when I offered her millers but jerked them out of my fingers and made short work of them.

I kept Lady Hecate for two days. By the third night she had become so tame that I could not go in my cabin that she did not light on my sleeves or shoulder and crawl to my hand to be fed. She drank drops of water from my finger tips and then licked my fingers. I fed her at least six large millers the third night. She would hang calmly upside down on the screen and chew them. I could hear her little teeth cracking. Generally she was most fastidious and was careful not to eat the wings of the

moth. They would flutter to the floor after the last chew.

Six millers did not satisfy her hunger, however, and she seemed to be insistent for more. She really became quite a nuisance, begging for food every time I went in the cabin. I had exhausted the supply of millers from two cabins and could not find any more, so finally I decided she would have to feed herself. I hated to let her go because in that short time she had become so friendly and trusting.

As I stood there deciding to liberate her she flew up and clung to my sleeve. Then, very nimbly, she crawled to my hand. There she sat comfortably and looked up at me inquiringly with her bright, little, near-sighted eyes. Very quietly I walked across the porch, opened the screened door and stood in the path outside. Not realizing her freedom she continued to rest quietly in my hand. Then, slowly she crawled to my finger tips, hesitated a moment, and with a noiseless spread of her wings she was gone into the night, leaving me with a feeling that I had lost a friend.

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