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THE MICROSCOPE AND PHOTOMICROGRAPHY IN CRIMINAL INVESTIGATION

E. CARLETON HOOD¹

Every day we hear of new discoveries, all tending to make crime more and more unprofitable. It used to be the fashion to believe that the police and detective methods of France were more efficient than our own. But it is difficult to compare the criminal problems of the two countries, and therefore the methods employed by their police. It is my own view that the systems of both countries are extraordinarily efficient. This in no way alters the fact that France makes greater use of scientific men in connection with criminal investigations. Experts are employed extensively in this country, but they are not officially attached to the police. It is our want of organization and not our use of science which is at fault. The policeman does not understand the scientific man, nor the scientific man the policeman. Nor will they ever understand each other until they work together.

With these considerations in mind this paper is written. In it I endeavor to show that the scientific man is not always shut up in his laboratory for the purpose of working out abstruse problems in mathematical physics or physical chemistry quite incomprehensible to average men and women. He is, on occasion, capable of being practical and presenting his discoveries in an intelligible way. That is a point of view likely to be received sympathetically both by the police and the public which science, in an unobtrusive way, does a good deal to serve.

It is, from first to last, the practical test which is supreme.

Most of us remember the scorn in which the official police are supposed to have held Sherlock Holmes with his lens and his theories, but however much they may have resented the infallibility of his deductions, they came at last to recognize the value of his lens. But prejudice dies hard. It is only comparatively recently that the uses of the microscope for every-day purposes have been recognized as something to be employed not noly in specialized and expert investigations, but simply an instrument whose essential function is to magnify.

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Yet its value to the police was proven many years ago. There was the stabbing affair in which no other clue was available except a knife, upon the blade of which appeared a few letters which the naked eye could not read. The microscope, however, revealed their identity. A careful and painstaking investigation traced the weapon on this slight clue, to the woman who had originally supplied it to the murderer. He was arrested and, on confirmatory evidence, convicted. There was nothing more than those four letters by which to trace him, and these would never have been deciphered but for the microscope.

An example such as this widens the sphere of the microscope at once. It emerges from the august seclusion of the laboratory and becomes, as it were, the most approachable of all scientific instruments. Because, up to a point, it can be used by anyone. The higher branches of microscopy are among the most specialized in the world, but the instrument nevertheless has familiar uses for the amateur. Unlike chemistry, which is a highly dangerous pastime for the uninitiated, microscopy can be use on occasion with profit by those without scientific knowledge. The case quoted is one in point. The function of the microscope here was merely to magnify a few letters unrecognizable by other means. An operator without scientific attainments would have been able to master the technique in a short time. This is not to say that all microscopy is in this category. Emphatically it is not. The microscope recognition of starches and fibers, a comparatively elementary matter, cannot be undertaken except by an experienced investigator. It is not merely a case of looking at something enlarged, but recognizing and identifying an object the appearance of which to the naked eye and when greatly magnified, is vastly different.

There was once an expert who did not clearly recognize this admittedly nice point. He took his microscope into court with him and adjusted it for his own vision, then invited the judge to look through it. His honor accepted the invitation, looked, saw nothing and said so. He naturally drew the conclusion, which happened to be the wrong one, that there was nothing worth considering in the expert's evidence, and found accordingly.

Such a mistake is not made today. It is one of the principal advantages of the microscope that, combined with the camera, it can produce pictures available for demonstration in court. It is superior in this respect even to chemical evidence. It is not usual to perform experiments in court, although this has occasionally been done. The

record of the chemist is his notebook and his verifiable facts. He cannot, as a rule, bring his test-tube and chemicals with him. Even if he does, the significance of the experiments performed may be lost upon the spectators. It is for this reason that the chemist generally makes a study of microscopy. He is thus able to combine the technique of chemistry and the microscope and to express his most important results in terms of illustration.

Fibers have a characteristic form under the microscope by which they can readily be distinguished by the expert. Cotton differs from linen, hemp from manila, jute from esparto and so on. The type of paper used in a forgery cannot be hidden from the eye of the microscope.

We are now in a region where only the expert can freely move. Magnification readily causes objects to assume quite different appearances. An ink stroke remains recognizable as an ink stroke. It merely looks larger than before. It is quite another matter to distinguish fibers in their characteristic microscopic forms, when greatly enlarged.

This, however, is one of the most important developments of chemistry and microscopy combined. That is why it has come about that specks of dust, minute smears and stains, tiny clues which would escape the unassisted eye, are made to yield their secrets.

Micro-chemistry, as it is called, has been for many years a recognized science but it is but recently that it has become an organized branch of chemical technique. The chemist relies upon reactions which he can watch in order to detect the existence of a particular substance,—a precipitate of a peculiar color,—a dark stain in a small tube,—the formation of a tinted solution when that of a suspected substance is tested with certain chemicals. If he has not a sufficiency of material, these things cannot be observed with the naked eye, but if the reactions are watched under the microscope, tests can literally be applied to specks of dust and to minute droplets.

This is only one branch of micro-analysis. In others the microscope need not be used at all. The methods employed in such cases are too technical to be of general interest. They rely, however, upon the use of instruments of really marvelous precision for weighing and measuring. Here is a good illustration. The balance, an apparatus for weighing used by the chemist for his every-day work, is so delicate that if a piece of paper is weighed upon it and a small pencil-mark is then made on that paper, the graphite deposit produced by the pencil-point will add enough weight to unbalance the scale!

Imagine, then, the micro-balance, a piece of apparatus about a thousand times more delicate than this, and you will have some conception of the accuracy of the instruments employed for micro-analysis.

The importance of these refinements is obvious. It means not only greater general precision, but it also makes possible the accurate examination of substances when only minute quantities are available. One of the difficulties of old-fashioned chemistry was that unless a relatively large quantity of the suspected material was at hand, useful conclusions often could not be arrived at. Micro-chemistry makes things very difficult for the criminal. He will have to remove traces of his presence and identity which he himself cannot see.

It will now be evident that the examination of the wax in a man's ears to determine his occupation, although a delicate operation, has nothing of the mysterious in it. You remove the wax, dissolve it, and recover the substances you require to examine by various methods. It may be wheat starch; the microscope will infallibly pick that out for you, or a crystal of a characteristic shape which reveals its identity, or a trace of aniline dye giving itself away by the intense coloration that even a microscopic fragment will produce in a drop of water. All the time the microscope is the chemist's ally. Beneath it, the reactions which show things for what they are,—reactions between drops and specks, take on the appearance of large-scale operations.

From the detection of the deadly atropine used by Dr. Eustachy, to the examination of the traces of dusts to be found in a worker's ears and which remain with him for many years; for the detection of traces of everything from the rarest to the commonest, the microscope holds an enviable record in the solution of crime.

Had its uses been unknown many murderers might have gone free. To mention an obscure example, it supplied the clue of the dandelion seed in the case of the French tramp; its evidence was the final link completing the chain in the Gutteridge murder committed by Browne and Kennedy. Its powers are great, because their application is practically unlimited.

Most sciences have only a restricted application; all of them must, in the last analysis, fall back upon microscopy. Microscopic methods are essentially simple, and the evidence they supply can be appreciated by anyone. The judge and jury may not be able to recognize potato starch under the microscope. But there is always the

method of comparison, showing a photomicrograph of known potato starch, and one of the suspected substance, and demonstrating the characteristics common to both. Seeing is believing. Comparison and contrast are the basis of our judgments whether we are expert witnesses or one of twelve good men and true.

We may as well emphasize that, in this connection, the scientific man differs not at all from the man in the street. For him also, only seeing is believing. In cases of crime, as in most other things, fine theories are of no use except so far as they help to establish a proof that can be demonstrated as incontrovertible to those who did not invent it originally—probably could not have invented it, and therefore could not be biased in its favor.