simplification of its constituent elements. The main lesson that he learned by his journey is that France can no longer remain stationary in these matters and that it should make efforts to organize biology as applied to agriculture upon a large and solid basis, and he proceeds with practical suggestions in this direction. He praises the Federal Horticultural Board, the Federal Insecticide Board, and the Horticultural Commission of California, and thinks that all of these should be imitated in France. He especially points out the necessity for the introduction into France of such education as our young men get in applied biology in the agricultural colleges and universities like Cornell and Illinois. There is, he points out, in France at the present time no way of getting a scientific education in biological studies as applied to agriculture.

After pointing out some of the great examples of monetary saving in this country as the result of work in applied biology, he closes with the sentence, "These are great examples which it is well to recall, for they establish with the most complete evidence the fact that there is no other sure way than that of scientific organization of work to get full value from the national soil and to give back to agriculture the greatest possible part of the riches which are lost to it annually from pests."

L. O. Howard

CONCERNING THE HISTORY OF FINGER-PRINTS

Sir William J. Herschel published recently a brief pamphlet of 41 pages under the title "The Origin of Finger-Printing" (Oxford University Press, 1916). This is mainly an autobiographical sketch, giving in detail the story of how the author during the time of his useful service in India (1853–78) conceived the notion of finger-prints and elaborated this system, which was subsequently developed and placed on a truly scientific basis by Sir Francis Galton. We are indebted to Sir W. Herschel for his interesting document: it is always valuable when one who has played a prominent rôle in inaugurating a new movement presents us with a record of what he believes was his share in bringing about this innovation or invention. The inventor, however, will seldom be able to write impartially the history of his own invention; no one, in fact, whether statesman, artist, poet or scholar, while recording his own history, has the faculty (I should even say, the right) of clearly determining his own place in the long chain of historical development. This judgment must be left to the historian of the future. The principal purpose by which Sir W. Herschel was guided in writing his account is to demonstrate that he was the real "discoverer" of finger-prints in Bengal in 1858, entirely from his own resources, and to discredit all other claims to priority in this matter, especially those on the part of the Chinese. I regret that the author has failed to take notice of the "History of the Finger-Print System" published by me in the Smithsonian Report for 1912 (pp. 631–652, Washington, 1913). Not only are Sir W. Herschel's great merits and his share in the history of the invention, if invention it may be called, duly acknowledged and objectively expounded there, but he would also have found there all the available evidence in favor of the Chinese, Japanese and Tibetans, all of whom applied ages ago with full consciousness the system of finger-prints for the purpose of identifying individuals. The few modern traces of evidence known to Sir W. Herschel are treated by him slightly, and he wonders that "a system so practically useful as this could have been known in the great lands of the East for generations past, without arresting the notice of western statesmen, merchants, travelers and students." The Mohammedan authors who visited China did not fail to describe this system. Rashid-eddin, the famous Persian historian, who wrote in 1303, reports as follows:

> When matters have passed the six boards of the Chinese, they are remitted to the Council of State, where they are discussed, and the decision is issued after being verified by the *khat angusht* or "finger-signature" of all who have a right to a voice in

the council. This "finger-signature" indicates that the act, to which it is attached in attestation, has been discussed and definitively approved by those whose mark has thus been put upon it. It is usual in Cathay [China], when any contract is entered into, for the outline of the fingers of the parties to be traced upon the document. For experience shows that no two individuals have fingers precisely alike. The hand of the contracting party is set upon the back of the paper containing the deed, and lines are then traced round his fingers up to the knuckles, in order that if ever one of them should deny his obligation this tracing may be compared with his fingers and he may thus be convicted.[1]

Professor Henri Cordier of Paris, the editor of Yule's famous work, adds to this passage a footnote relative to the history of finger-prints, and commenting on the claim of Sir W. Herschel, tersely remarks:

Sir W. Herschel was entirely wrong; Mr. Faulds protested against the claim of Sir W. Herschel, and finally a Japanese gentlemen, Kumagusu Minakata, proved the case for the Japanese and the Chinese. None of these writers quoted the passage of Rashid-eddin which is a peremptory proof of the antiquity of the use of finger-prints by the Chinese.

Indeed it is, and the observation that no two individuals have finger-marks precisely alike is thoroughly Galtonian. There is the earlier testimony of the Arabic merchant Soleiman, who wrote in A.D. 851, and who states that in China creditor's bills were marked by the debtor with his middle finger and index united (see my History, p. 643). But we have more. E. Chavannes, in reviewing my article in the *T'oung Pao* (1913, p. 490), has pointed out three contracts of the T'ang period, dated A.D. 782 and 786 and discovered in Turkestan (two by Sir Aurel Stein), which were provided with the finger-marks of both parties, and contain at the end the typical formula:

The two parties have found this just and clear, and have affixed the impressions of their fingers as a distinctive mark.[2]

A clay seal for which no later date than the third century B.C. can be assumed, and which bears on its reverse a very deeply and clearly cut impression of the owner's thumb-mark, has been brought back by me from China, and is illustrated and described in the above paper. I have also shown how the system was developed in ancient China from magical beliefs in the power of bodily parts, the individual, as it were, sacrificing his finger in good faith of his promises; in its origin, the finger-print had a magical and ritualistic character.

Sir W. Herschel states that he fails to see the definite force of the word "identification" in the Chinese finger-print system. In his opinion, there must be two impressions at least, that will bear comparison, to constitute "identification." He thinks, of course, one-sidedly of the detection of criminals to which the process has been applied by us, but never in the East (for what reason, I have stated elsewhere). Most certainly, the idea underlying Chinese finger-prints was principally that of identification, as expressly stated by Rashid-eddin and all Chinese informants. If a doubt or litigation arose, all that was necessary was to repeat the finger impression of the contractor who had formerly signed the deed.

B. LAUFER

FIELD MUSEUM,
CHICAGO, ILL.

[1] See H. Yule, "Cathay," new ed., Vol. III., p. 123, London, 1914, Hakluyt Society.

[2] See A. Stein, "Ancient Khotan," Vol. I., pp. 525–529, Oxford, 1907, where the three documents are published and translated by Chavannes.

SPECIAL ARTICLES

ON THE COLLOID CHEMISTRY OF FEHLING'S TEST

I

As familiarly known, when Fehling's solution is treated with a reducing substance, it is generally expected that a bright red precipitate will be obtained. Frequently, however, an orange or yellow precipitate is obtained and in certain instances nothing but a yellowish-green or bluish-green discoloration results. The attempts to account for these differences are, for the most part, chemical in nature; it is held that the red reaction represents a precipitate of cuprous oxide, the orange or yellow ones more doubtful suboxides or hydrated forms of the oxide, while the character of the greenish discolorations is left doubtful. It is often be-