

This Week's Citation Classic

Gibson L E & Cooke R E. A test for concentration of electrolytes in sweat in cystic fibrosis of the pancreas utilizing pilocarpine by iontophoresis. *Pediatrics* 23:545-49, 1959.

A method of inducing localized sweating by the iontophoretic induction of pilocarpine into the skin is described. It is shown that when this sweat is collected appropriately and analyzed for its sodium or chloride content the method is a simple and rapid means of diagnosing cystic fibrosis. [The *SCF*[®] indicates that this paper has been cited over 205 times since 1961.]

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"It is a pleasure to write this commentary since I enjoy recalling the stimulating, somewhat unstructured, environment in which the work was done and where my abiding fascination with the pathophysiology of cystic fibrosis originated.

"In 1953 Paul di Sant'Agnese discovered the strikingly elevated concentration of salt in the sweat of patients with cystic fibrosis.¹ My interest in these patients was stimulated by Harry Schwachman in 1953-55 when I was a house-officer in Boston. Therefore, when I became a clinical associate at the NIH in 1955, I welcomed the opportunity to study a group of CF patients. The fact that I worked in the Institute of Allergy and Infectious Diseases and that I was investigating the physiology of a genetic disease did not seem to bother anybody.

"I became interested in the effects of autonomically active drugs upon human sweat. Side effects made systemic administration unsatisfactory so I looked for a method of local

stimulation. Iontophoresis was found to be ideal. Soon a number of drugs could be iontophoretized. Pilocarpine, also iontophoretized, was found to be a convenient cholinergic stimulator of the sweat I was attempting to modify.

"At that time the usual way of performing a sweat test for the diagnosis of CF was to place the subject's, usually nude, body in a plastic bag which fitted tightly around the neck. The procedure was time consuming, uncomfortable, and sometimes even dangerous. Iontophoresis obviously needed to move from the research to the diagnostic laboratory.

"The greatest impetus to make this move, however, came during a study of the sweat of obligate CF heterozygotes. Frequently the subjects were the mothers of CF patients. Their modesty seemed to have a positive correlation with their body weight. The task of persuading ladies with sweat soaked girdles to remain in hot plastic bags proved too difficult and iontophoresis became diagnostic.

"As a senior pediatric resident at Johns Hopkins, I found that the departmental chairman, Robert E. Cooke, shared my interest in CF sweat. He believed that the iontophoretic method of performing the sweat test was of sufficient importance to deserve publication and encouraged me to gather the data necessary to prove its efficacy.

"A method of stimulating localized sweating more convenient than pilocarpine iontophoresis has not been found, so our original paper continues to be cited. Sometimes, however, the manufacturers of \$100.00 plus, current sources forget us for a fairly good reason: We stated that our current source cost \$7.00. This included a zero labor cost which, though almost accurate for a resident physician at that time, could not apply to an electrician. We also forgot to price the EKG electrodes which were 'permanently borrowed' from Helen Tausig."

1. di Sant'Agnese P A, Darling R C, Perera G A & Shea E. Abnormal electrolyte composition of sweat in cystic fibrosis of the pancreas. *Pediatrics* 12:549, 1953.