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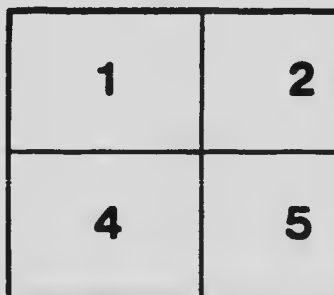
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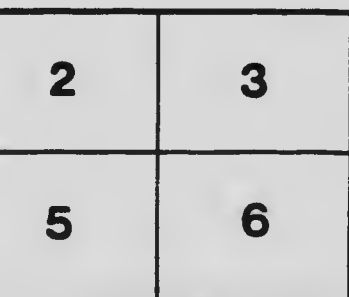
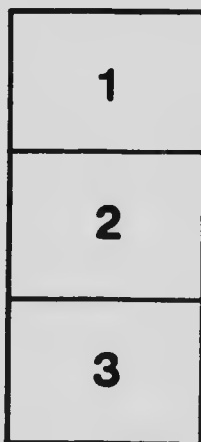
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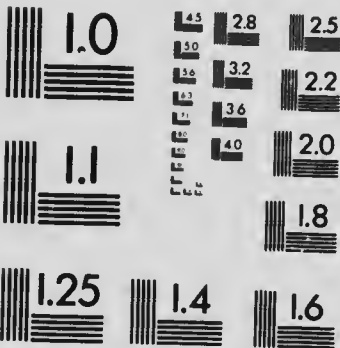
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## PHOSPHORUS AS A THERAPEUTIC AGENT

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*London, Ont.*

PHOSPHORUS therapy dates from about the middle of last century, following the discovery that phosphorus was a constituent of normal blood. Churchill of Paris<sup>1</sup>, in a paper published in 1858, enunciated the theory that tuberculosis was due to a deficiency of phosphorus in the blood. The drug produced its beneficial results because it was a hematinic. He claimed the production of new blood was so great that the patients suffered from hæmorrhages from the nose and from hæmorrhoids. Some of his patients grew heavy beards in an incredibly short time, others cut wisdom teeth with astonishing rapidity. The bed-ridden rose and walked.

The hypophosphite was chosen because phosphorus was too irritating and secondly because it was the form of phosphorus which was readily oxidized "The tuberculous diathesis depends on a diminution in the element phosphorus and that this element, having to play the rôle of a combustible body, must be administered in a less completely oxidized form than that of phosphoric acid."<sup>2</sup> The inorganic salts became popular, especially the preparation known as Parrish's Chemical Food (Syr. Ferri Phosph. Co.). Later the medical profession had to pass through the era of organic preparations. The glycerophosphates were introduced in medicine by Robin<sup>3</sup> in 1894, and were recommended for malnutrition. Their use became so popular that they are now included in nearly every foreign pharmacopea. Among the more recent additions to the list of organic preparations are phospholecithin, sanatogen and Wincarnis, the last a preparation of glycerophosphates in red wine. Wincarnis is recommended (to quote from the literature sent out by the manufacturer) "as a general tonic and is indicated for what is vulgarly termed general debility, also for the weak, anæmic, nervous or emaciated; of special value in anæmia, chlorosis, neur-

<sup>1</sup> Read before the Harvey Club, London, Canada, January 13th, 1920.

<sup>2</sup> From the Department of Pharmacology, Western University Medical School.



asthenia, senility and cachexia due to tuberculosis or other chronic diseases".

The organic preparations have no advantages over the inorganic. Hart, McCollum and Fuller's<sup>4</sup> experiments on growing pigs showed that there was no difference in the growth curve when organic or inorganic phosphorus was added to the diet. Other investigators, Wendt<sup>5</sup>, Holsti<sup>6</sup> and Gregerson<sup>7</sup> demonstrated that the body can synthesize organic phosphorus from inorganic compounds. Fingerling<sup>8</sup> fed a flock of geese for a year on food containing only inorganic phosphorus. Next year the diet was rich in organic phosphorus, and the results were compared. The number of eggs laid, the total weight of the eggs, the content of lecithin, nucleic acid and phosphorus were practically the same. McCollum, Halpin and Drescher<sup>9</sup> made observations on the effects of inorganic and organic phosphorus compounds in the diet of hens and concluded that the organic preparations had no advantages over the inorganic. Marshall<sup>10</sup> of the Johns Hopkins Hospital investigated this same problem and his conclusions agreed with the findings of the other investigators.

The discovery that the nervous system was comparatively rich in phosphorus, extended the therapeutic field of the drug. The result has been, that it is recommended for many diverse functional nervous diseases. It gained the reputation as a "general tonic"—a term which is still used too often as a cloak for our ignorance and "an indefinable limbo into which anyone can thrust anything of which he knows little or nothing".

A fair percentage of our patients require a tonic often because they suggest the diagnosis and treatment. They are "run down and only need a tonic". Many of our patients suffer from functional nervous conditions and all of them, according to Osler, have tuberculosis. It is not at all surprising then, that the hypophosphites became a panacea of almost universal use.

Marriott<sup>11</sup> at the request of the Council on Pharmacy and Chemistry of the American Medical Association, studied the therapeutic value of hypophosphites. He postulates that a drug must do one of three things if it is to be of any benefit; it must produce a local or general physiological effect; it must exert a specific, demonstrable influence on pathological conditions; or it must have a food value. In his experiments he gave fifteen grains of hypophosphites three times a day to normal men, and found that it produced no symptoms and almost all of the drug was excreted unchanged. Other investigators claimed to have recovered the entire amount unchanged in the urine. Marriott concludes with the following



statements: "In the absence of proof as to the value of the drug, we are not justified in using it merely because it may do good. It is doubtful if there are any conditions when the body suffers from lack of phosphorus. A half glass of milk contains more available phosphorus than three large doses of hypophosphites of fifteen grains each. There is no reliable evidence that the hypophosphites have any physiological effect. It has not been demonstrated that they influence any physiological process. They are not 'foods'. If they have any use, that use has never been discovered."

Fellow's Syrup of Hypophosphites has been among the most popular preparations. No very exact information about its composition can be obtained from the manufacturers beyond the fact that it contains 1/64 grain of strychnine to each drachm along with the hypophosphites of iron, quinine, calcium, manganese and potash. This uncertainty as to its composition puts it in the class of nostrums; and secrecy in medicine impedes rather than advances the progress of medical science. The extravagant claims made by its manufacturer remind one of a patent medicine testimonial. For example, they make this statement: "the fact has never been challenged that in Fellow's Syrup of Hypophosphites we have one of the most efficient, most complete, most all-round tonics and roborants in the materia medica."

Since the action of hypophosphites alone is under discussion, no reference has been made as to the effects of strychnine, quinine, iron, calcium, manganese and potassium. It is impossible to exactly determine their effects because one is dealing with a number of different factors in a mixture of so many drugs. The ordinary preparation of hypophosphites may be a convenient form in which to administer the inorganic radicals, *e.g.* iron, manganese, etc., or the alkaloids, *e.g.* quinine and strychnine. This is the only justification for the use of any of the preparations of hypophosphites.

The following testimonial<sup>12</sup> of a physician has a very obvious moral: "Just about six years ago I had a severe attack of La Grippe which almost killed me. Left me with asthma (Catarrh) and a severe cough. Did not get out of the house for three months. Took over a dozen bottles of McArthur's Hypophosphites, came out all right and have since then worked hard. Last fall took another cold but worked on, used McArthur's Hypophosphites, am using it now and am on my twelfth bottle. I have five or six patients whom I have put on McArthur's Hypophosphites but I do not prescribe the single bottle but wholesale, no less than six bottles. One patient is on his twenty-fourth bottle with orders to get another half-dozen and keep it up all winter. I have given

the same order to all (keep it up all winter), and I myself intend to do the same, for with its use I have lost no time—rain or shine, I am doing my work. I know what it has done for me and what it is doing for my patients."

## SUMMARY

1. It is now known that tuberculosis is not due to a deficiency of phosphorus.

2. There is no justification for giving hypophosphites for the sake of the phosphorus content, because very little, if any, of the hypophosphite is metabolized. It is excreted unchanged.

3. Phosphorus medication either as hypophosphites, phosphates, glycerophosphates or phospholecithin has no definite value in the treatment of pathological conditions, nor do they have any value as foods.

4. Many physicians still use the hypophosphites partly from force of habit, partly because of the psychological effect of the propaganda carried on by the manufacturers who laud their wares most extravagantly.

5. If there is ever a definite indication for the use of phosphorus, one and a half pints of milk or three eggs daily will supply more phosphorus than the patient can metabolize.

6. If the profession is to learn more about the action of drugs, it is essential that the patient be given one drug (instead of a mixture of from three to ten). Accurate observations should be made and recorded and finally an analysis of the results obtained.

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