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THE COLON BACILLUS, A REGULATOR OF POPULATION *

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When certain species of animals, like rabbits and lemmings, increase beyond the limit desired by Nature in any locality, epidemic diseases suddenly appear and stop this disturbance of natural balance.

In the earlier days of history the human species was subjected to similar epidemics. It seems to have been Nature's plan to allow the medical profession to take charge of this subject up to a certain point, but there are limitations which we may not be allowed to pass, because there appears to be a plan to destroy by poison various species of plants and animals which have arrived at stages of increase or of development beyond Nature's liking.

Concerning the stage of development which is to be allowed for man, we can no more anticipate the limit than we can state the reason for the presence of so many thousands of suns in space. We may simply observe the fact that an oak tree is not allowed to grow beyond a certain height, and a rose is not allowed to progress beyond limited stages of development, after which its stamens are transformed into beautiful petals, and the rose then loses its power of reproduction and falls a ready prey to enemies.

Man and domesticated animals carried to the higher stages of development begin shortly to show stigmata of decadence indicating that Nature has been setting her limit.

At the present time there are few individuals among us who do not show some of the stigmata of decadence, even though no more marked than in irregular development of teeth, or abnormal shape of toes. Still more striking stigmata are familiar to all of us, as seen in every day practice in a fair proportion of all of the individuals in a community.

We may assume that glandular structures of the body, engaged in manufacturing protective elements against bacteria, present decadent features, quite as well marked, though not as observable, as external anatomic defects. Such decadence of manufacturing organs would mean derangement in function with a lessening of their protective efficiency. The higher our development, the sooner decadence begins in any one family or group of individuals. Vulnerability to bacteria of various kinds increases. In other words, a poisoning process takes place in plants and in animals when decadence begins.

The toxins of bacteria are employed by Nature for killing off plants and animals when limitations of development, quite as well as when limitations of increase, have been reached.

Bacteria which formerly caused disastrous epidemics, attacking practically all types of individuals, are under excellent control at the present time, through the resources of preventive medicine. Endemics, like tuberculosis, are controlled to the point where only those individuals who have passed the higher stages of development remain very vulnerable.

There are many bacteria, insidious in their methods of attack, still conducting Nature's plan of poisoning off excess of population, and attacking most freely individuals who carry heels of Achilles after passing the higher stages of development in the family.

It is becoming apparent that the colon bacillus group of bacteria stands among the most active malefactors (malefactors from our egoistic point of view, benefactors from Nature's standpoint), and this group will perhaps be found to stand next to the tubercle bacillus group in the proportion of deaths which it causes in a community. It has even been found to extend beyond animal prey in causing destruction of terminal buds of coconut palms.

The reason that the activities of this group of bacteria have not been more quickly recognized is in general the reason that the flying-machine was not invented earlier; and in special, the reason is that methods of search for the colon bacillus are of recent development, and not yet extended to cover most of the field. This is in part due to the method of work which Nature allows us up to the present time. Nature has not even allowed the laboratory clinician to make routine search for the colon bacillus in urine as yet.

At the university we are trained in science to make use of all available data before arriving at a conclusion. Later in life we develop the art of the practice of medicine, and Nature sets us at grouping data about theories in a harmonious way to fit our art. This natural antagonism between science and art explains the regulation of progress, which must not be too rapid, according to Nature's plan.

In abdominal surgery we all recognize the destructive activity of the colon bacillus when it leads to gangrene of the appendix, but how often do we follow the bacillus from an actively proliferating colony at the appendix, and note distant effects of toxins or of separate colonies which occur synchronously with the development of the colony which is most in evidence?

How often do we recognize the relation of colon bacilli, for instance, to infections in the vicinity of the pylorus and duodenum?

At post-mortem examinations we find adhesions extremely abundant in the vicinity of the pylorus and duodenum in cases in which the patients have complained

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during life of nothing more perhaps than dyspepsia. This dyspepsia in itself has not been fatal to the individual, but has been a factor in lessening the resistance of the individual to other infections. The colon bacillus, however, was the original malefactor, from my present point of view. Such adhesions are mostly overlooked by the medical profession as yet. In dyspepsia the x-ray is just rising over the horizon, but we are already making gastric diagnoses with the x-ray which takes a picture of the stomach filled with bismuth solution, showing interference with motility of the stomach, abnormal peristalsis, or hepatofixation of the stomach, due to adhesions which have apparently resulted from insidious colon bacillus action. To-day we depend as much on the x-ray for dyspepsia diagnosis as we do for broken bone diagnosis.

Examination of adhesion tissue from the attic of the abdomen by Dr. B. B. Stroud, who is making observations for me, shows the presence of the colon bacillus in such tissue, just as others found it encapsuled in gall-stones.

It is only recently, however, that we have learned of the activities of the colon bacillus in the gall-bladder.

It seems to me a tenable hypothesis that the colon bacillus is responsible for a large proportion of our cases of ulcer of the stomach and duodenum, such ulcers to my mind simply representing symptoms, like acne of the face. In 1895, I described proliferating endarteritis in the blood-vessels of the appendix. If the colon bacillus causes similar endarteritis of the terminal vessels of the stomach, it would explain why anemic distribution areas of these plugged vessels are exposed to bacterial and digestive destructive attack, resulting in symptoms which become graphic as ulcer.

We have recently noted the fact that the colon bacillus is an agent in the production of pancreatitis, but only the acute forms of pancreatitis producing death quickly have as yet attracted our attention acutely. How about the very large group of cases of interstitial pancreatitis not yet noted by the clinician, but which may often result in diabetes mellitus from squeezing out of the islands of Langerhans by hyperplastic connective tissue? Diabetes mellitus, then, like ulcer of the stomach, would belong in classification among the symptoms of poisoning by the colon bacillus, until we had disproved the point in any given case.

If the colon bacillus is known to cause interstitial pancreatitis, may it not be a salient factor in the development of those cases of hepatic cirrhosis which are known to be of toxic origin, from the influence of intestinal bacteria?

If we already know about pancreatic cirrhosis from the influence of the colon bacillus, and assume that hepatic sclerosis represents a similar infection, should we not think next in order of arteriosclerosis, which causes much shortening of life, as belonging in the colon bacillus class of cases? In arteriosclerosis we have alteration of blood-vessels, including increase of connective tissue, and believed by some to be a result, secondarily at least, of toxic hypertension. A very small proportion of the cases of arteriosclerosis are caused by alcohol and syphilis, the great majority being perhaps secondary to saprophytic hypertension. We know that intestinal putrefaction is a forerunner in many cases of arteriosclerosis.

When the blood-circulatory system is being injured by colon bacillus toxins, we may also have neurasthenia, for these poisons attack the nerves as well as other struc-

tures, and neurasthenia is found chiefly in individuals of families who have passed the higher stages of development, and who are prone to intestinal putrefaction.

Indican in the urine is said to be the index of various toxins of intestinal origin, and we know that the colon bacillus is one of the most abundant bacteria which develop out of normal proportion in the bowel of patients who have lost part of their resistance, and whose urine contains indican.

A vicious circle is established when defective protective organs allow the colon bacillus to increase to a point where its toxins produce tissue-changes, these tissue-changes in themselves giving rise to still further disturbance of function of glands engaged in protection, nutrition and excretion.

If we are free to assume that the colon bacillus is a malefactor in arteriosclerosis, we may easily place this bacterium as ranking with the tubercle bacillus in limiting over-population by increasing the death-rate. The colon bacillus sometimes develops insidiously at various points, when any actively proliferating colony is at work at some one focus and making distant colonies. Thus we may have subphrenic colonies when the primary nest of active bacteria is as far away as in a diverticulum of the sigmoid flexure of the colon. These flagellated bacilli frequently spread over the peritoneum, causing acute peritonitis, when they escape from some focus of destructive activity.

Dr. Charlton, of McGill University, has suggested that pernicious anemia may at times result from colon bacillus infection, but at the present time it seems to me perhaps better to recognize a colon bacillus anemia simulating pernicious anemia.

Malarial infection is simulated by the toxic impression that goes with some forms of intestinal putrefaction, and as the colon bacillus is the commoner saprophyte, it seems fair to assume that the sapremia is to be charged against a bacterium that is dominant at the time. In any event, it is evident where the burden of proof lies ready for the clinician.

Dr. H. G. Harris has found the colon bacillus abundant in the urine of a patient with infantile paralysis. We know that experimental injection of the colon bacillus into the circulation has resulted in special impression on the spinal cord, and that at least makes us pause for a moment to consider what sort of relation may exist between the colon bacillus and infantile paralysis. Perhaps the colon bacillus prepares the way for the special infection of infantile paralysis; perhaps the special infection of infantile paralysis prepares the way for terminal infection by the colon bacillus.

One of the largest groups of cases in which the influence of the colon bacillus is daily overlooked by clinicians of the world is in its relation to infections of the kidneys, and this is particularly regrettable because in no other field, perhaps, have we such good control of the movements of the colon bacillus.

Dr. William H. Thomson has shown that hexamethylenamin (urotropin) combined with benzoate of soda, in the course of excretion from the kidneys, is directly destructive to the colon bacillus throughout the urinary tract. Some patients do not split up hexamethylenamin into the requisite by-products readily, but the addition of benzoate of soda seems to facilitate the process.

In many cases of infectious and contagious diseases, like scarlatina, measles, typhoid and diphtheria, the organism found in the urine is the colon bacillus. In several forms of acute gastro-intestinal disturbance, like

cholera morbus, particularly in elderly people, the kidneys may be so filled with colon bacilli that a fatal result is due to this complication, which could have been averted by recognition of the colon bacillus in the urine and application of the Thomson treatment. Persistent bacilluria may require in addition colonic flushing to reduce the primary toxic source.

We have less cause to fear the dangerous nephritis of scarlatina when we find the colon bacillus abundant in the urine, and recognize it as an agent hastening the patient toward death.

Sometimes in consultation physicians have advised against operation in cases of appendicitis because of the presence of albuminuria, but when they were shown the presence of the colon bacillus in the kidneys, they were not surprised at the rapidity with which albuminuria ceased after operation on the primary focus of infection.

Infection of the urinary tract occurs in several ways. We have ascending infection through the open portal of the urethra, descending infection through the mazes of the blood-stream, infection by contiguity when the bacilli make their way through tissue from a neighboring focus.

Concerning ascending infection through the open portal of the urethra, we shall often find the colon bacillus as the chief malefactor in many cases of chronic cystitis if we simply look for it, and I have found it in cases in which the clinical diagnosis was tuberculosis of the bladder, and a hopeless prognosis had been given. Yet the cystitis disappeared under the influence of hexamethylenamin before I had taken up the improved treatment of Thomson, with the addition of benzoate of soda.

Infection of ureters and the pelvis of the kidney is often due to the colon bacillus, and we may obtain this bacterium from any part of the urinary tract. Some obscure cases in which we suspect the presence of stone in the kidney, but cannot prove it by text-book resources, are really cases in which we will find the colon bacillus at work, if we look for it. This is true also of some kidney abscesses.

The colon bacillus ascends the open portal of the vagina, and is responsible for some of the leukorrhæas of intractable character. I have found it chiefly in the ones in which the leukorrhæa was secretory in character rather than purulent and particularly in neurasthenic young women.

This bacterium is sometimes the cause of oviduct infection, when resistance is suddenly lessened in a woman exposed to cold during the time of menstruation.

In other cases the colon bacillus insidiously escapes into the peritoneal cavity beyond the oviducts, without making particular demonstration en route, but attacks an ovary at a point of injury, like that caused by recent escape of an ovum, and gives rise to ovarian abscess. I suspect it to be the cause for some of the ovarian and tubal adhesions in cases giving no clear history of acute attack.

Incontinence of urine in children is sometimes due to the presence in the bladder of the colon bacillus, which has entered through the urethra, or has descended from the kidney. Highly acid urine caused by the colon bacillus accounts for the irritability of the bladder and the incontinence in this group of cases.

The same bacterium is undoubtedly a factor in limiting population when it goes into the vagina and causes such highly acid secretion that spermatozoa perish, unless we correct the hyperacidity with milk of magnesia or other resources.

The colon bacillus penetrating the diaphragm sometimes causes local pulmonary consolidation, and it has been found by Kemp as an abundant bacterium in double pneumonia and purulent bronchitis, and obtained in pure culture from the urine at the same time.

The effects of the colon bacillus are sometimes so remote that the influence of this bacterium is not suspected at all. In one case of chorioiditis in which the patient had become nearly blind, Dr. Kirkendall, of Ithaca, N. Y., recognizing the toxic character of the chorioiditis, sent the patient to Dr. Stockton, of Buffalo, for consultation. Dr. Stockton believed that the toxin in the case might be from the colon bacillus, due to bowel disturbance caused by chronic inflammation of the appendix, and the patient was sent to me for operation. Removal of the appendix cured the patient of his chorioiditis.

Clinicians must form a habit of looking for the colon bacillus as systematically as they now make differential blood-count.

My view that the colon bacillus ranks along with the tubercle bacillus as an agent for preventing overpopulation and regulating the character of population, by means of poison, might have been given special attention by Darwin or Malthus, had they been in possession of our present data which open such an interesting new vista.

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THE PRESENT STATUS OF SALVARSAN THERAPY IN SYPHILIS*

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Since the introduction of salvarsan to the profession, in the early part of 1910, the use of this powerful specific in the treatment of syphilis has passed through several stages and its final position is not yet entirely fixed on account of the chronic nature of the disease. The purely experimental period, however, is practically over. Certain definite statements can now be made, and the lines for future development are fairly well laid down. The present status of the whole subject can best be appreciated by a brief review of its history, which is illustrated by personal experiences.

As a preliminary to the discussion of the treatment of syphilis, it is very desirable to decide, if possible, on some criterion of cure. Before the day of the Wassermann reaction the question of cure in a given case was somewhat problematical, as a number of cases which have received "classical" treatment still give positive reactions. But now that we have in the Wassermann reaction an index of the infection, and in salvarsan a remedy which helps cut short the length of treatment, I believe that it is feasible to adopt a criterion of cure which will hold good and within a reasonable period of time. Accordingly the following criterion has been tentatively adopted: one year without treatment, without symptoms and with several negative serum reactions. This standard depends largely on the observed fact that after the discontinuance of treatment, the great majority of relapses, clinically or serologically, occur within six months, and it is believed that but few untreated persons can harbor living spirochetes for a year without giving

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