

Nature as a Physician*

The Blunders She Makes in Her Efforts to Cure

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It was Voltaire who made the remark that "the physician amuses the patient while nature cures the disease." Unfortunately there has always been much that is true in this aphorism, but if the author of the "Age of Louis XIV" could return to-day with a gangrenous appendix or a plaque muqueuse he would have to confess that the physician is becoming as useful as he is amusing. As a matter of fact, the physician has always owed his livelihood to nature's inability to care for the sick. If nature were famed for its skill at relieving pain, draining abscesses and killing invading parasites, the physician would starve to death; but judging by the stream of newborn healers which pours from our colleges as fast as the printers can turn out the diplomas, nature leaves a large field for improvement. There is still a lot of talk of adhering strictly to natural methods in the treatment of disease, but those who talk the loudest must confess that in severe diseases where we "leave nature to take its course" the outlook for the patient is always the worst. To turn a very ill person over to nature is like sending a dying consumptive to Egypt. Compare the breathless victim of pneumonia or the stuporous typhoid patient, untouched by cold water, awaiting the verdict of the unknown, to the surgical case of gallstones or the prey of the anopheles well dosed with quinine. Is nature's treatment for pain, by causing the sufferer to faint from exhaustion, better than the physician's hypo of morphia, or is nature's effort to squeeze a kidney stone through sixteen inches of tubing, one-fourth its diameter, preferable to ether, antisepsis and the knife? It is common to hear a drug or system of treatment recommended because "it is nature's own remedy." Would it not be better to say that it is *our* own remedy and twice as good as anything nature has to offer? Would this be blasphemous to a system of government which puts us on earth to fight unceasingly for our life? It is the surgeon who to-day is leaving the least to nature and doing the most for his patient; it is the internist who lags behind in his treatment under the delusion that what is natural is best and is making nature his guide rather than experiment.

Inflammation and Scar Tissue.—Not long ago an Eastern surgeon in suturing a wound of the intestines left the lumen too small and chronic intestinal obstruction resulted. The surgeon suffered severely in the hands of local gossips, for the most inexperienced holder of a medical diploma was expected to know how to sew a gut and still leave it open. Yet, this trick is performed every day by nature in healing dysenteric and other ulcers of the bowel; the wound is bound with scar tissue which shrinks with age and finally strangles the gut it came to heal. Scar tissue is nature's cureall for wounds. When a cut is made through the skin the edges are brought together by a delicate net-work of scar tissue threads and so neatly is the work done that in time only a seam is left to mark the once unsightly deformity. This scar at first is pink from a rich supply of capillary vessels, but as scar tissue grows older its nature to contract and squeeze, shut the vessels which give it life; so that in time a white, tough, puckered scar remains. All this is of no great consequence on the skin, except for a possible distorted face or crippled hand, but it plays havoc within the body where the structures are more delicate. Take the heart valve which is left ulcerated by an attack of endocarditis; the inevitable scar tissue starts its patchwork and makes a neat job of covering over the denuded areas, but instead of leaving well enough alone it goes on contracting and in time a useless, puckered bunch of valve leaflets remains, the heart works in vain to overcome the backflow of blood and the days of the victim are numbered. Among numerous other examples of serious results from scar tissue may be mentioned strictures of the pylorus, rectum and urethra; deformed joints; cirrhosis of the liver; Jacksonian epilepsy; chronic Bright's disease, and arteriosclerosis. Even with a strictured pylorus the victim manages to find some enjoyment in life, but this is not all that is sometimes in store for him; only too often the scar tissue sets up such an irritation of its own that cancer takes root as the result. That this is frequently the final stage in nature's long drawn-out effort to heal an ulcer of the stomach, a torn cervix uteri, or a scarred gall-bladder is unfortunately common knowledge. No quack ever handed his patient a worse deal than this. In old age the organs have become so riddled with this weedy substance, scar tissue, that life is squeezed from

the body many years before the proper time. Suppose we had a scar tissue which, after it had performed its duty, stayed pink and soft and never shrank—what an ideal remedy this would be!

Acute inflammation is also a fair example of the crude way disease is often handled by nature. All the swelling, pain, and discomfort of an infected area is not due to the invading germ but to the natural remedy. Of course we should be grateful for any protection at all from foreign irritants, but we must confess that this process is frequently rather far fetched. Does not the swelling about the glottis, which cuts off the air from the little chap, the victim of croup, seem a rather drastic treatment for a slight irritation of the larynx, and is not this also true for the infant who cannot suckle because nature is treating a slight cold in the head, and again, the patient who is dyed a deep yellow because the bile ducts are swollen shut from a catarrh which otherwise would pass unnoticed? When inflammation goes on to suppuration and an abscess forms it is certainly time for us to interfere; left to itself the abscess may, after a long and torturing interval, dry up and leave adhesions tugging on neighboring structures, or it may, with agonizing pain to the patient, point and drive its deadly contents straight into the peritoneum or some other vital field. Who is there to-day with an abscess of the appendix who will place himself in nature's hands when a surgeon is nearby?

The tendency of different mineral salts from the body juices to collect about irritating foci is often applauded, and well so, for it is in this way that a tuberculous area is imprisoned. However, there are times when this process does more harm than good. Take a mass of typhoid bacilli which is providing a nuisance within the gall-bladder; nature turns loose an abundance of bile salts which deposit about groups of bacilli to form thick shells. Are the bacilli walled off and made harmless by this method? Yes, but there are left ten to a hundred or more gallstones which play the very devil with the unlucky owner.

Overdosing.—We have learned by experience that moderation in treating disease is as important as moderation in everything else, and that the most harmless remedies become poisons in overdoses. Nature often gives overdoses, and thereby does more harm than good. Fever is a good example. Fever is now recognized as nature's attempt to make the blood too hot for the comfort of invading microbes. A moderate amount of fever evidently aids the patient, but when it becomes excessive the question arises: which is causing the most damage, the bacterial toxins or the heat? The headache, anorexia, malaise, rapid heart, hurried breathing, scanty kidney elimination, nervousness, delirium, stupor, cloudy swelling and the whole train of symptoms of the acute infections—how many are caused by the disease, the toxins, and how many by the natural remedy, the fever? The benefit derived from the use of plain cold water in typhoid fever will help to answer this question. Another example of a natural remedy carried to excess is the hypertrophied heart. When imperfect closure of the valves demands more work of the heart its muscular walls thicken to supply the extra power. If this method made up for the deficiency and kept step with an ever-increasing deficiency, well and good, but it does not. The heart goes on enlarging and pounding away far beyond the demand made upon it and the patient relieved of some little tendency to dropsy or shortness of breath now suffers more distressing symptoms. If this ability to increase in size were unlimited the natural treatment of heart disease might remain merely troublesome and not prove dangerous, but there comes a time when the growing muscle cannot receive enough blood to nourish it; it is the old cry of no food, no work, and the heart, unable to keep up the pace it has set, fails and fails rapidly. Here is an example of how a little prudence on the part of nature could keep the heart active many years after it has ceased to beat, for it is not nature, but the physician who, with his drops of aconite, prolongs the patient's life, or, at a later date, with his digitalis, keeps beating the heart long since thrown aside by its maker. A high blood-pressure is commonly a bad natural therapeutic measure. In attempting to compensate for what the failing heart and kidneys refuse to do, the pressure in the vessels rises often above 200 millimeters of mercury. Any minute such a man may drop unconscious from apoplexy unless the physician with his nitrates can undo some of the mischief by bring-

ing the pressure down. A cough, as we know, is nature's method of blowing irritating matter from the bronchi. We can all recall instances of how this is frequently carried too far. There is, for example, no sense in making a child cough until it vomits or breaks a sub-conjunctival blood vessel, for all the good it does in whooping cough. The congestion of the mucous membrane of the larynx and its injury by being brought into violent contact following a severe paroxysm of coughing, surely does more harm than good. The cough of phthisis is certainly an unwise prescription when it keeps the patient sleepless and nervous or encourages hemorrhage or the dissemination of infection. Diarrhea, which persists after the bowel is as clean as a gun barrel, the profuse nasal flow from a single cold, the edema which closes the glottis, the bony callus which entangles the nerve—these are but few of the many other examples of how nature overdoses its patients.

Antibacterial Properties of the Blood.—Much is heard today of the wonderful natural properties of the blood to kill invading bacteria and neutralize their toxins and of our ability to aid nature in the use of these. When we add antitoxins or bactericidal products to the blood, we are merely imitating nature, not doing something better. Of course, in adding, for example, diphtheria antitoxin to the blood in large quantities and thereby saving an urgent case of diphtheria, we are doing something which in the time allowed nature could never have accomplished, but, nevertheless, the method employed is purely nature's. Armed with antitoxins, antibacterial sera, and preventive vaccines, our task of fighting infectious diseases will be lightened for some time to come. It is not these, however, but chemical compounds like salvarsan, selenium with eosine and mercuric succinimide, purely the work of man, which will constitute the ultimate goal of therapeutics. Suppose the blood had naturally a *therapia sterilisans magna*, instead of all these million and one different antitoxins, opsonins, agglutinins, precipitins, bacteriolysins, and other unchristened agents—what a remedy this would be! One trouble about these antibodies is that they are too complicated and have to be manufactured by the body cells separately for each disease, and this the cells often cannot do; we can readily understand how the cells may find it difficult to manufacture the different complicated side chains to fit the corresponding links of each separate germ. Another fault is that being biological products manufactured by living cells and the bacteria which they attack also being living cells, the bacteria are able to make similar antibodies of their own. Thus we have the reciprocal antibodies, or so-called aggressins of the invading parasite being prepared to neutralize the antibodies of the blood; while in the case of a chemical compound the germ would be unable to manufacture an antidote so readily. The recognition of a hypersensitiveness or an anaphylaxis which the body may develop for a substance, comes as a warning to the unreliability of some of nature's methods in this direction. How are we to know on administering a remedy, especially a foreign blood serum, whether the patient can stand a double amount the next time or has developed such a hypersensitiveness to it that another similar dose will kill him? We were led to believe that nature could develop enormous powers of resistance to any poison administered in increasing doses; what are we to think now of this dangerous reversion? How do we know now whether nature does not possibly at times make us hypersensitive to the secretions of our own body cells and allow this rebellion of the tissues to cause all kinds of disagreeable idiopathic symptoms?

Where Compensation Fails.—We often admire the way in which one kidney does the work of two when the second is removed and how a small portion of lung will carry on the work of a wide-spread area destroyed by tuberculosis. This natural compensatory action, however, is by no means constant. In injuries to the eyeball we are familiar with the danger of sympathetic inflammation of the healthy eye. Sometimes, in fact, the ophthalmic surgeon can make of the injured eye a more useful one than the other, the victim of natural interference. In treating a wound involving a main artery of the leg or arm, nature calls various anastomosing arteries into service to form a circuit around the break in the blood stream and to allow the circulation to proceed unimpeded. This is a wise provision and means the saving of a limb which at the present time the surgeon would have to sacrifice. Why, may we ask, does nature not have these anastomosing arter-

* Reproduced from the *Medical Record*.

ies instead of the so-called end arteries in vital organs so much more important than the limbs? If the dorsal artery of the thumb becomes plugged or divided, anastomosis with the *princeps pollicis* on the other side prevents this finger from suffering any loss of blood supply; on the other hand, if one of the ganglionic

branches of the middle cerebral artery becomes plugged, nature is unable to do for the brain what it did for the thumb and apoplexy with death or worse is the result. The most vital spot of the brain is thus laid bare to a bit of natural negligence which even the smallest toe does not suffer. During starvation the

different ways in which the body metabolism economizes the food supply is often remarkable. Nevertheless, in a starving child, nature will allow the food to be used for the growth of the skeleton before supplying the vital organs dying of hunger, and the bones ignorant of the greed grow longer up to the very point of death.

The Conquest of the Air by the Chemist*

Oxidation of Atmospheric Nitrogen and the Development of the Resulting Industries of Norway

UNDOUBTEDLY one of the most interesting features of the late International Congress of Applied Chemistry was the address by Dr. Samuel Eyde, who is not only one of the joint inventors of the Birkeland-Eyde process, but who has been able to promote the industry of the fixation of atmospheric nitrogen within ten years in such a way that it is now the biggest and most marvelous new industry of Norway. After explaining that the atmosphere surrounding us is composed of oxygen and nitrogen and that the task of the new industry is to create by the union of the oxygen and nitrogen gases new chemical combinations which can be utilized in the world's household, he referred to the pioneer work of Priestley and Cavendish, of Sir William Crookes and Lord Rayleigh, and of Bradley and Lovejoy at Niagara Falls.

The difference between these previous methods and those of the Birkeland-Eyde process is that the latter employ large quantities of electric energy in the electric arc and have first found out the best method of doing this, while it was previously believed that it was small quantities of energy that gave the best results.

Dr. Eyde described the principle of the Birkeland-Eyde process, which as our readers know, is to drive the air through a flame disk produced by electromagnetic deviations of an electric arc.

With the commercial furnace which they have developed they have been able to reduce the whole operation to such a routine practice that the furnace burns for weeks without any regulation worth mentioning. The maintenance of the furnace and its repairs are simple, as the most exposed portions, the electrodes, only require to be changed every third or fourth week, and then only a small part of them, and the fireproof masonry every fourth to sixth month.

The temperature of their flames exceeds 2,500 deg. or 3,000 deg. C. The temperature of the escaping gases may vary between 800 deg. and 1,000 deg. during ordinary working. The furnaces are made of cast steel and iron, the middle of the furnace being built out to a circular flame chamber. The electrodes are led radially into this flame chamber. By aid of centrifugal fans the air is brought into each furnace through tubes from the basement.

The experimental work of Birkeland and Eyde started with a furnace not larger than could be held in a hand, and now they have succeeded in building furnaces which consume more than 5,000 horse-power and from absorption apparatus on a laboratory scale with a few liters capacity they have passed over now to absorption towers of granite with a capacity of 600 cubic meters or 600,000 liters each.

Dr. Eyde then discussed the Schoenherr furnace. In this furnace the air passes in a spiral path around a very long drawn-out arc upward, the furnace being of a long tube form. Dr. Eyde remarked that the reaction in the Schoenherr furnace is identical with that obtained in the Birkeland-Eyde furnace and the yield as far as the results now obtained shows practically the same.

Dr. Eyde stated that at Notodden they have only furnaces of the Birkeland-Eyde system from 1,000 kilowatts to 3,000 kilowatts. At Rjukan there are, however, furnaces of the Birkeland-Eyde system of 3,000 kilowatts as well as furnaces of Schoenherr's system all of 1,000 kilowatts.

The operation aside from the electric furnace was described by Dr. Eyde as follows: The air for the furnaces is procured by swiftly revolving fans. The air is conducted through large iron pipe lines to the furnaces. When the air in the flame chamber has been treated by the electric flames, the nitrous gases formed pass out through a channel to two fireproof lined gas-collecting pipes, which convey the gas through the basement to the steam boilers in which the temperature is reduced from 1,000 deg. C.

The steam produced in the boilers is utilized in the further treatment of the products. In the boiler house there are also two large and two small air compressors, which supply compressed air for pumping acids and lye in the factory's various departments.

The gases pass on from the steam boilers through an iron pipe into the cooling house, with the object of completing the cooling commenced in the steam boilers. This cooling is necessary in order to obtain a suitable absorption. Each cooler consists of a great number of aluminium tubes, over which cold water runs, while the hot gases pass through them. The temperature of the gas is considerably reduced. From the coolers the gases go on to the oxidation tanks.

These oxidation tanks are vertical iron cylinders, lined with acid-proof stone. The object is to give the cooled gases a sufficient period of repose in which the oxidation of the oxide of nitrogen may have time to take place. The necessary amount of oxygen is present in ample quantity in the air which accompanies the gases from the furnaces. From the oxidation tanks the gases are forced by blast engines into the absorbers.

ABSORPTION TOWERS.

All the towers are filled with broken quartz, which is neither affected by nitrous gases nor by nitric acid. To assist the passage of the gases on their way from the furnaces there are centrifugal fans, constructed of aluminium on each row of towers.

The gases enter at the basis of the first tower, go up through the quartz packing and thence by a large earthenware pipe enter the top of another tower through which they pass downward through the quartz to the bottom of the third tower, and so on, until the air, relieved of all nitrous gases, leaves the last tower. Water trickles through the granite towers and this is gradually converted into a weak nitric acid, while the liquid used in the iron towers is a solution of soda.

The absorbing liquid enters the top of the tower and is distributed in jets by a series of earthenware pipes, so that the permeating gases come in immediate contact with the absorbing liquid. In the granite towers nitric acid is thus formed and in the iron towers a solution of nitrate of soda.

The liquid emerges in a constant even stream from the bottom of the towers, that from the granite towers running into a granite cistern. Hence it flows into the montejus which serve to pump up the acid, which has to pass repeatedly through the tower before it has become strong enough for the purpose for which it is intended. The montejus are of stoneware strengthened with iron shields, are worked by compressed air and send the acid up into large stoneware jars. From these jars the acid again runs through the towers as described. The montejus work automatically.

The iron towers are percolated, as already mentioned, by a solution of soda, otherwise the whole process is practically similar to that in the granite towers. The solution of soda, owing to its far greater power of absorption, effects the separation of the last remains of nitrogenous gases from the accompanying air. Of the entire quantity of nitrous gases passed through the absorption system about 97 per cent is absorbed.

SOLUTION WORKS.

The finished nitric acid coming from the towers, which has a strength of about 30 per cent by volume, is collected in granite cisterns, from which it is drawn to what is called the solution works. These consist of granite vats filled with limestone over which the acid is poured. This drives off, with violent effervescence, the carbonic acid contained in the limestone, while the nitric acid takes its place and forms a watery solution of nitrate of lime or calcium nitrate.

The rest of the acid is neutralized in small towers filled with milk of lime and is now pumped into vacuum evaporating apparatus. The object in boiling in vacuum is the well-known fact that great saving is thereby effected in the heat required.

The steam required from the evaporation is obtained from the steam boilers, heated, as before mentioned, by furnace gases. The concentration of the nitrate solution in the evaporizing plant is continued until the specific weight of the liquid at a given temperature shows a content of 13 per cent of nitrogen.

This solution is then sufficiently evaporated and can be pumped up into the solidification chambers, where it is conducted upon a revolving cylinder, cooled on the inside, where it stiffens so quickly that it easily can be brought to spring off into small leaf-similar pieces,

which without difficulty can be granulated in the crushing mill, where the mass is reduced to a granular state.

The coarse powder so produced is raised by elevator to a vat, from the bottom of which it is tapped into casks holding 100 kilograms net weight. The gas led into the iron tower forms with the solution of caustic soda a solution of nearly pure sodium nitrate. This is concentrated by evaporation in the same sort of apparatus as above and allowed to crystallize. The crystals are dried in a centrifuge and tapped into casks. The barrels are made at the factory's own cooper's shop and are lined with paper to guard against damp. Besides these two products, nitrate of lime and nitrate of soda, they have during the last year at the Notodden Works taken up the manufacture of nitrate of ammonia, which product already has won a good reputation, and in comparatively large quantities is shipped to the United States.

THE IMPORTANCE OF WATER POWER.

In this industry the water power is all important. The works now being built are all situated in the southeastern part of Norway and the Telemark River. The first work, the Notodden nitrate factories are admirably situated at the lake of Hiterdal, about 50 feet above the level. A short channel with a series of locks permits communication with the town Skien, an important seaport at the head of the fjord. Under the present conditions vessels of 200 tons burden can ascend to Notodden. It is planned to enlarge the locks so as to allow the passage of seagoing vessels of 2,000 tons. This ability to ship directly to all parts of the world by water is an important factor in the future of the Notodden nitrate industry.

The Notodden factories, which now have about 60,000 horse-power in working, get this power from two neighboring waterfalls, Lienfos and Svaelfjos.

The equipment of the hydro-electric plants was described by Dr. Eyde in some detail. For transportation it was necessary to build railways and provide ferryboats, and the end of the development has not yet been reached. At the Rjukan waterfalls it is intended to build two power stations which will furnish the factories with 250,000 horse-power.

Dr. Eyde illustrated brilliantly the development of his industry by lantern slides showing the factories at different times. In the beginning a few farmers were at the spot. Now there are towns with all the comforts of modern civilization.

According to the results of the use of their nitrate of lime, it is stated, that the use is the same as the Chile salpeter, and for certain soils it is even better. Now they are sending many thousands of tons of Norgersalpeter to California and Hawaii to be applied in fruit orchards and sugar plantations; and the demand this year has been twice as large as last year.

The conclusion of Dr. Eyde's speech is perhaps more characteristic of the man than anything else. He spoke as follows:

"If you ask me what above all has contributed to such a rapid development of an industry, then I wish to mention the confidence the financial people gave me and the good collaboration between me and my engineers. We all were filled with the same thought, to create something great and useful for our country, and we all had in view the great importance this new industry would have from an international standpoint.

YOUNG MEN FOR PIONEER WORK.

"There is, however, one thing which I wish to tell you and which more than anything else has contributed to the great success obtained in the development in this industry, and that is that I mainly have employed young men for this work. This assertion may appear strange, but I assure you that it is the 'lack' of experience which has created this industry. If I had paid attention to all the doubt and hesitation brought forward by the so-called authorities during the development of our enterprise, the Norwegian nitrate industry of to-day would never have existed. Thanks to the young people, to their undaunted courage, energy and love of action, the work has been done, and it is in grateful remembrance of all our struggles I, as their boss, had with the men in joy and sorrow that I look backward to the work that has been done."

* Paper read before the International Congress of Applied Chemistry. The account here given is reproduced from *Metalurgical and Chemical Engineering*.