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EFFECT OF EMOTIONS ON
GASTRO-INTESTINAL TRACT

by

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Senior Thesis 1937

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I. Introduction

A. Emotion

A complete emotion is a combination of subjective affect and objective emotional stress: gestures, postures, facial movements, vocal expression and modulation, and many visceral changes. Affect is the most central and vital element in an emotion, infinitely and eternally subjective (45). Affect denotes the emotional conative aspect of all mental activity, with the recognition that feelings of pleasure or pain are conditioned by and in turn act upon the course of such mental activity, furthering or checking it in proportion to their intensity (48). Affectivity, according to MacCurdy, is the determining element in our acts and omissions, directing our attention as well as our whole behavior, and determining the direction of our endeavors; while logic and judgment seem only the servants that show the way to the goal and furnish the necessary apparatus. The affective faculties represent the emotional propensities peculiar to man. Affectivity, when unusually responsive and in the presence of defective reflective power, causes by its exaggerated action morbid syndromes as seen in the psychoses.
McDougal divides emotions into primary, secondary, and derived. Primary emotions owe their specific qualities largely to the visceral sense impressions made by the bodily adjustments that accompany instinctive strivings. Secondary emotions are made up of blended primary emotions which, in turn, are made up of two or more instinctive impulses excited simultaneously. Derived emotions or feelings arise in the course of the operation of any strong impulse or tendency, the emotion being dependent on or derived from the working of the impulse taking the form of desire. These emotions arise only in the course of actively prompted and sustained desire. In short, the derived emotions are affections and feelings, in the strict sense of the word, resulting from fundamental feelings of pleasure or pain and accompanied by developed powers of imagination and an intellectual capacity to conjoin pleasure with pain.

B. Moods

An emotion normally subsides into a mood before the excitement wholly passes away. Mood is the persistent emotion prolonged after any thought of the object. Persistent moods may become morbid, as in the affective states of the neurotic and the psychotic. Moods, by their repetition of corresponding conceptions, sustain
the affect at the expense of effect on somatic and visceral expression until a level is reached at which there is an entire absence of reaction at the lower level (41).

Some moods are largely due to organic conditions, which, in chemical and in other ways, predispose the subject to this or that kind of emotional excitement. In cases of long persistent morbid moods, one naturally suspects the presence of an organic factor as in the affectful ideas of the manic-depressive patient (48).

While disturbances of the affects may depend upon changes in the brain or in the chemistry of the organism, a certain constitution, usually congenital, seems to be a prerequisite in most cases. The hysteric, the paranoic are born different from healthy people. In all mental diseases, the symptoms are largely an expression of the affective condition. Congenital anomalies, injuries, and diseases of the brain, disturbances of nutrition, intoxications and infections plus the prolonged action of affects form, in varied array and admixture, the basis upon which psychopathic reactions occur (4).

C. Vegetative System

The pathway for emotional reaction on visceral function is the vegetative system. This comprises the
autonomic system and the endocrine system. The endocrine glands appeared before the outbudding of the involuntary nervous system, regulating body metabolism by hormonal control. Later these two great divisions joined under one system to regulate and maintain particularly all visceral function of tone, motility, glandular activity, sensitivity and absorption.

The central gray, or midbrain, which surrounds the third ventricle, or hollow space of the primary anterior vesicle of the brain is supposed to be the seat of the elementary vital and vegetative functions of life (64). On both sides of the third ventricle lies the optic thalamus, the old important center of the whole sensibility. in the medulla or bulb, the enlarged portion of the cord, at its junction with the midbrain or mesencephalon, is localized the important centers of respiration and circulation. It is by outgrowth from the midbrain and medulla and the neural crest of the embryonal stem that the vegetative nervous system developed, to form three distinct groups of neurons: one with its origin in the midbrain and bulb; one from the neural crest to form the lateral ganglia, connected with the thoracic and upper lumbar segments of the cord, and a third in the sacral segments of the cord. The middle group is called the sympathetic nerves; the remaining two, the parasym pathetic;
the third, seventh, ninth, and tenth cranial nerves and the pelvic nerve form the latter division of the system. The vegetative nervous system remains connected by afferent and efferent fibers with the central nervous system, so that one may affect the other. Moreover, a number of specialized vegetative nerve cells remain within the cerebrospinal axis, thereby accounting for the occurrence of vegetative phenomena in certain diseases of the brain.

D. Parasympathetic and Sympathetic Nerves

The parasympathetic nerves, when stimulated, increase visceral motor and secretory activity. The sympathetic nerves inhibit visceral function, except to some structures like the pilomotor muscles, sweat glands, most of the blood vessels, fallopian tubes, uterus, vagina, vas deferens, and seminal vesicles and ureters, to which no parasympathetic fibers travel; here the sympathetic nerves may either increase or inhibit motor or secretory activity. The parasympathetic fibers running to the intestine end in ganglions in the muscle coats and mucus, the plexuses of Auerbach and Meissner, respectively. The sympathetic or splanchnic nerves originate in the thoracolumbar region of the spinal cord with their cell stations in the lateral ganglions on each side of the vertebral column, and also in the collateral ganglions grouped to form especially the celiac or solar
plexus and the inferior mesenteric plexus. The sympathetic nerves are connected by white and gray rami to the spinal nerves of the voluntary nervous system, supplying the skin and muscles of the torso and extremities. The parasympathetic nerves are connected to certain of the cranial nerves, but especially to the fifth or trigeminal. The two systems are assumed to be in a state of equilibrium, similar to that in an alternating current of stimulation and inhibition. An excitability of the vagosacral side is called vagotonia; of the sympathetic, sympathicotonia. An atony or paralysis of one side will cause a relative tonicity of the other side.

The vagotonic type of person is reserved and cold-blooded, and has a slow pulse, hypotension, contracted pupil, deep, closely set eyes, a cool pale skin which sweats easily and patchily and clammy hands and feet. He is subject to hyperchlorhydria, spastic colon; low blood sugar, hyperinsulinemia; calcium deficiency; chronic anaphylactic states, hay-fever, asthma, angioneurotic edema, urticaria; migraine and epilepsy and vertigo. He is relieved by the administration of atropine, epinephrine, calcium, ammonium chloride, parathormone, and reduction in the intake of sodium (61).
The sympathicotonic person is lively and excitable, with a rapid heart rate, hypertension, dilated pupils, rosy color, warm, dry skin and prominent eyes; he has a high blood sugar. He tends to suffer from slow digestion and atonic constipation due to stasis, spasm of various sphincters, eczema, pruritus, hyperesthesias, myalgias and pains over the main arterial trunks. There is a deficiency of magnesium. They are relieved by pilocarpine, magnesium, and morphine. The sympathetic nervous system with its connections with the thyroid and suprarenal glands, liver, brain, skeletal muscles, and cardiovascular system is stimulated by fear, anger, shock, or pain, to form the mechanism of defense, attack, or flight; and of the conservation of visceral function by inhibition.
II. Effect of Psychogenic Influences on Secretory Phase of Gastro-Intestinal Tract

The gastro-intestinal tract is a motor-secretory apparatus, the functioning of which is largely the result of the interaction of the nerve pathways just described—-that stimuli aroused by the emotional state of the individual may produce profound variations in the functioning of this system, it is the purpose of this paper to prove.

From time immemorial it has been known to man that under the influence of psychic stimuli the salivary glands prepare for the approaching feast, but only in the last century has it been known that the gastric glands respond likewise.

An emotional disturbance affecting the alimentary canal is capable of starting a vicious circle; the stagnant food, unprotected by abundant juice, naturally undergoes bacterial fermentation, with the formation of gasses and irritant decomposition produces. These in turn may produce mild inflammation or be absorbed as substances disturbing to metabolism. The importance of avoiding, as far as possible, the initial states of worry and anxiety, and of not permitting grief and anger and other violent emotions to prevail unduly, is not commonly understood, for the subtle changes wrought
by these emotional disturbances are not brought to consciousness, and are clearly known solely through physiological studies. Just as feelings of comfort and peace of mind are fundamental to normal digestion, so discomfort and mental discord may be fundamental to disturbed digestion. In recent physiological studies of the alimentary canal, the importance of emotional states to normal digestion has received striking confirmation, the motility and secretory activity have both been proved to be closely dependent on the nature of the excitation in the central nervous system (16).

Pavlov's (56) well known observations showed the importance of appetite and a relish for food in starting the secretions of the stomach. These observations on dogs have been almost completely confirmed by studies on human beings having esophageal obstruction and gastric fistula.

Not only is it true that normal secretion is favored by pleasurable sensations during mastication, but also that unpleasant feelings such as vexation and some of the major emotions are accompanied by a failure of secretion (16).

It was in 1843 that Blondlot (9) first noticed, while working with animals with a gastric fistula, that
the simple tasting of food could cause secretion to appear in the opening, and nine years later, Bidder and Schmidt quoted by Alvarez (33), again with animals, found that even the sight of food would cause the gastric juice to flow.

Heyer (34) reports a series of interesting experiments. He mentions the observations made by Cade and Latorget on a girl twenty years old who, in her first years of life, had suffered from a gastric hernia. From this there had developed through inflammation and adhesions a "small stomach" entirely separated from the stomach, and in free communication with the surface. This "small stomach" in the fasting stage produced liquid without free hydrochloric acid. Under psychic influence (talk about a menu, etc.) double the amount was produced with .15 per cent free hydrochloric acid and pepsin; the total acidity increased from .17 per cent to .80 per cent in this experiment. Similar observations were made by Schrottenbach (60) on two patients with total stricture of the esophagus and gastric fistula. He found, also, that latent unpleasurable affects diminish or abolish the effect which otherwise would increase secretion, and that pleasurable and unpleasurable affects have an inverse effect.
Interesting is Bogen's (34) experiment on a child three and one half years old with oesophageal stenosis and gastric fistula. In the feeding of milk and meat, the food itself always remained caught in the diverticulum resulting uniformly in psychic secretion. Bogen was struck by the fact that before the beginning of the experiment, hydrochloric acid, which had not been present previously, suddenly appeared in the juice. This happened every time after he had talked with the nurse about the meat the child was to have. He then carried out the following experiment: forty times the child was fed with meat, and a trumpet sounded simultaneously; then the trumpet was sounded but no feeding was given, and this was accompanied by secretion of gastric juice with free hydrochloric acid. Bogen found, furthermore, that if the child became angry because of not receiving the meat there was no secretion when the meat was finally given.

Many investigators have criticised such evidence on various grounds, implying the animal experiments did not represent an analogous state of affairs in men, and that human subjects with fistulas could be questioned as pathological. A certain group of men felt that experiments conducted on humans under hypnosis would furnish more conclusive evidence. Adolf Meyers (47) commenting
on hypnosis as an experimental basis for studying the effect of emotions on the gastrointestinal tract states that the best opportunity we have of determining this experimentally is probably with hypnosis, because there we have in our possession a method of inducing, also, less conscious experiments practically dissociated from the general trend, but as closely active or potent as definitely conscious ones.

Heyer (34) conducted a series of experiments on human subjects under hypnosis. Individuals having been carefully examined and found to have healthy gastrointestinal tracts were hypnotized. In deep hypnosis a fine sound was introduced into the stomach of these subjects, they knowing nothing about the experiment. The "empty" stomach content was first pumped, but, if after this, no secretion occurred for ten minutes, the subject was given the suggestion of taking a cup of bouillon, a slice of bread, or a glass of milk. Swallowing was prevented by hypnotic command, and the saliva flowed out of the mouth. After the latency period of two to ten minutes, there was always a plentiful flow of juice through the sound. The juice was collected every five minutes and examined as to quantity, acidity, and albumin digestive potency. The absolute quantity seemed to correspond to the vividness of the suggestion as it
was received.

In the course of these experiments, i.e., at a time when the gastric secretion was well under way, these subjects were subjected to vivid affects: fear, fright, and worry on one hand; joyful expectation on the other. These affects regularly disturbed the flow, irrespective of their euphoric or dysphoric nature, although the effect of the dysphoric ideas worked more quickly. When the disturbing sensation was retracted, in time, the secretion usually began again.

Bennet and Venables (7) using hypnosis for the purpose of determining the effect of psychic stimuli on secretion report the following results:

(1) Suggestion of nausea resulted in almost complete inhibition of secretion.

(2) Suggestion of hunger resulted in an increase of acidity, and an increase in emptying time.

(3) Suggestion to create anxiety resulted in increase in acidity, and a notable delay in emptying.

The work of these men has clearly demonstrated the remarkable changes which may take place in gastric secretions as a result of psychic influences. What about
the other secretions of the digestive tract, the pancreas, the gallbladder, the liver?

Intuitive knowledge of the connection between emotions and bile goes back to the "melancholia" of the ancients, and finds its expression in many common turns of speech. Only recently, however, has scientific observation confirmed this intuitive knowledge, first by an accidental observation made by Oechsler (55). While an animal was being dissected in the laboratory, a dog with a gallbladder fistula standing nearby became greatly excited and Oechsler observed the following: The bile which theretofore had been flowing regularly without interruption suddenly ceased to flow at the beginning of the excitement; for twenty minutes, that is as long as the excitement lasted, there was not a drop of bile. Only after that length of time did the secretion begin to come back slowly. Another dog whose pancreatic secretion had been stimulated by a plentiful meal was angered by being thrown a cat. In a few minutes the pancreatic secretion stopped almost entirely. In a third experiment, when the secretion was well under way, the dog was excited sexually by being shown a bitch in heat, and made angry by detention. Again the flow stopped, but almost became normal after sexual gratification was permitted.
Recently Doberoff (23) made an extensive study on dogs with gallbladder fistula and gall duct fistula. The dogs were annoyed by being shown a cat. In twenty-three experiments with dogs having gall bladder fistula there was a marked inhibition of bile secretion in ten cases, in eight cases the secretion stopped entirely. In fifteen experiments with dogs having duct fistula, there was marked inhibition of secretion in eight cases, in six of which secretion stopped entirely; in one case there was only a slight decrease of secretion.

Langhenrich (42) has investigated this phase of the problem on human subjects by means of hypnosis. A sound was introduced into the duodenum after hypnosis was complete. With the suggestion, bouillon, there was always after half an hour: (1) liver bile in small quantities and constant secretion; (2) trypsin in relatively small amounts. With the suggestion of sweet butter the secretion was the same the first twenty-five to thirty minutes following the suggestion. After this period, however, the secretion of bile began to be much more copious and of longer duration; moreover, the last portions were dark brown to green in color, i.e., bladder bile. Comparison of the various series of figures shows three facts. (1) with the suggestion of fat, bile secretion is more plentiful than with the suggestion of
bouillion; (2) with the suggestion of fat, there is secretion not only of thick, yellow liver bile, but also of dark brown bladder bile; (3) with the suggestion of fat the tryptic digestion of albumin is greater.

E. Whittkower (66) studied the effects of various affects on bile secretion. His procedure was as follows: While the subject was under hypnosis the bile which flowed spontaneously from the duodenal sound was caught in test tubes which were changed every five minutes. Suggestions were given of four affects: joy, sorrow, anxiety, and annoyance. He found uniformly, in a series of more than twenty experiments that joy, sorrow, and anxiety increased bile secretion, bringing about an increase of two to six times. The effect was almost immediate with the beginning of the suggestion and subsided equally sharply. Annoyance, on the other hand occupies a unique position. For the duration of the annoyance, the bile secretion was entirely or almost entirely inhibited. He observed qualitative changes in the bile, gaining the impression that bile accompanying joy is especially light. He summarizes as follows: (1) certain sensations in the right upper abdominal region, after annoyance, are to be explained by spasm of the bile ducts; (2) the digestive process in a person who is annoyed may follow a course similar to that of obstructive icterus; (3) psychic
processes may constitute a contributing factor in icterus as well as in gall stone formation.

Ivy (37) writing on pancreatic secretions concludes: we are convinced that there is a cephalic phase of extrernal pancreatic secretion as observed from effect of sight and smell of food in a dog with pancreatic fistula. Fuestow (57) states that sight and odor of food frequently stimulate the flow of bile, whereas excitement occasionally has an inhibitory effect. Molleen (50) says that in psychoneurotic patients the secretion of the pancreatic juices is inhibited and the volume consequently diminished; but also its enzymatic content is also diminished or altered. Indeed, with all the factors that may influence pancreatic secretion, it would be surprising if complaints from the gastro-intestinal tract were not forthcoming. Bayden (13) states that when a patient is suddenly subjected to the odor of fried bacon, there ensues a momentary discharge of bladder bile.

Little is known of the extent to which the various liver functions are influenced by psychic factors. Alvarez (4) in a communication with Wilder quotes him as saying that the sudden exacerbations of diabetics often seen in patients undergoing psychic strain are probably due to changes emotionally produced in hepatic function.
Alkan (1) discusses, in considerable detail, the psychology of the bile passages and the role played by psychic factors in the acute flare-ups of chronic cholecystitis and in cholestrin stone formation. Every abdominal surgeon has had those annoying cases where a stone expected with certainty was not found, and not even a kink or an adhesion which could explain the colic; whereas if laughing one to scorn, the gall bladder lies there in the body of the narcotized patient without a sign of spasm. These are the non-infected gall bladders in which the intermittent spastic vagotonic obstruction led simply to hypertonic retention in the bladder, which empties normally with the elimination of the central stimulus.

M. Marchiafara (46) writes: "Icterus ex emotione" is known to physicians and laymen; but only with the latter is this knowledge of the connection between emotion and icterus so ingrained through heredity that in every case of icterus the question as to the emotional factor is asked. He notes that whereas, as a rule, the course of emotional icterus is short and the outcome favorable, malignant cases do occur. He cites two fatal cases of "icterus ex emotione" reported by Morgagni as early as 1765, and reports three cases of his own observation.
That the flow of intestinal juice may likewise be stopped by distressing emotions is indicated by the experience of Macewen (44) with a young man who had a large opening into the cecum. One day when the patient received bad news, it was noticed that the mucous membrane had lost its luster and its usual coating of moisture. It was noticed, also, that the material coming down from the small bowel became acid, and the man complained of feeling "bilious". C. B. Farr and C. W. Lueders (43) conclude from a study of forty-six cases of mental disorder: "Depressing emotions appear to exert an inhibiting effect on gastric and even on duodenal secretions." Thus it may be concluded that emotional stimuli exert a very definite influence upon the secretions of the gastro-intestinal tract. How far-reaching these effects may prove to be is speculative at this time, but it seems reasonable to believe that disturbances of secretion interfering with normal physiology may play a part in organic disease far greater than is now believed. But what of the effect of emotions on the motor functions of the gastro-intestinal tract?
III. Effect of Psychogenic Influences on Motor Activity of Gastro-Intestinal Tract

Not only are the secretory activities of the stomach unfavorably affected by strong emotions; the movements of the stomach as well, and indeed, the movements of almost the entire alimentary canal are wholly stopped during excitement (16) The purging effect of fear and anxiety is quite well known. One of the earliest references to it is to be found in the Taylor Cylinder in which Sennacherib (about 700 B.C.) describes his battle with two young kings of Elam. He says: "The vehemence of my battle line like a bull overwhelmed them....to save their lives they trampled over the bodies of their soldiers and fled. Like young captured birds they lost courage. With their urine they defiled their chariots and let fall their excrements."

The most striking evidence of psychic increase in tone and activity was seen in a jolly bon-vivant whose anal sphincters had been destroyed by a series of operations for fistulas. As a result, many of the rush waves down the bowel, instead of stopping as they normally do at the ileocecal sphincter or somewhere in the colon, ran on and produced a bowel movement. The interesting point is that in this man the sight and smell and even thought of food produced rushes. Another man with an opening in
the abdominal wall, in which a small balloon, connected by rubber tubing to a tambour, was passed into the small bowel, exhibited an increase in intestinal activity when questioned about his favorite foods. A similar increase was observed in a woman with a large rupture. This allowed the bowel to escape under a thin covering of skin which only slightly concealed the rhythmic movements. One day when, for a time, the loops had been quiet, the nurse appeared with luncheon and within a few seconds, a peristaltic wave rushing down the bowel was seen (4).

Takahashi (63) found if he fed cats with a spoon the stomach emptied slowly, whereas, if he allowed them to eat by themselves, it emptied more rapidly. Another group found that a barium meal left the stomach more rapidly if it was made somewhat palatable (50). According to Conheim and Dreyfuss (19) the stomach emptied with big spurts (through duodenal fistula) when a thirsty dog was shown water or food. Carlson and Luckhardt (18) noticed in a dog that sight and smell of food initiated contractions in the esophagus. This observation was confirmed by Borchardt (12) who worked with similar loops. Similarly Katsch (39) while working with a rabbit in which part of the abdominal wall was replaced by a celluloid window, noticed that when he showed the animal a carrot and then let it eat, the whole digestive tract
immediately became active. Later the rabbit came so to associate its presence in the laboratory with feeding that as soon as it came into the room the bowel became active. According to Hannes (29), the ileocecal sphincter, ordinarily relaxed during periods of starvation, tightens not only when food is given, but also when it is seen and desired.

Hurst and Newton (35) were one day watching with the roentgenoscope the bismuth filled ileum of a woman, when some food was brought into the room, and probably because of an increase in the tone of the muscle, the lower small intestine promptly emptied its contents into the colon.

The view that tonicity of the neuromusculature is a fundamental necessity for the appearance of rhythmic movements harmonizes many diverse observations. It is in agreement with the observation that worry, anxiety, and distress stop gastro-intestinal movements, for such states, accompanied by splanchnic impulses, abolish tonus (17). Brunswick (15) made a very extensive investigation upon the effect of emotional stimuli upon tonicity of the intestinal tract, and concludes:

Tonus changes of stomach and rectum in emotions are demonstrated by experiments with the balloon method. The specificity of the changes appears limited to differentia-
tion between pleasant and unpleasant emotions, with the possible specific effect in the stomach in the case of disgust.

One might expect a certain amount of malfunction in the motor apparatus of patients frankly psychotic, if observations cited above are correct. Henry (31) made observations on about four hundred mental patients suffering from all kinds and degrees of emotional disorders. Special attentions were paid to the position, tone, and motility of stomach and intestines. It was soon noticed that certain digestive conditions were peculiar to different kinds of emotional disorders. The patients were accordingly divided into groups showing similar types of emotional reactions so that a comparison might be made of digestive functions to determine a normal standard for further comparison.

Observations were made on a group of individuals who were free from nervous and mental illnesses and from emotional disturbances. Conclusions are based on x-ray studies.

(1) There is an intimate relationship between emotional disorders and digestive functions.

(2) Persons who feel unusually well are exhilarated and have an excess of energy seldom have
digestive disturbances. Their digestive functions are more rapid and more effective than normal.

(3) Persons who feel unhappy, lack energy, and have difficulty in attending to ordinary daily tasks, frequently have digestive disturbances and show marked sluggishness in digestive function.

(4) The more intense the emotional disturbance or conflict, the more the digestive processes are disordered.

(5) Persons who are intensely depressed or perplexed may retain food residue in the body for over two weeks.

Further investigations on definite types of psychotic patients were made by Henry (33) and he reported the following conclusions from roentgenological observations in fifty-one cases of schizophrenia:

(1) Definitive changes in gastro-intestinal motor functions are found in schizophrenic.

(2) The more acute the psychosis is, the more abnormal are the changes.

(3) Gastro-intestinal motor functions are normal in chronic deteriorated causes of schizophrenia.
(4) The visceral reaction to intense emotions in acute schizophrenia is analogous to that observed in lower animals when experiencing fear, rage, or other intense emotions.

(5) In acute schizophrenia sympathetic control of certain functions and concomitant autonomic control of other functions contributes to disorganization of digestive processes.

(6) In acute schizophrenia the colon is more susceptible to sympathetic control.

(7) In 70 per cent of acute, actively hallucinating cases of schizophrenia there is retention of barium or food residue in the colon for a period longer than five days.

In 1931 Henry (32) reports the following general conclusions from roentgenological observations in ninety-six cases of manic-depressive psychosis:

(1) Definitive changes in visceral functions occur in manic-depressive psychoses.

(2) Hypomanic patients present a marked increase in visceral tension and motility.

(3) In manic patients visceral function has already passed the limit of acceleration and begins to be retarded.
(4) Depressed patients present a marked decrease in visceral tension and motility.

(5) Gastro-intestinal hypotonicity and hypomotility are most exaggerated in those depressed patients who are described as being retarded, hypochondriacal, confused or perplexed.

(6) The average time required for a hypomanic patient to evacuate a bariumized meal is forty-seven hours.

The investigation of motor function by hypnosis was carried out by R. Heilig and H. Hoff (30) and described as follows:

Immediately following the ingestion of the barium meal, the subjects were observed in the waking state fluoroscopically, and then put under hypnosis. Some of the subjects were given the suggestion of taking an indifferent food. (Chewing and swallowing movements were prevented to exclude the reflex effect of these processes). On the suggestion of aversion for food the authors observed the following: Peristalsis which until then had been normal and rhythmical, ceased completely; the stomach, previously well contracted, became atonic; emptying of the stomach with consequent filling of the bulbous and rhythmical passage through the duodenum,
having occurred previously at regular intervals ceased entirely. When the hypnotist increased the feeling of disgust, reverse contractions of the stomach occurred with backward motion of the content up through the cardia. It was possible to change this picture completely within one minute, if the idea of disgust was replaced by the idea of relish of the same food. The stomach returned to the previous state of tonus; the level of secretion became visibly higher; peristaltic waves followed each other in quicker succession than in the waking state, were deeper, and resulted in markedly accelerated emptying of the stomach.

Thus from the accumulated evidence collected from experimental work on animals, and clinical observations on human subjects, it would be extremely difficult to deny that emotional stimuli do not exert a quite marked effect on gastro-intestinal motor function. In view of this it is not strange that the clinician, who adequately treats gastro-intestinal complaints, must take into consideration functional elements in the causation of symptoms. The recognition of certain syndromes as entirely functional in nature has found approval in modern textbooks, but so convincing is the evidence on this point that organic disease of the gastro-intestinal cannot be adequately explained unless the functional element is
taken into consideration. It is then, the further purpose of this paper to discuss functional syndromes, and certain organic diseases in which functional considerations cannot be overlooked. In addition, there are often functional disturbances of the gastro-intestinal tract which closely simulate organic disease, but which at operation have revealed their true identity.

B. Functional Spasms

(1) Globus Hystericus.

There are patients who complain of the inability to swallow solid foods, bilateral throat pains, and a lump in the throat. They are readily diagnosed as neurotic individuals by most clinicians, even without actual throat examinations. Ferenczi (28) writes that one of the commonest hysterical manifestations is the symptom of globus hystericus, that peculiar condition of spasm of the oesophageal musculature along with another oesophageal symptom, the loss of the swallowing reflex. He proves that the symptom is not just a subjective sensation or imagination on the part of the patient, but an actual somatic alteration.

(2) Cardiospasm

Idiopathic dilation of the oesophagus without anatomic stenosis, more commonly designated as cardiospasm,
is second in frequency to carcinoma in producing symptoms of oesophageal obstruction. Cardinal symptoms of the disease are epigastric pain, dysphagia and regurgitation (20). The etiological psychic disturbance is usually superficial and can be treated successfully in its early stages by psycho-therapy (59).

(3) Pylorospasm.

Spasm of the pylorus may result from organic influences or from purely psychogenic factors. Eve (27) states that the spasm appears about two hours after food, and although duodenal ulcer, appendicitis, gall stones, etc. may cause this condition, there is frequently no organic condition to be found. Alkan (1) says that this disorder may be very deceptive in its simulation of all the various single symptoms of organic pyloric obstruction. But on operation the pylorus, relaxed in narcosis, fails to show any stenosis. A humiliating finding! But it is even more humiliating when the patient, fearing operation, refuses it and is cured readily by the quack. Functional pylorospasm may lead to changes in the stomach similar to those produced in the oesophagus by cardiospasm. There is a practical application of mental control of the pylorus. Frequently when the duodenal cap is slow in appearing a short conversation with the patient on the subject of favorite foods will produce
a prompt relaxation of the pyloric sphincter.

(4) Spasm of the ileo-cecal sphincter.

There is a definite sphincter in the small bowel at its point of entrance into the caecum. This should relax during a meal to allow the small gut to unload slowly in readiness for fresh traffic. When it fails to do so, there may be abdominal pain and a tender tumor of the size and shape of a sausage may be felt just above and parallel to Poupart's ligament. This is the contracted ileum just above the sphincter (27). Elliot (26) concluded from his experimental studies that the ileo-cecal junction is sphincteric in nature and may be made to contract under the influence of the stimulation of sympathetic nerves. Since more will be said on this subject later, it will suffice at this point to suggest the possibility of right sided abdominal pain as a result of sphincter spasm.

(5) Spasm of anal sphincter

Spasm at this point is not infrequent causing rather severe rectal pains at times. A certain group of patients, obviously neurotic, consider that during their attacks they are unable to pass wind either freely or quietly (27). Psychic processes leading to conscious inhibition of the defecation reflex are, on the one hand shame, on the other fear of pain. In young girls who
see in the animal functions of the body a debasing of the human ideal, who, in company, consciously repress defeca-
tion, the whole process of defecation becomes disturbed. The rectal mucosa becomes hyperthetic, the sphincters hypertonic, their results the condition of prostogenic constipation.

(6) Spasm of Small Intestine

Spasm of the small intestine resulting in symptoms of mechanical obstruction is not unknown. Trauma, neur-
asthenia, hysteria, and intrinsic factors operating with the bowel have been observed to give rise to the condi-
tion. Many of these patients are definitely neurotic (21). Heyer (34) reports an operation on a nurse with a diag-
nosis of iliac strangulation. Nothing was found except rings of contraction about one cm. wide, with complete obstruction of the lumen in different parts of the intestine. After the abdomen was sewed up, there having been no further surgical procedure, the patient was free from complaints. There are many cases on record of this same nature, all of which serve to illustrate the fact that psychic factors may produce a physiological condition, which may simulate organic disease.
IV. Spastic Colon. Mucous Colitis. Ulcerative Colitis.

That there is a marked psychic factor in these conditions of the colon, the abundant literature will testify. In the limited space of this paper it will suffice to touch only the surface. Many years ago, DaCosta (22) gave a classical description of the disorder associated with colic. The disease is characterized by attacks of abdominal pain followed by the discharge of what looks like skins or membranes, sometimes coming off in the shape of moulds or long tubes. There may be but one attack, but this is very exceptional; much more generally one paroxysm is followed after an interval of months by another, and yet another. . . . I wish to insist upon the necessity of inquiring, in every case of anomalous nervous symptoms particularly, when happening in hysterical persons, the frequency of the condition in individuals who present hysterical or neurasthenic symptoms was noted by von Noorden (65). He considered that a neurosis of motility and secretion of the large intestine was involved. Boas (10) found a neurasthenic strain in most cases of mucous membranous colitis. Liddell (40) has also emphasized the close relationships of nervous disturbances associated with this condition. Baker (5) reviewing the literature on the subject, concludes that of all the factors concerned with the production of the condition of irritable
colon, the factor most generally agreed upon as being of undoubttable importance is the unstable nervous system.

In a study of fifty cases Bockus (11) concluded that the condition is due to an underlying basis of instability of vegetative nervous system. Another author states that acute exacerbations of symptoms often accompany nervous shock or emotional disturbances. Woodyot (68) reports a case of spasm of sigmoid colon which for hours simulated organic obstruction, and which was later found to be due to an emotional upset. He goes on to say that he has seen a number of patients who have been operated on once or twice, and some of them more times for conditions analagous to this.

Murray (52) writing on ulcerative colitis concludes that the reality of an actual nervous link between mental states and colon disturbances is virtually proved by the abundance of histories which reveal a close time relationship between the mental and physical symptoms. The outstanding traits in colitis patients, besides fearfulness is their emotional immaturity. It goes without saying that diarrhea is an infant response to fear. Aside from their physical symptoms, the colitis patients revealed definite childish elements in their make-up. Of a group of cases interviewed, all were tied to their
mothers except one who had found a mother substitute in an older sister. Although nothing can be absolutely proved as yet, the evidence is very suggestive that the most severe cases of colitis with bloody diarrhea, and ulcerations have a psychological factor in their etiology of the kind similar to that which has long been recognized as existing in simple diarrheas and in mucous colitis.

That the disease is often purely nervous in origin can be seen from the fact that occasionally a man or woman who has never had trouble before will, after severe nervous shock, suffer a violent attack and will pass a large mucous cast of the bowel. Sullivan and Chandler (62) investigated some further cases of ulcerative colitis. They report six cases in which psychogenic factors seem to have played a major part in the onset and course of the disease. We believe that psychotherapy materially alters the prognosis in these cases. From this amount of evidence it seems safe to conclude that psychogenic factors play a very definite role in disorders of the colon.
V. Peptic Ulcer

Gastroenterology dealing with stomach and intestine is concerned with vital apparatus which is perhaps more than any other physiological system exposed to blows from both ponderable and imponderable worlds. Physical, chemical, and thermal onslaughts alternate with the rapid fire of emotions such as fear, anger, jealousy, and sexual confusions. Yet no two stomachs and no two intestinal tracts react similarly to any of these menaces. This is because the gastrointestinal tract is not the man; the whole man is the digestive mechanism, and as the whole man responds to the pressure of the whole environment, so will any of his parts respond for each cell and system within him is stamped indelibly with his special mark. Fear which is clearly an important factor in the digestive disturbance of the gastric ulcer race is of two sorts:

(1) There is a chronic substratum of anxiety due to the person's constitutional sensitiveness to the threat of the female component.

(2) There is the acute or precipitating fear occasioned by the accident or insult which produces a transient menace to life, limb, or ego. Those of peptic ulcer race are com-
posed of persons of a definite constitutional type (24). Having reviewed over one thousand cases, their conclusion, states in essence that ulcer is not a local disease of the stomach but a matter of psychosomatic predisposition.

Cushing (21a) having observed three acute perforations following the removal of cerebellar tumors made an extensive review of the literature on the neurogenic aspects of ulcer pathogenesis, and conducted several experiments of his own. This work led him to believe that there was a parasympathetic center in the diencephalon. He says that experimental lesions anywhere in the intracranial course of these fiber tracts from anterior hypothalamus to vagal center are prone to cause gastric erosions, perforations, or ulcers.

The interbrain has been shown to be the seat of primitive emotions which are normally under cortical control; but in experimentally decorticated animals, probably from the release of the sympathetic nucleus in the posterior hypothalamus, there occur explosions of "sham rage" accompanied by a mass discharge of the sympathico-adrenal system.

The parasympathetic apparatus under normal conditions is likewise strongly affected by psychic influences.
However this may be direct stimulation of the tuber or of its descending fiber tracts. A functional release of the vagus from the paralysis of the antagonistic sympathetic fibers leads to hypersecretion, hyperchlorhydria, hypermotility, and hypertonicity, especially marked in the pyloric segment. By the spasmodic contractions of musculature, possibly supplemented by local accompanying spasms of the terminal blood vessels, small areas of ischemic or hemorrhagic infarction are produced, leaving the overlying mucosa exposed to the digestive effects of its own hyperacid juices. So it may easily be that highly strung persons who incline to the form of nervous instability, classified as parasympathetic vagotonic, through emotions, incidental to continued worry and anxiety and heavy responsibility, combined with other factors are particularly prone to have chronic digestive disturbances and hyperacidity often leading to ulcer.

The degree of autonomic imbalance is striking in gastric neuroses and acute ulcerations. A gastric neurosis may evolve into an acute ulcer writes Thomas (67). A group of acute gastroduodenal ulcers has, in a high percentage of cases, shown autonomic imbalance similar to that of gastric neurosis. Monsarrat (51) states that the evidence available points to alterations in gastric rhythm being the primary morbid condition
which persistent, leads to the development of ulceration. This morbid condition may have its origin in toxic, psychic, or reflex influences. Alkan (1) discusses the pathogenesis of ulcer from the psychosomatic point of view. In the last analysis ulcer is the result of a central process which is either psychically caused or at least physically conditioned, leading to anatomical alterations only as a result of anatomical preconditions of the stomach. Actually the ulcer is only the last manifestation of the disease. The fundamental process common to all its phases is hypermotility in the antrum region and simultaneously hypersecretion.

Boye (14) writes: Of course the nervous manifestations often can be easily explained as secondary phenomena, but the frequent occurrence of nervous alteration makes their primary etiological significance also very highly probable. In any case, experience has shown that the nervous dysfunctions involved are of primary importance particularly for the intensity and stubbornness of the subjective symptoms. A further point of interest is the increasing recognition of psychic factors in the etiology of ulcer and recurrent attacks thereof.

Einhorn (25) on the basis of an extensive study, finds that psychic influences, such as anger, shock,
emotion, and business reverses play a causative role in
the development and recurrent attacks of ulcer. Kaufman
(38) cites a case in which the patient had four gastro-
enterostomies performed for recurrent ulcers following
as many emotional crises. There are few articles discus-
sing specifically the role of psychic factors in the
etiology of ulcer. This is not surprising as a peptic
ulcer cannot be psychogenic as, for example, globus
hystericus or cardiospasm; it cannot be the organ-symbolic
expression of an emotional conflict and tell the story
of this conflict, as it were, in the "organ language."
It may be said that in ulcer we have an example of indirect
rather than direct psychogenesis, a fact which is respon-
sible for some of the confusion in the literature. It
is well known that the secretory and motor functions of
the stomach are markedly influenced by psychic factors.
Accordingly, to the extent to which disturbances of these
functions play a role in the etiology of ulcer, psychic
factors must be recognized as etiological.
VI. Gastric Neuroses

In the experience of every physician are patients presenting gastro-intestinal complaints for which no organic pathology can be demonstrated. McLester (49), interested in this problem, kept careful records of the last one thousand patients coming to his office. Of this group, organic disease was the probable cause in 67.2 per cent while 32.6 per cent did not have any recognizable organic pathology. Since the gastro-intestinal tract may well be regarded as the barometer of physical well being, it is not a stretch of the imagination to regard it as a barometer of mental well being. The gastric neurotic may be variously classified and his symptoms may include the entire range of possible complaints. I like the classification that Alvarez (3) has adopted in an attempt to catalogue the gastric neurotic.

(1) Fatigue Neurosis. This is the most common diagnosis of the group. The clinical picture is that of a man or woman who has broken down under the strain of overwork, heavy responsibility, no vacations, and, perhaps, insomnia. The symptoms are generally vague as compared with those of patients with organic disease,
and they consist, ordinarily, of loss of appetite, distress after meals, flatulence, belching, constipation, and general hypersensitivity.

(2) Temperamental Indigestion. This term is used to describe the troubles of certain men and women who get along well enough until some annoyance sets them off into an emotional debauch. If they would only learn not to let other people annoy them, if they would avoid losing their temper as they would avoid the plague, and if they would learn to control their emotions, they would be well.

(3) Anxiety Neurosis. This term is useful for designating those cases in which, after the sudden death of a relative or friend, or after a visit to a pessimistic or tactless physician, or after the appearance of symptoms which are thought to be due to the return of old, well treated syphilis, the patient becomes terrorstricken. It might perhaps be used also in those cases in which the patient has to watch the slow death of some loved one, or in which a man lives in daily dread of bankruptcy or of arrest or conviction for some serious crime.
(4) Marital Infelicity. In some cases, the diagnosis must be marital infelicity. There are, unfortunately, many persons who have to go on living together in spite of the fact that they have come to loathe each other. Their troubles find expression in the gastro-intestinal tract.

(5) Nervous Vomiting. I believe that there should be a separate classification for the girls and young women who vomit or regurgitate immediately after meals or excitement. The problem is rarely one of indigestion because the food which is retained is generally handled comfortably, and operations on the stomach or bowel are worse than useless.

(6) Psychopathy. The gastroenterologist sees many patients whose primary trouble is a psychopathy. They are worn out and on the verge of a nervous breakdown, not because their work is hard, but because they have poor nervous heredity, because they spend their mental energies so riotously and so unwisely, and because they adjust themselves so poorly to the demands of the world about them. They fuss and fret openly or silently over little things, and they expend, over trifles, more thought and energy
than a sensible man or woman puts into a week's work. Few physicians seem to realize the importance of insane ancestry in the causation of many of the disease pictures they see.

Many of these patients not only worry about their illness, but fear the diseases they might have. Some spend much energy trying to diagnose their own troubles, and to decide on the proper treatment. Some are grieving over the death of a dear relative and accusing themselves bitterly of sins either of omission or of commission. Others have religious and moral doubts and no matter how gentle and quiet and devoted a life they may have lead, they torture themselves with the idea that they have committed the unpardonable sin. On and on these types of individuals might be recited.

Constipation, flatulence, diarrhea, vomiting, feeling of fulness after meals, anorexia, bulimia, abdominal pain, etc. may be symptoms resulting from psychogenic disturbances. Bedenfield (6) would place the functional disorders into three groups:

(1) Constitutionally inferior individuals.

(2) Individuals of a neurotic character who respond to life's difficulties by way of the digestive system.
(3) Those whose symptoms are the result of a failure of repression.

That disease should be either organic or functional is a conception not intended in this paper, rather that the individual as a whole be considered when evaluating any given set of symptoms. Otherwise, how explain the reaction to illness in two patients with similar lesions, yet with a marked difference in the severity of symptoms complained of, and a marked difference in the course of the illness. The courage of one patient in the face of pain and discomfort and his determination to fight off the illness, and the resignation and despair of the second patient comes within the experiences of every physician. It has elsewhere been emphasized the part that psychogenic influences might have on initiating organic disease, but what of the patient with organic disease to which is added deleterious psychogenic influences. Since these influences may initiate disease, it is no misplacement of logic to imply that they may and do aggravate the severity of organic disease. As Murvish (53) states, "Many organic abdominal diseases have a large functional element superadded." Recognition of this fact might help to explain the seeming inefficacy of treatment in many patients. Medicine alone cannot heal a gastric ulcer.
if in that patient there seethes an unresolved emotional conflict.

Everybody, sick or well, is affected in one way or another, consciously or subconsciously, by the material and spiritual forces that bear on his life, and especially to the sick such forces may act as powerful stimulants or depressants. What is spoken of as a "clinical picture" is not just a photograph of a man sick in bed; it is an impressionistic painting of the patient surrounded by his home, his work, his relations, his friends, his joys, sorrows, hopes, and fears. Every human being has, at some time, suffered for a few hours or days the tortures of anxiety over a loved one who was critically ill, or perhaps it was jealousy, a family row, a crash in the stock market, a note coming due, a broken engagement, or an important law suit. Imagine for a moment that sort of anxiety continued day in and day out for months, and the reason for many illnesses will become apparent.

Nichols (54) provides an appropriate conclusion when he says: The ancient association of medicine with the priesthood had a profound significance, and medicine must still cultivate the priestly element, the element that reaches the heart of humanity if it would attain its fullest influence and usefulness. The general interests
and resources of the profession are more complete on the physical and material side than on the psychic side, and to a large extent we are deficient in the application of psychotherapy. We lack sympathy with and interest in our numerous patients with psychogenetic disorders; we are impatient with their multitudinous complaints; we have no effective treatment to offer them; we are glad to be rid of them. We cannot blame them if they turn to sectarian practice. These sufferers are just as miserable as if they had organic disease, and if relief is possible they are equally entitled to it. If they derive benefit from the sectarians after looking to us in vain, we have failed in what should be an appropriate field for our activities.
VII. Conclusions

(1) Psychogenic influences may profoundly alter both motor and secretory activities of the gastro-intestinal tract.

(2) Psychogenic influences may produce spasm at the cardiac, pyloric, ileo-cecal, and anal sphincters which may be the starting point for more serious organic disorders, and which may be mistaken as primary organic disorder.

(3) Psychogenic influences must be taken into consideration in such conditions as peptic ulcer, mucous colitis, spastic colon, ulcerative colitis.

(4) Gastric neuroses may develop independent of organic disease, and form an important portion of those patients who consult the gastro-enterologist.

(5) Gastric neurosis may be super-imposed on organic disease.
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