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A CLINICAL STUDY WITH BLOOD EXAMINATIONS OF TWO ATYPICAL CASES RELATED TO THE DEMENTIA PRECOX GROUP.

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That the study of the blood of the insane has provided an attractive field for research during the past half century or more, may easily be determined by a casual glance over the literature accumulated during that time. Because of the inaccuracy of the methods known to the older workers, not much value can be placed on the results which they obtained. With the advances made in the clinical methods for examining the blood, there has been a coincident gain in a more accurate knowledge of the hematologic changes which occur, both in healthy and diseased states, so much so that a blood examination in certain maladies is essential to verify the diagnosis. Could it not reasonably be expected that in psychiatric medicine there might be some characteristic divergences from the normal in the blood picture? The older, and also some of the recent investigators in this field, concur in the opinion that there is in general, some deterioration, a mild secondary anemia, present in most cases. This, however, cannot be said to be characteristic of any one psychosis or of the psychoses as a whole, but is more probably the direct result of the mode of life among the insane, as was pointed out by Lindsay more than fifty years ago. More recent studies have apparently shown that undoubted changes occur in the number of leucocytes, and some observers, of which class Bruce is perhaps the foremost exponent, believe that factors of diagnostic importance can be ascertained from an estimation of the number of white blood cells.

This One



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Further work is needed to fully substantiate these views. At the present time, it seems that such conclusions push the pendulum to its widest excursion and at a rate which, later on, it may be found necessary to retard.

Not only has the morphology of the blood been investigated, but considerable time and energy have been expended in studying other points—the specific gravity, tonicity, reaction, viscosity, and the detection of the presence or absence of abnormal constituents, particularly the existence of toxins or other deleterious substances of a similar nature. Factors known to affect the condition of the blood, such as muscular exercise, nourishment, temperature and blood pressure variations, have all received more or less careful attention, and have resulted in findings which are fairly uniform.

It is only within comparatively recent years that sufficiently carefully-controlled observations extending over a considerable period of time have been carried out. A vast majority of the papers relating to the condition of the blood in the various psychoses, report the results of examinations in a great many cases which were not, however, studied for any length of time; indeed, in many cases, not more than one or two examinations in all were made. And again, many writers have attempted to bring the results of their blood examinations into accord with the various clinical types of mental disease, without particular regard to the exact condition of the patient at the time of the examination.

Thinking that frequently repeated examinations of the blood in a few selected cases, continued over a long period of time, might be of some value, this work was undertaken in the fall of 1907. It was decided to study, at first, only such cases in which the symptom of stupor supervened, disregarding, for the time being, the character of the underlying psychosis.

Almost at the beginning of this work, the two cases here presented, were found to possess such similarities, and on the other hand, to differ so widely from the ordinary type, that they have been reported together.

As within a period of ten years or more, a vast amount of data concerning these patients has been accumulated, the histories will first be given, and then the consideration of the results of the blood examination, in connection with the clinical conditions existing, will be taken up.

CASE I.—No. 541, male, age 46.

Anamnesis.—A maternal great-aunt suffered with some mental trouble, the nature of which is unascertainable. There was a distant blood relationship between the father and mother. One brother and one sister are characterized as "neurotic," and one sister developed a psychosis from which she did not recover; otherwise, the history is unimportant. No alcoholic or drug addictions. The mother was 27 years old when he was born, the fifth of ten children. As a child he had some mild convulsive attacks, and in boyhood, there was a trifling head trauma. Puberal epoch was uneventful. He attended school until fifteen and is said to have done average work, but to have been more inclined toward games and amusements than toward study. After leaving school, and until the onset of present illness, he was employed in various clerical positions, always rendering efficient and satisfactory services and exhibiting ambition and diligence. There is no luetic history.

The first mental attack occurred about 1890, when he was twenty-eight or nine years old. The first symptoms appeared abruptly; some suspiciousness and ideas of reference of a mild persecutory nature, coincident with motor-restlessness; and later, seclusiveness and reticence. Psychomotor activity gradually increased, developing into a condition of turbulent excitement, throughout which was noted a tendency towards posing and attitudinizing. No suicidal or homicidal tendencies were exhibited. After about a month, he was considered "almost well."

The next attack, which was similar to the first, occurred at the time of his mother's death some six or eight months later. There were no further attacks until 1894, when he was first admitted to this hospital, then in the midst of an excited attack which had begun three weeks previous. For another month, excitement continued. There were marked psychomotor activity, incoherent and disconnected rambling logorrhea, inaccessibility and irrelevancy; also suspiciousness and mild delusions of a persecutory nature. These symptoms gradually disappeared, and he was discharged improved. From this time until 1897, when re-admitted, he passed through two or three similar attacks. During this time his disposition underwent a marked change and he became irritable, complaining and domineering. This attack lasted several months, when he was again taken home where he remained idle, inactive and indifferent; when, becoming excited, he was re-admitted to the hospital in 1898, where he has since remained.

1900.—Since his last admission, the attacks have become more frequent and of shorter duration. At the onset, there is noted motor-restlessness, insomnia, irritability, inaccessibility and irrelevance. The excitement rapidly reaches its height, and auditory and visual hallucinations are present. During this time he is careless in person and habits. The attacks average now, from five to six weeks in duration. The only change is the appearance recently, of short periods of mutism, posing, etc., in an otherwise excited day.

1902.—During the past two years, the attacks have become even more frequent and of still shorter duration. Excitement begins the attacks as formerly, but lasts now only from one to three weeks, when it is replaced by a short, stuporous period from which he emerges into his "normal" condition. Excitement is the most prominent feature of the attacks, although stupor is becoming more pronounced both in intensity and duration.

1904.—At the onset of his attacks, there is a marked tendency toward talkativeness, with some distractibility and complete irrelevancy in answers, frequently singing or chanting his replies, and often rhyming. Distractibility and accessibility become less noticeable, even to a self-centered inaccessibility. Words heard are interpolated into his continuous logorrhea. There is some resistance to passive motion; a coarse volitional tremor, and at times, negativism, are present. When "well," he denies his illness, but admits that he used to have attacks of "nervousness." His insight is partial, judgment poor; mental deterioration is not marked. Physically, he continues in excellent health.

1906.—Within the past two years, the attacks have begun with less noise and turbulence. The initial logorrhea is still present but is much milder. Soon, the former excitement appears and after several days, gradually subsides into a depression of a few days' duration, from which he passes into his "normal" condition. During the past summer while "well," he has been unusually drowsy and disinterested in his usual pursuits. Since September, his attacks frequently begin with a mute, stuporous period which lasts but a short time, and this is replaced by a period of excitement from which, however, the motor element has almost completely disappeared. During this excitement he is, to a degree, inaccessible, distractible, and irrelevant. His continuous logorrhea is without order or sequence in association or reasoning. With the abatement of the excitement, stupor, together with mutism and resistiveness appear, and in turn, these symptoms gradually vanish as the patient approaches "normal." This stuporous phase is now fully as prominent as the excitement, both in its depth and duration.

1908.—The most noticeable change is the increasing prominence of the stuporous element, this now constituting almost the entire abnormal phase.

Present Condition.—On reviewing the condition for the past year, one finds that the changes which have taken place have been those of detail only. As a general rule, the patient exhibits no prodromal signs by which the beginning of an "abnormal" period can be detected. Occasionally for a period of from 24 to 48 hours, he may appear drowsy and disinterested in his usual pastimes. The onset may occur in either one of two ways: after a night's undisturbed sleep, he may awake mute and resistive; later in the day this mutism may be interrupted by a psychic elevation with marked logorrhea, irrelevancy in answers and inaccessibility, with slight distractibility, which condition, however, is soon replaced by the former one of mutism and resistiveness. The most common onset is that with mild excitement which persists for several hours and is replaced by a mute, re-

sistive phase. During the excited phase he is quite inaccessible; attention is poor or wanting and there is but little distractibility or divertibility; association is rapid but imperfect. Occasionally one may get a reply to questions, but the replies are irrelevant in the extreme. Irritability is often marked; logorrhea is continuous, the stimulus apparently is mostly internal, but at times, the trend of thought is obviously influenced by outside events.

The average course of an attack varies somewhat. As a general rule, after a few hours of mild excitement, there follows a period of from five to ten days' duration during which he will remain in bed, mute and resistive. Occasionally during this period a condition of mild excitement will return for transient intervals. During the first few days he is untidy in person.

The following note made during the first day of an "abnormal" phase may give some idea of the patient's condition at this stage. He was sitting alone talking rapidly and incoherently to himself, gesticulating, and at times, impressing one with the idea that he was arguing or demonstrating some point, when the following was taken:

"They are good leather with soft tops and have good soles (pointing to his shoes). They are fine, too, almost the size of tacks. These have no tacks at all; are sewed in the seams and then the tacks are put in the heels and the heels made satisfactory, and the cotton is sewed all around the sole. Some of these—that fellow, J—, he never, he gave them a sample. (Patient glances out of window and continues.) Who was that running a sleigh along out here the other day? (No snow at the time.) I don't see anything of it now. He ought to know these different foundations now. I don't know them. (Q. What are you talking about?) I am talking about when it starts—I cannot see. I know a good many different people like J— C—, and I know the K—s; they look more like the L—s. Then they differ very little. Some of the A—s and P—s, people like that were there. I know a good many of the P—s, quite a number of them. These things (pointing to his ear to which a piece of gauze was clinging, blood examination having been made a few minutes before) have got clamps. They hold anything on while they stay, like a wet rag or a pocket-handkerchief. I know about such things. (Looking from the window again.) My! don't these windows look fine. These people can see them. (Q. Did you have any breakfast this morning?) I don't eat breakfast. I used to go to the buildings on Broad Street. People live along there that are white and other colors—Broad Street from the City Hall right straight out and along out there, R—s and J—s, people like that. Do you know any of them? (Q. Do you mean Philadelphia?) I was trying to find out Byron's name, his first name, the name that he had. I want to know his first name because I had an idea that he lived on Madison Avenue," etc.

This logorrhea, which is a fair specimen of the speech content, continued for a few hours after the patient was left, after which he went to

bed, when the following notes were made. As his room was entered there was no reaction, there being, for the first few minutes of the visit, an absence of both spontaneous and voluntary attention. Pupils react normally and with good excursion. The deep tendon reflexes are all exaggerated. Dermatographic reaction is prompt, intense, persistent and localised. There is a marked hyperidrosis. The face is much flushed and reddened. There is a hypertonic muscular resistance, which gives rise to a coarse clonic tremor when the attempt is made to move the extremities. There is no *flexibilitas cerea*. A fine flickering contraction of the individual muscle bundles of the calves of the legs and the dorsolateral regions of the feet is noted. He flinches before any sudden or quick motion, but objects gradually advanced may touch the cornea before the lids close. Later on during the visit, he would, to a certain extent, follow directions, obeying when asked to change his position, but exhibiting a marked parafunction and a tendency toward negativism. At this point he suddenly partially arose in bed, made a series of unintelligible motions, outlining circles with his index finger on his body and on the nearby wall. When asked to explain these, he shook his head in negation. Here, he objected to further examination and showed irritability when this was persisted in. The respiratory rate became somewhat increased and breathing was irregular and catchy. The tremor before noted, became more marked and the face redder. At this point he makes more signs, elevates his fingers, one, two or four, but will not speak. He makes it known that he understands and can speak, but will not, and more strenuously objects to the examination, turning his back on the visitors and resisting any change in his position.

Subsequent examinations have shown that the hypertonic trembling resistance can be made out only by sudden quick motions; a steady pull on the arm, for instance, will not elicit it. True *flexibilitas cerea* is probably never present, although he will leave his arms in any awkward position when they are so placed, but will immediately put them down when told that he may do so. Throughout all, the tendency to negation has been marked. He denies that he ever lived in Baltimore, knows nothing whatever about it, denies his own name and maintains that he knows no one of those present. During the "abnormal" phase, confusion of identities of both himself and others is quite frequent. He will, for instance, mistake the nurse for one of his old schoolmates. There is a tendency to reminiscence which is quite marked, most of the subject-matter of his logorrhea being composed of events which occurred years ago, before his illness began. The tendency to deny his own name is prominent. Repeatedly, when called by that name, he will insist that his name is Kelly. Sound association is also noted; for instance, the following: "My name is not C—. I never knew C—. I never heard of such a man; my name is Kelly and I spell it without any 'e,' as I have only a few e's, and cannot spare more. Some people say that C-o-e-l-e spells, but E-a-l spells eel. S-e-a-l spells seal. In German, E-i-l spells eel, but I don't

know anything about German; I have never crossed and never studied German. I don't know anything. I cannot hear and cannot see."

After varying durations of the mute and resistive phase, the first break in the attack is indicated when he begins to designate his wants by means of signs and gestures. The return to his "normal" condition occurs very gradually, mutism being generally the last symptom to disappear.

During his "abnormal" phases, his appetite is poor, and especially during the first three to five days, when he will take practically no food at all. There is consequently a fall in the weight curve, but this loss is rapidly regained, as during his "normal" phases his appetite is extremely ravenous.

When "well," he seems to have varying insight, but it is never more than partial. He realizes at times that he is ill and that it is necessary for him to remain in a hospital. At other times, however, he will deny absolutely his illness and explain his recurrent periods in bed by saying that he only goes there in order to break the monotony of his stay in the hospital. Apparently realizing his condition, he sometimes asks the nurse to take him to the disturbed ward, this being before his attack is outwardly evident. When "well," it is difficult to elicit anything from him concerning the events transpiring during the "abnormal" phases. He generally claims that he knows all that is going on, but at times will admit that there are periods when he does not know all and when he is occasionally confused.

Occasionally, he may be found in a rather happy, jovial mood. When spoken to, however, he is mute, but even in this state he is often noted to be smiling, laughing and nodding his head as if in response to some outside stimulus. It is difficult, however, to prove definitely, the existence of actual hallucinations or delusions. At other times, he will be found (though this is rare) with tears in his eyes, showing evidence of distress. There is, however, when "well," no affect depression to be ascertained, but rather is the lowering one of apathy and indifference. The reticence of the patient regarding himself, makes investigation difficult; co-operation with various tests is not well carried out. While "well," he has parole of the grounds and spends the greater part of his time out-of-doors, playing games and reading. He frequently makes excursions to town and enjoys going to the theatres. On these trips, he takes an almost childish delight in looking in the shop windows. While he is inquisitive, it is not to the degree of intrusiveness. He is generally quiet, polite and affable. He expresses some regard for his family when questioned, but spontaneously, he rarely speaks of them.

Looking over the whole course of the illness, the following points are to be noted:

(1) The attacks have become much shorter in duration and occur at more frequent intervals since the onset, although within the past few years there has been but little change in this respect.

(2) The change in the character of the individual attacks: in the early ones, excitement was quite a prominent feature, this gradually diminishing until, at the present time, only at the beginning is there a slight psychic ele-

vation lasting but a few hours. Occasionally, in the midst of an attack, mutism and reticence may be broken by a short period of laughing, singing, rhyming and logorrhea, but this is generally mild.

CASE 2.—No. 547, female, age 43.

Anamnesis.—There was one sister who died of tubercular meningitis; a paternal uncle was insane, and a maternal aunt has for a number of years been invalided with what is thought to be hysterical paralysis. There was no consanguinity, no history of alcoholic or drug addictions. History of the patient's early life is unimportant; there were no convulsions during childhood or later. She obtained a college education and was a good student. Since about sixteen years of age, at which time her mother died, she has been of a rather melancholic and depressed disposition, more reserved and quiet than formerly. Menstrual function was normal in all respects until 1890, at the age of twenty-five, when she received a severe fall from a horse; since then there has been considerable irregularity in time, associated with pains, headache, etc.

The first evidence of the present psychosis appeared in 1892, following the prolonged nursing of her sister. She became restless and irritable; at first would take no rest and then became insomnolent; was auto-accusatory (had neglected her sister) and attempted suicide. There were delusions of persecution, and both auditory and visual hallucinations. When she was admitted to this hospital in 1898 it was learned that since 1892 she had had repeated attacks at intervals of from two to three weeks and of from two to three weeks' duration. These have all been of a similar nature. More recently they have become more intense and violent, occurring at still more frequent intervals and lasting for shorter periods. Excitement is the most prominent feature during the attacks, when, at its height, she is violent and homicidal. A brief period of depression (apathy and inertia) may either precede or follow the excited phase; in the intervals she seems quite well.

1902.—Since her admission, the attacks have continued at frequent intervals. Her condition varies during the attack from day to day, and at times she will be huddled in one corner of the bed for hours, the picture of marked and deep confusion. During the excitement, her attention may be gained momentarily; there is little spontaneity. Her speech is irrelevant and she is to a degree, inaccessible, but to a certain extent, distractible. Negativism and stereotypy are sometimes present. Following her excited phases she is often confused. When "well," her memory of events during the excited period is but partial; attention is easily gained and fairly well maintained. Orientation in time, place and person is quite accurate. Her insight is fair and she realizes that she is ill, and, though she feels that she will not recover, says it causes her no depression or sadness. During the "well" periods, apathy and indifference are more marked than formerly, and now, she seldom leaves her bed. She says she can give no idea when an attack is approaching. Generally, there is insomnia and a feeling of "nervousness," and after that, a blank. During the first few days, espe-

cially, there are some cephalic cenesthesias—a sense of heat and discomfort—and there are auditory hallucinations; while toward the end of an attack there is a feeling of faintness and weakness. She thinks the voices may be imaginary, although they sound real to her. The many violent and impulsive acts which she commits cannot be resisted, and with their completion she experiences a sense of relief. In her excited phases she is resistive, aggressive, violent and threatening; she shouts, screams, grimaces and gesticulates; her language is profane and abusive; her speech is incoherent—there is no sequence in association or logic; irrelevance is marked and stereotyped expressions frequently interrupt; in attitude and manner she may be threatening, playful, erotic or dramatic.

1908.—During the past six years the attacks have occurred with about the same frequency. On comparing the present condition with that in 1902, it is found that the duration of the attacks remains practically unchanged: compared with the first year of the onset of the psychosis, it is found that they have become much more frequent and of decidedly shorter duration.

Present Condition.—There has been some change in the course of the attacks, as will be seen from a comparison of her condition in 1902 with that of 1908 (Charts 5 and 6).¹ Formerly, there was little evidence of the stupor which is now so marked. At the onset, which is sudden, abrupt and unheralded, occurring in the early morning usually, there is wild psychomotor excitement; this after a few days, gives way to a mixed state of alternating excitement and stupor, which is, in turn, replaced by a condition of stupor of varying intensity, from which she emerges to her “normal” state.

The section of Chart 5 best showing a characteristic cycle, is that beginning March 6, for ten days, uniform excitement, then a similar duration of the mixed phase, this being succeeded by a period in which stupor of varying depth was present, and followed by “normal.”

Chart 6 shows a condition of almost uninterrupted excitement throughout the entire “abnormal” phase. The excitement is of a high degree—laughing, singing, shouting, screaming, swearing, grimacing and gesticulating. Her speech is incoherent, often but a jargon of unintelligible

¹ Charts 5 and 6 were necessarily made by different nurses, but each chart was made by the same individual throughout. In gathering data for Chart 5, the stimulus was, so far as possible, on all occasions the same. The nurse entered the patient's room and silently observed her for five minutes, then approached the bed and raised the patient's arm. At each observation, points common to this patient were noted, viz., whether she was laughing, shouting, screaming, singing or whistling, or whether she was mute, aggressive, passive or resistive, and from these collectively, the degree of elevation above, or of depression below, the “normal line” was judged. The circles indicate that she was sleeping and are placed on the same lines, it being considered that she was in the same condition as when last awake.

sounds, and often showing a marked tendency to stereotyped repetition. The attitude is one of aggressiveness and violence. She may be obscene, abusive, vulgar and threatening; often becoming even within the next moment, playful, erotic and affective. During this phase, her attention may be gained momentarily and she will often interpolate into her jargon, words spoken in her presence and occasionally will make pertinent comments on remarks which she hears. For the most part, however, she is inaccessible and is quite irrelevant, though at times she may be directed or distracted.

While blood examination was being made, during one of the excited days, the following, representing 8 minutes spontaneous production, was taken: "Sign yourself, sign yourself (laughs), nothing, nothing, nothing. Yes, you do it yourself, do it yourself. How many more? How many more of them? How many more are there? I am tired of these things (blood smears were being made)—my father took it out—eight o'clock—no, nothing. What's that in your mouth? (blood pipette). Transactions—put that in your mouth. Can you see? Who is this? I don't know. How many more is there? How much of that trash have you got there? How many more of them? I will get up on the stage. How many more of them are there? How many more? How is your stomach (laughs)? Blue flag (looking at physician's blue necktie—laughs) yes, yes, yes (laughs), good-bye (this to the nurse who leaves the room). (Q. Are you happy now?) Perfectly."

During the excited stage she sleeps but little; is entirely negligent of care of self. During the first few days, she takes but very little nourishment, frequently refusing everything. For a number of days, only fluids are taken, and lastly, meats and other solid foods. During this period she loses in weight, but gains during her "normal" phases. During the past year there has been a total gain of twenty pounds, her weight now being 123. Although no physical examination during her excited periods is possible, it may be noted that her pupils are dilated and there is a marked erythema of the nose which progressively increases during the first several days.

The second element, stupor, varies in depth. In the most intense grade, she is absolutely passive, inert and irresponsive to all stimuli. When, however, the stimulus proves sufficient, she will pass almost instantaneously into a state of violent excitement and rage. At times, merely entering her room will cause a transition of this nature; whereas, again, it may be impossible to rouse her. The stimulus necessary is less in the middle than toward the end of the "abnormal" phase. During the stuporous phase, she sleeps the greater part of the time. Within the last two years it has been noted that often toward the end of her "abnormal" phases, there have occurred periods varying from one-half to twenty-four hours, during which she seems in her "normal" state. Following such periods, she may become excited, or relapse into the stuporous condition.

An examination while "well," reveals that she is in remarkably good

physical condition considering her mode of life. Pupils are oval, and eccentrically placed; they react normally. Dermatographic reaction is below the normal. The deep reflexes are exaggerated; cutaneous sensation is acute and normal. Even during this examination, although she is considered "well," she seems to be quite irritable and unstable, loath to be disturbed; her expression is somewhat sullen, and again, indifferent.

In her "normal" condition, she is generally accessible, affable and pleasant; attention is easy to gain and hold during ordinary conversation. There is, however, little spontaneous production and she limits herself to brief replies. She is oriented as to person and place, and quite accurately as to time. She reads the newspapers and when asked, comments with understanding, on their contents. Memory for remote events is fairly good; she knows but little of happenings during her "abnormal" phases, although she can tell, when she was last "well." Calculation is fairly accurate and quite rapidly performed. She does not say much about her illness; cannot tell when the attack is coming on. Although she says she would rather be well than as she is, her present condition leaves not the slightest trace of depression or sadness. Only when questioned, does she speak of her relatives, although quite recently she voluntarily wrote a note to one of them, requesting a visit. (It is interesting to note that the wording of this letter is almost identical with several that have been written during the past few years.) Occasionally during her "well" periods, she is distinctly below par, but not stuporous. During such times, she will answer questions but not so quickly, fully, or briskly as usual. (Such a condition is shown in Chart 5, from March 1 to 6. Also, a short period of well-marked lowering is shown in the same chart—February 8.) Both of these conditions when present, generally precede the onset of the excited phase.

As in some cases, exacerbation of the mental symptoms seems to occur with some relation to the menstrual function, this point has been carefully observed for several years past. Apparently, there is no regular association between the two, as may be seen in Chart 4.

We have here, two individuals in whom a psychosis developed during early life. Since the onset, both have been subject to recurring attacks at gradually decreasing intervals, which present many points in common. Early in the course, there were in both, periods of marked psychomotor excitement which at times were replaced by a depressed and confused condition. Hallucinations and delusions were present, disorientation was not in evidence; tendencies toward stereotypy in speech and action, neologisms, irrelevance, incongruity in affective states, with emotional dulling, purposeless resistance with a retardation amounting to stupor, during which mutism, refusal of nourishment and attention were

present, have all been prominent. As the disease progressed, the excited phases have gradually lessened in degree, at the same time, there being an increase in the duration and depth of the stupor.

During the intervals, which are here spoken of as "normal" or "well" periods, in contradistinction to the "abnormal," both patients were capable of a varying amount of mental activity; yet there is no doubt but that deterioration of an easily discernible grade obtains. With the woman, the process has been evidently of greater severity. During her "normal" periods, there is exhibited a marked degree of affect lowering—little spontaneity in thought or action is ascertainable, interest in pleasures or diversions has reached a low ebb, and contentedly remaining in bed from day to day, she declares in a lackadaisical manner that she is "perfectly happy."

With the other, the condition is somewhat different. When "well," his interest in pleasure-seeking and amusement is patent, up early in the morning and out of doors, daily perusing the newspapers or current fiction, taking part in the games with other patients, or planning with youthful delight, the details of some excursion for the morrow—all this contributing to disguise and conceal the actual mental impairment which is to be made out on closer acquaintance. Here, is seen the effect of association with the outside world—activity is continued, interest kept up and desire stimulated.

Although the initial severity of the disease process, and although the sexual element, the more generally inherent passivity and submission of the female organism, may explain partially the difference in this particular aspect of the present condition of these two patients, the question arises: Would not this man, after an existence of a number of years in a similar unstimulating environment, have exhibited as marked an affective decolorization as the woman? Are we not too prone at times to overlook the result of such an isolation in a mentally normal person? With the knowledge of the loss of this possibility of attainment, would there not be associated naturally a weakening of the desire and interest—a state of more or less intense apathetic indifference and inertia?

When we come to the question of diagnosis, in which nosologic category may these two cases be placed? There are present many

of the symptoms commonly described as part and parcel of that condition summarized by the now already overtaxed diagnosis—dementia precox. There were the early onset, with hallucinations and delusions, verbigerations, stereotypy, negativism, echolalia, neologisms, muticismus, impulsive actions, etc. Again, were noted the marked motor activity and psychic elevation, rhyming, paralogia, inaccessibility, distractibility, and sound associations. At other times, confusion and definite clouding of consciousness exists. Throughout all, memory of past events is fairly well preserved, orientation is quite accurate, with, however, a deficit in insight and judgment. At the present, one cannot miss the evident mental depreciation—want in spontaneity, defective emotional tone and more or less dissociated affective reaction.

It does not seem that any one disease entity suffices to sum up fully and accurately the status of these two patients. Therefore, they are presented as atypical psychoses, related to the dementia precox group and particularly to the catatonic variety, in which recurrent attacks, consisting of alternations between phases of varying length of excitement of a maniacal-depressive character, and stupor, persisting throughout a number of years have left the present condition of moderate deterioration noticeable principally in the affective sphere.

EXPLANATION OF CHARTS.

To show more in detail the relation of the temperature, blood pressure, pulse and respiration during a typical cycle, charts have been made. In Chart 1 (Case 1) the curve of blood pressure is not shown in its usual variation. Very frequently during the "abnormal" phase, it will reach 200, or higher. The respiration shows an increase in rate, although this too, like the blood pressure, is not easily demonstrable in such a chart. The temperature and pulse curves on this chart show well, the usual fluctuation seen in this patient. From November 27 to December 6, he was up and dressed and about, being considered in his "normal" state. During this time, as will be seen, his temperature was subnormal. The pulse kept within normal limits. Although the temperature curve gradually reached its highest point on December 1 and 2, from there on, again, it rose each day until, on December 7, it

passed above the normal line, and on this day he entered upon one of his "abnormal" phases. Remaining well above the normal until December 17, it gradually fell, going below normal on the 21st, the patient getting up and dressing on the 25th.

As may be seen from this small section, which is quite typical, the curves on the clinical chart show almost unbroken, wavelike changes corresponding with the mental condition. Variations are, however, noticed, which will be pointed out presently.

In Chart 2 (Case 1) an attempt has been made to show the relation existing between the changes in the blood pressure, pulse, temperature and respiration, and the blood—especially the number of leucocytes during the different phases of the cycle. This represents a daily chart; the clinical observations are those taken at 7 p. m. The heavy block lines above represent days when he was passing through an attack—"abnormal" days. No attempt to divide this into periods of exaltation or depression has been made, as his condition during the past year during his "abnormal" phases has been almost uniformly one of depression or stupor. The last two blocks connected by the two lines, differ from the usual. It was about at that time that it was decided to make daily observations of the blood condition during a complete cycle. Thinking that the "abnormal" phase was about to end, a start was made February 21. From February 25 to March 5, he was up and about and generally considered to be in his "normal" condition, although he was somewhat dull and stupid and wanting in his usual interests and energy. It was noted during this period that his leucocyte count remained higher than usual during his "well" stages. The peculiar behavior of the temperature curve during this period is to be noted in comparison with all others. At this point it resembles more closely the curve shown in Chart 4 (Case 2).³

In Chart 2, the striking correspondence in the variation of the temperature curve and that representing the number of leucocytes

³ The observations here recorded were made almost exclusively by the same nurse; this is true of all other charts. The enormous temperature variations of Charts 2 and 4 are only apparent, and due to the fact that between each two horizontal lines, there is represented only 2/10 of a degree Fahr.; whereas, with the blood pressure, pulse and respiration, the same space is worth several points.

needs not to be pointed out. It is to be noted that both curves decrease and increase somewhat before the beginning and ending of an "abnormal" phase, although variations from this rule occur, as seen in the attack beginning March 11. It may be seen from Charts 1 and 2, that some idea of the advent of an attack and also of its ending, can be formed by following the clinical charts; whereas, in Charts 3 and 4 (Case 2) no idea is given of the approaching onset, though one may expect the ending. In neither case, however, are these indications always to be relied upon.

Charts 3 and 4 (Case 2) are to be compared with similar ones in Case 1. They were made in a similar manner, with the exception that on Chart 4 the "abnormal" periods are indicated by the heavy block lines below, while the similar lines above indicate the menstrual epochs.* In Chart 3, it is seen that an enormous sudden and abrupt rise in all four curves takes place with the onset of the excitement. This rise is well maintained for a number of days and only gradually falls to "normal." In Chart 4, this is also shown in relation to the variation in the number of leucocytes.

On comparing similar charts in these two cases, it will be seen that there is a striking resemblance. In both, there is a rise in all of the curves at the onset of, and during the "abnormal" phase. In Case 1, the rise is more commonly a gradual one, with the exception, as had been mentioned, occurring in the period beginning February 11 (Chart 2); whereas in Case 2, the rise is as sudden as it is decided. In Case 1, these various curves barely reach normal, when they again begin to show a gradual rise, thus producing the wavelike fluctuations previously noted. In Case 2, however, during the "well" periods, the curves all remain quite uniformly normal, or slightly below; the variations in this case being more closely confined to the days while the patient is "abnormal."

Technique of Blood Examinations.—An attempt has been made to observe all of the usual precautions advised to prevent errors in blood work.

* As there was a marked degree of excitement in Case 2, especially at the onset, and as this might affect the various observations made, particularly the respiration and blood pressure, care was taken in each instance that after adjusting the cuff over the brachial artery, several minutes were allowed to pass before the pressure was taken. As a general rule, within this length of time she would cease struggling entirely. A Riva Rocci instrument, with a broad cuff, was used in determining all blood pressures.

As nearly as possible, the same hour was taken each day, generally in the morning. Blood was always obtained from the lobe of the ear, which had first been cleansed with alcohol. Pressure to increase the flow was never used, and several drops were allowed to escape before filling the pipette. Counting pipettes were first filled, shaken briskly a few moments and laid aside while the smears were made. Diluted acetic acid for the leucocytes, and Hayem's solution for the red blood corpuscles, were used as diluting fluids. Immediately after leaving the patient, the counting pipettes were shaken briskly for from three to five minutes, and two or three drops allowed to escape in each instance, before a drop was placed on the counting chamber. The same pipettes and counting chambers (Thoma-Zeiss, with Türk ruling) were always used. Two preparations were always counted, and with the leucocytes, the total number in 1 cmm., with the red blood corpuscles, 1/20 cmm. was counted. A Sahli hemoglobinometer which had been standardized against a Miescher instrument was used. Immediately after filling the pipettes, a dozen or more cover-slip smears were made at each examination. Several of the best of these were fixed by heat in the air bath for about two hours, and then stained with Ehrlich's triple mixture, the same lot of stain being used in nearly the entire work. In making the differential count, not more than 250 leucocytes were counted on a single smear. In a number of examinations, the estimate was based on 1000 cells, but in the majority, only 500 were counted as this number was found to give fairly accurate results.

Classification of Leucocytes.—As many classifications are in vogue, it was deemed advisable to describe the cells as they were classed in this work.

The granular cells offer but slight difficulty. Ehrlich's division into neutrophilic, eosinophilic and basophilic granulations has been followed. Unless stated to the contrary, the granular cells are understood to possess a polymorphous nucleus.

Concerning the non-granular, mononuclear elements of the blood, there is still considerable divergence of opinion. Here, they are divided into the following classes:

(a) Small lymphocytes; cells about the size of the average red blood corpuscle, a trifle smaller or larger. The nucleus takes up most of the cell, stains deeply with the basic colors, is generally round or oval in shape, but occasionally may present a bi-lobed, dumb-bell appearance. The cytoplasm is very small in amount and stains faintly, or not at all, with the acid or basic dyes.

(b) Large lymphocytes; cells varying in size from that of a red blood corpuscle to the polymorphonuclear leucocyte. In these, the nucleus is round or oval in shape, is proportionately larger than in the small lymphocyte and stains less intensely with the basic colors. The cytoplasm is more abundant than in the small lymphocytes and, like it, varies in staining reaction.

(c) Large mononuclear (large mononuclears and transitionals of Ehrlich; stimulation cells of Türk; non-granular myelocytes of Weil; myelo-

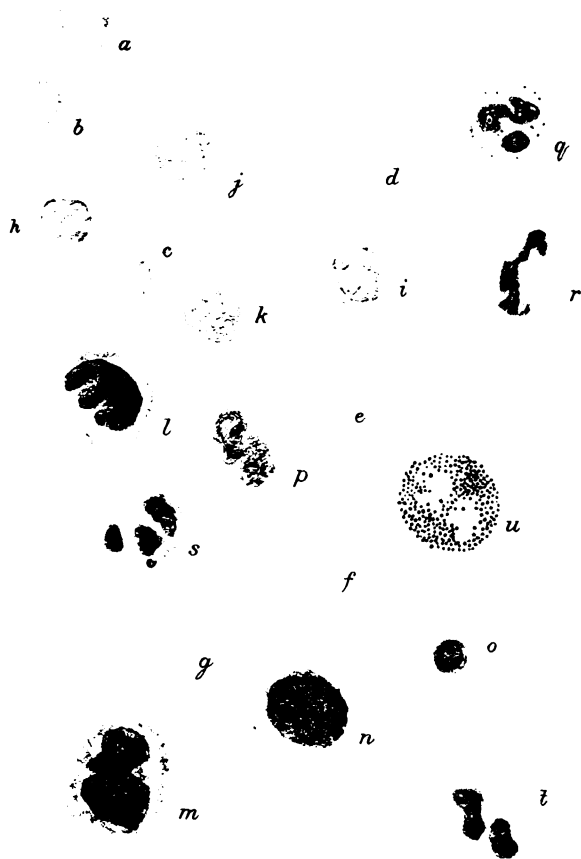


PLATE I.—(Bausch-Lomb, oc. 1, obj. 1/12 oil immer., camera lucida, Ehrlich.) *a-g*—Red blood cells. *h, i, o*—Small lymphocytes. *j, k*—Large lymphocytes. *l, m*—Transitionals. *n*—Large mononuclear. *p, q*—Basophiles. *r, s, t*—Neutrophiles. *u*—Eosinophiles.

blasts of Naegeli, etc.); cells larger than a polymorphonuclear leucocyte; the nucleus is relatively smaller than that of the large lymphocyte; in shape, oval or round, and often eccentrically placed, and staining well with basic dyes, showing more structure than the large lymphocyte nucleus. The cytoplasm is abundant and takes on basic stains with varying intensity.

(d) Transitionals; cells differing from the last, in that the nucleus presents a more varying form, due to indentations and irregularities in outline.

Between the large and small lymphocytes there occur all grades of transition. At times it is practically impossible to decide in which class the cell belongs; however, as in these two cases the larger forms have seemed to be somewhat more frequent than is usual, the attempt to separate them has been made throughout. Also, between the large mononuclears and transitionals, one may find at times, but slight differences. Any cell which has the general characteristics of a large mononuclear, but in which the nucleus is in any way indented or irregular in shape, has been classed with the transitionals. In Plate I, these various cells are shown.

(e) It has been found that a varying small percentage of all the leucocytes cannot be classified accurately, because of the poor staining reaction, or because broken up, and these have been thrown together under the heading "Unclassified." This, however, does not include cells in which pathologic changes have occurred.

DISCUSSION OF THE BLOOD FINDINGS, IN RELATION TO THE CLINICAL CONDITION OF THE PATIENT.

As but little work was done with the red blood cells and hemoglobin, not much importance can be attached to it. It is generally conceded that among the insane as a class, there is present a varying grade of secondary anemia. Hittorf (1), Erlenmayer (2), and Lindsay (3), among the first to do work on the blood of the insane, noted this reduction; and later, Sutherland (4) and MacPhail (5), using more accurate methods, announced the same conclusion. More recently, Winckler (6) points out the same fact, and Melvin (7) has shown that the anemia varies in intensity, according to the mode of life of the patient; those living indoors showed a lower percentage of hemoglobin and a smaller number of red blood cells than those who worked out of doors a part of the day, or who lived in tents. On the other hand, both Capps (8) in cases of paresis, and Burrows (9) in paresis and other diseases associated with convulsions, have found no especial reduction, and after convulsions, have even found a mild polycythemia, with a corresponding increase in hemoglobin. Loveland (10) finds al-

most invariably, an increase in the number of red blood cells with a correspondingly high hemoglobin value in early cases of "melancholia."

In neither of these cases was anemia present; the fresh blood showed no abnormalities, poikilocytosis was not present, and excessive variations in the size of the red blood cells were not noted; occasionally microcytes and macrocytes seemed somewhat more numerous than is normal. Also, in specimens stained by Ehrlich's method, no abnormalities were found. There were no nucleated reds.

The principal object of this study was the white blood cells. Firstly, considering the leucocytes as a class, there were found definite variations in their total number which occurred with a certain definite relationship to the condition of the patient. From the figures obtained in these two cases, I think that for them we may consider about 7000 leucocytes per cmm. as the normal number during the "well" periods. There is with the onset of the "abnormal" phase, an increase in the number of leucocytes. In Case 1, this increase is a gradual one beginning before the patient takes to his bed, and again decreasing some days before he is considered "well." As has been pointed out, this follows closely the temperature curve (Chart 2). In Case 2, however, the increase is sudden, abrupt and extensive. A similar numerical increase was found by Capps (11) and Burrows (12) immediately following seizures in paresis and other conditions.

Obviously, this sudden rise cannot be attributed to a digestion leucocytosis. Not only is it not present in relation to the taking of food, but, besides this, it persists over a too-extended period. And also, it is to be remembered that for the first few days after the onset of an "abnormal" phase, both these patients took but very little nourishment and often none at all. On this account, one might with more reason expect a reduction in the number. We know that during periods of starvation, there is a decrease in the number of leucocytes, as has been pointed out by Luciani (13); and von Limbeck (14) notes the case of a "lunatic" in whom, during a fast of several days, the white blood cells fell to 2800 per cmm. Cabot (15) does not consider that there is constantly a digestion leucocytosis in man.

The marked synchronism of the change in the temperature and the number of the leucocytes suggests that perhaps the temperature may offer some explanation. Pyrexia itself, does not seem to be sufficient. In Case 2, with pyrexia of a mild grade, the leucocyte count is found to be low (Chart 4), whereas, in Case 1, we see a subnormal temperature with the white blood cells somewhat higher than normal. This same relation was noted by Burrows (16) and by Elzholtz (17) in cases of delirium tremens. Carter (18), after a careful experimental study of leucocytosis, concludes that pyrexia itself is not a sufficient cause for the increase in the number of leucocytes.

Might this increase in the number of leucocytes be due to the exercise incident to the excitement and struggling? An increase in the number of leucocytes following exercise is known to occur, but Burrows (19) found during various convulsive seizures where an increase in the number of leucocytes occurred, that this was of two kinds: firstly, that which was due to the exercise itself and which the differential count showed to be physiologic; and secondly, that which was due in some way to the convulsion itself, and which was of the pathologic, inflammatory type. In Case 2, in all probability, the muscular activity would cause some increase in the number of cells. At times when the blood was taken, the patient struggled violently. In Case 1, however, motor-excitement is almost entirely absent at all times, and never was there the least struggling when the blood was taken. And again, it is noted that at the time when he is taking the most exercise, viz., while "well," his leucocyte counts are lowest. Fisher (20) attributes the increase in the number of leucocytes in manic-depressive-excitement, to the muscular activity alone. The high leucocyte counts shown in his tables do not seem to occur always with the presence of psychomotor activity, and generally the polymorphonuclear neutrophilic percentage is decidedly increased.

Recently, in a few experimental studies, Camus and Pagniez (21) and others have found that the height of the blood pressure may exert some influence on the number of white blood corpuscles. With a marked lowering of the blood pressure, these observers noted a concomitant decrease in the number of leucocytes, attributing this to the tendency of the white blood corpuscles to adhere

to the vessel walls during the period of lowered pressure, with the accompanying slowing of the velocity of the blood stream. The reverse of this condition, an increase of leucocytes with a high blood pressure, they were unable to state. Whether the leucocytosis in these two cases bears any causal relation to the rise in blood pressure, has not been determined. In this connection it might be noted that Gordon (22) found that athletes after prolonged exercise, show but a slight or no increase in blood pressure, provided that such exercise did not lead to extreme exhaustion through overtaxation.

In a recent communication, Hasselbalch and Heyerdahl (23) have considered a number of the physical factors which may influence the number of leucocytes in a specimen of blood taken from a certain locality. They find that variations in blood pressure bear no relation to the number of leucocytes, but that the pulse amplitude (the difference between the systolic and diastolic blood pressure) shows fluctuations which parallel the changes in the number of white blood corpuscles. They, however, have noted this in but a few cases, and until further work with more accurate methods has been carried out, they do not advance this point as an established fact. With an increase in the pulse rate resulting from variations in position, and from muscular exercise, there is a transient change in the number of leucocytes which disappear during rest, before, however, the pulse has regained its normal rate; and these observers conclude that the leucocyte variations are not due so much to the degree of the increased cardiac action *per se*, but rather to the sudden transition from a condition of complete rest to one of decided activity.

We come next to the results of the differential counts, the details of which are shown in Tables 1 and 2. Not all examinations made have been figured in these tables; a number of those which exhibited no particular variation have been omitted, and in addition to the findings during one complete cycle, only those near the transition periods are shown. Not only the percentage, but the absolute number of the various forms of leucocytes are tabulated, because, as has been pointed out by Elzholtz (24), the percentage values alone afford, if not an actually erroneous conclusion, at least at times, only partial and mayhaps, misleading deductions.

The "remarks" refer to the condition of the patient at the moment of blood examination.

In Table 1 (Case 1), the results of examinations show, firstly, that in this patient the polymorphonuclear percentage is continuously high, and although showing some fluctuations, rarely goes below 70 per cent. The lymphocytes are correspondingly decreased, the small lymphocytes, to a greater degree. The percentage number of the other forms shows no particular variation. On the day of onset of an "abnormal" phase, there occurs a marked hyperleucocytosis, and the differential count shows that there is a slight but definite increase in percentage number of polymorphonuclears, with a very decided absolute increase. The relative number of lymphocytes does not seem to change appreciably with any regularity, but the absolute number is increased. While the increase in polymorphonuclears is immediate, the rise in number of lymphocytes follows somewhat more slowly; but on the other hand, generally persists over a longer period. The observation on March 6 (Table 1), the beginning of an "abnormal" phase, shows a relative and absolute increase in polymorphonuclear cells, a relative decrease, but an absolute increase in large and small lymphocytes. Also, that the absolute lymphocytosis, although it occurs on the same day, more gradually reaches its height, and on March 10, when the polymorphonuclears have returned to "normal," the lymphocytes are still high, having shown, however, at no time, such a marked proportionate rise as the polymorphonuclears.

In Case 2 (Table 2), if the average number of white blood corpuscles of various classes is taken during the "well" and "abnormal" periods, it will be seen that there is practically no change in the percentage values. However, during the excited period, there is an absolute increase in the number of white blood corpuscles, especially due to the increase of the first few days, and during the stupor, there is a similar decrease.

At the onset of the excitement, there is found both an absolute and relative increase in polymorphonuclears, with a compensatory decrease in lymphocytes affecting small lymphocytes and large lymphocytes almost equally. There is also, a slight decrease in large mononuclears and transitionals found at this time. In Chart

TABLE I.

Date.	Hour.	Number of leucocytes in 1 cmm.	Number counted differentially.	Total number in 1 cmm.								Remarks.	
				Percentage of the total number.									
				Polymorpho-nuclears.	Large lymphocytes.	Small lymphocytes.	Large mono-nuclears.	Transition-als.	Eosino-philes.	Basophiles.	Unclassified.		Myelocytes.
1907 Oct. 8	11 a.	12,390	500 4.0	10,560 85.6	791 6.4	173 1.4	49 .4	544 4.4	99 .8	25 .2	0	Stupor.	
"	2.15 p.	8,430	500 5.9	6,019 71.4	1,012 12.0	292 3.4	67 .8	759 9.0	292 2.4	50 .6	0	38.7 .4	Do.
"	4 p.	9,390	500 5.3	6,889 73.6	898 9.6	282 2.8	112 1.2	917 9.8	243 2.6	0	87 .4	0	Normal first day.
Nov. 4	10.30 a.	14,390	500 3.4	11,820 82.2	978 6.8	230 1.6	57 .4	1,150 8.0	86 .6	0	29 .2	57.5 .4	Abnormal first day.
"	7 10.30 a.	13,400	500 3.7	10,720 80.0	868 6.4	568 4.2	54 .4	992 7.4	80 .6	107 .8	0	26.8 .2	Stupor.
"	11 10.15 a.	10,390	500 4.6	8,688 80.0	868 8.0	399 3.4	43 .4	673 6.2	195 1.8	0	0	21.7 .2	Do.
"	25 3.45 p.	7,920	500 6.3	6,035 76.2	631 8.0	238 3.0	32 .4	684 8.0	222 2.8	16 .2	16 .2	47.5 .6	Normal.
Dec. 2	10.15 a.	5,520	500 9.0	4,515 81.8	331 6.0	148 2.6	44 .8	386 7.0	55 1.0	33 .6	11 .2	0	Do.
"	4 11.30 a.	7,232	500 6.8	5,287 72.6	374 12.0	58 .8	87 1.2	728 10.0	204 2.8	44 .6	0	0	Do.
"	6 10.45 a.	6,220	500 8.0	4,652 74.8	522 8.4	274 4.4	37 .6	522 8.4	149 2.4	25 .4	37 .6	0	Do.
"	7 10.45 a.	11,040	500 4.5	9,053 82.0	729 6.6	177 1.6	132 1.2	1,080 9.6	0	66 .6	44 .4	0	Abnormal psychic elevation.
"	10 5 p.	9,320	500 5.4	8,052 82.0	844 8.6	255 2.6	39 .4	511 5.2	98 1.0	0	18 .0	0	Stupor.
"	18 2.45 p.	6,500	500 7.6	4,768 72.2	577 8.8	210 3.2	39 .6	840 12.8	105 1.6	39 .6	0	0	Do.

1907 Dec. 28	10.45 a.	5,984	600 8.8	4,571 76.4	610 10.2	263 4.4	24 .4	883 6.4	96 1.6	12 .2	12 .2	11.9 .2	Normal.
1908 Jan. 18	11.30 a.	10,640	600 4.6	9,023 84.8	553 5.2	298 2.8	42 .4	698 6.0	0 .0	64 .6	0	20.1 .2	Abnormal.
" 30	11.30 a.	8,068	600 6.1	6,671 82.4	469 5.8	97 1.2	82 .4	648 8.0	129 1.6	32 .4	16 .0	0	Confused.
Feb. 11	4.15 p.	13,400	600 8.7	10,479 78.2	1,897 10.2	241 1.8	107 .8	1,018 7.6	107 .8	0	64 .4	23.8 .2	Stupor.
" 21	4.45 p.	10,776	600 4.6	8,578 79.6	783 6.8	194 1.8	21 .2	797 7.4	388 8.6	43 .4	21 .0	0	Do.
" 22	2.30 p.	10,780	600 4.6	8,775 81.4	483 4.2	172 1.6	65 .6	905 8.4	345 3.2	43 .4	0	21.5 .2	Do.
" 23	10.30 a.	12,660	600 8.9	10,506 83.0	734 5.8	228 1.8	76 .6	709 5.6	253 2.0	101 .8	25 .2	23.3 .2	Do.
" 24	2 p.	9,840	600 5.8	7,696 82.4	448 4.8	149 1.6	37 .4	654 7.0	205 2.2	75 .8	19 .4	37.5 .4	Confused.
" 25	2.15 p.	9,740	600 5.1	7,943 81.6	487 5.0	234 2.4	89 .4	740 7.6	234 2.4	39 .4	19 .2	0	Normal.
" 26	10.30 a.	10,080	600 4.9	7,983 79.0	605 6.0	262 2.6	20 .2	823 8.2	232 2.8	40 .4	0	80.6 .8	Do.
" 27	10 a.	7,140	600 7.0	5,683 79.6	500 7.0	323 4.6	23 .4	387 5.0	114 1.6	14 .2	0	9.9 1.4	Normal; 1 eosinophile myeloc.
" 28	10.30 a.	8,120	600 6.1	6,683 82.0	552 6.8	179 2.2	33 .4	536 6.6	81 1.0	0	0	43.7 .6	Normal.
" 29	10 a.	9,480	600 5.2	7,944 83.8	720 7.6	162 1.6	38 .4	384 5.0	19 .2	95 .0	0	37.8 .4	Do.
Mar. 1	10 a.	8,080	600 6.2	6,883 85.4	500 6.2	139 1.6	48 .6	258 3.2	129 1.6	16 .2	0	98.7 1.2	Do.
" 2	10 a.	8,100	600 6.1	6,707 82.8	551 6.8	113 1.4	16 .2	535 6.6	113 1.4	65 .8	0	65.0 .8	Do.
" 3	2.15 p.	7,900	1,000 13.6	5,653 71.5	916 11.2	490 4.4	33 .7	537 9.3	126 1.7	32 .4	0	15.8 .2	Normal; 1 eosinophile myeloc.
" 4	10 a.	8,480	1,000 11.7	5,555 85.5	555 6.2	555 2.4	555 .7	555 4.2	555 1.4	555 .4	555 .0	555 .0	Normal.

TABLE I.—Continued.

Date.	Hour.	Number of leucocytes in 1 cmm.	Number counted differentially.	Total number in 1 cmm.								Remarks.	
				Percentage of the total number.									
				Poly-morpho-nuclears.	Large lymphocytes.	Small lymphocytes.	Large mono-nuclears.	Transitionals.	Eosino-philic.	Basophiles.	Unclassified.		Myelocytes.
1908 Mar. 5	9.30 a.	7,420	500 6.7	6,069 81.8	549 7.4	119 1.6	44 .6	475 6.4	89 1.2	15 .2	0 .0	23.6 .4	Stupid.
"	6 10 a.	11,880	500 4.3	9,627 84.6	614 5.4	296 2.6	23 .2	680 5.8	45 .4	91 .8	23 .2	0 .0	Do.
"	7 9.45 a.	11,120	500 4.4	9,230 83.0	387 7.8	173 1.6	156 1.4	639 6.2	23 .2	67 .6	0 .0	23 .2	Do.
"	8 9.45 a.	11,040	500 4.5	9,450 85.6	729 6.6	243 2.2	66 .6	464 4.2	88 .8	0 .0	0 .0	0 .0	Do.
"	9 9.45 a.	9,460	500 5.2	7,435 78.6	700 7.4	189 2.0	76 .8	832 8.8	113 1.2	113 1.2	0 .0	0 .0	Do.
"	10 8.30 a.	9,304	500 5.3	6,782 73.2	751 8.0	338 3.6	94 1.0	1,202 12.8	150 1.6	56 .6	19 .2	0 .0	Do.
"	11 10 a.	8,620	500 5.8	6,962 81.6	647 7.6	136 1.6	34 .4	630 7.4	170 2.0	17 .2	0 .0	0 .0	Do.
"	12 10 a.	8,272	500 6.0	6,733 81.4	711 8.6	215 2.6	33 .4	446 5.4	99 1.2	33 .4	0 .0	0 .0	Do.
"	13 9.45 a.	9,140	500 5.4	7,714 84.4	493 5.4	110 1.2	55 .6	567 6.2	146 1.6	18 .2	18 .2	18 .2	Do.
"	14 9.30 a.	6,990	500 7.1	5,374 84.4	529 7.6	83 1.2	28 .4	273 4.0	223 3.2	42 .6	0 .0	0 .0	Do.
"	15 9.45 a.	6,900	500 7.2	5,644 81.8	497 7.2	166 2.4	14 .2	230 4.2	276 4.0	14 .2	0 .0	0 .0	Do.
"	16 10 a.	8,600	500 5.8	7,000 81.4	654 7.6	253 3.0	52 .6	413 4.8	172 2.0	52 .6	0 .0	0 .0	Do.
"	17 8.30 a.	6,604	500 7.6	5,442 83.4	383 5.8	153 2.4	26 .4	387 5.4	224 3.4	13 .2	0 .0	0 .0	Do.

1908 Mar. 18	8,560	500	7,242	496	205	68	359	187	34	0	17	Stupid.
" 19 9.45 a.	7,980	500	6,559	496	287	16	303	271	16	0	16	Do.
" 20 9.30 a.	6,800	500	5,576	381	190	27	286	273	54	14	0	Do.
" 21 9.30 a.	6,732	500	5,464	380	148	54	463	181	40	13	0	Somewhat less stupid.
" 22 9.45 a.	7,020	500	5,616	407	295	42	495	196	28	0	0	Up and dressed; mute.
" 23 9.30 a.	5,940	500	4,633	570	154	71	291	166	59	0	23.7	Do.
" 24 8.15 a.	5,610	1,000	3,776	774	381	73	482	231	45	0	38.6	Normal.
" 25 9.30 a.	6,600	500	5,143	502	304	26	343	185	53	13	26	Do.
" 26 9.45 a.	7,130	500	5,715	617	215	29	383	201	14	0	14	Do.
" 27 9.45 a.	7,100	500	5,879	611	43	28	398	85	43	0	14.2	Do.
" 28 9.45 a.	6,292	500	5,197	373	101	50	315	214	25	0	12.5	Do.
" 29 9.45 a.	5,800	500	4,791	394	255	16	197	104	23	0	23	Drowy and stupid.
" 30 9.20 a.	6,100	500	4,575	761	85	61	439	123	37	0	0	Normal.
" 31 8.15 a.	7,080	500	5,577	508	311	14	325	226	85	0	14	Do.
Apr. 1 9.45 a.	7,620	500	6,431	305	107	91	579	61	15	30	0	Do.
" 2 9.30 a.	7,900	500	6,083	863	153	79	411	0	253	47	15.8	Restless and uneasy, though normal.
" 3 9.30 a.	16,640	500	13,745	1,198	300	166	1,291	0	0	0	0	Abnormal, resistive.

TABLE II.

Date.	Hour.	Number of leucocytes in 1 cmm.	Number counted differentially.	Per cent of total leucocytes in 1 cmm.	Total number in 1 cmm.								Remarks.
					Percentage of the total number.								
					Poly-nuclear.	Large lymphocytes.	Small lymphocytes.	Large mono-nuclears.	Transitionals.	Rosinophilic.	Basophiles.	Unclassified.	
1907 Oct. 17	10.30 a.	12,180	500 4.1	8,983 73.6	1,462 12.0	688 5.4	97 .8	770 6.4	49 .4	146 1.2	24 .2	0 .0	Excited since 6.30 a. m. Excited, struggling; no nourishment. Do. Mute and stuporous.
"	2 p.	19,660	500 2.5	15,374 78.2	2,084 10.6	944 4.8	89 .2	1,101 5.6	0 .0	79 .4	89 .2	89 .2	
"	12 n.	18,100	500 2.8	7,572 41.8	2,725 15.1	812 4.5	79 .4	1,520 8.4	157 0.9	183 1.0	52 .3	0 .0	
"	2.30 p.	13,550	500 3.6	7,209 53.2	2,846 21.0	1,599 11.8	81 .6	1,409 10.4	288 2.2	186 1.0	0 .0	0 .0	
"	10.30 a.	10,160	500 4.8	5,547 54.6	2,488 24.5	711 7.0	61 .6	1,02 10.0	294 2.6	61 .6	61 .6	0 .0	Do. Mute and stuporous. Do. Excited. Mute, stuporous. Do. Normal. Do. Excited since 5 a. m. Mute and stupid.
Nov. 6	10 a.	8,620	500 5.8	5,379 62.4	1,688 19.0	517 6.0	52 .6	517 6.0	108 1.2	52 .6	17 .2	0 .0	
"	12 n.	14,440	500 3.4	9,617 66.6	2,283 15.8	1,011 7.0	87 .6	1,213 8.4	29 .2	173 1.2	29 .2	0 .0	
"	11.15 a.	11,240	500 4.4	8,070 71.8	1,619 14.4	495 4.4	90 .8	877 7.8	22 .2	67 .6	0 .0	0 .0	
"	11 a.	7,880	500 6.2	4,596 58.3	1,676 21.0	702 8.8	48 .6	878 11.0	16 .2	32 .4	32 .4	0 .0	Do. Normal. Do. Do. Excited since 5 a. m. Mute and stupid.
"	2 p.	7,220	500 6.9	4,577 63.4	1,083 15.0	635 8.8	43 .6	698 9.6	180 2.5	58 .8	0 .0	0 .0	
"	10 a.	7,280	500 6.8	4,907 67.4	1,121 15.4	884 12.1	44 .6	78 10.0	58 .8	44 .6	15 .2	0 .0	
"	10.30 a.	15,160	500 3.2	11,249 74.2	2,213 14.6	728 4.8	121 .8	788 5.2	0 .0	61 .4	0 .0	0 .0	
Dec. 8	11.30 a.	6,400	500 7.8	4,581 70.8	870 13.6	141 2.2	77 1.2	653 10.3	90 1.4	26 .4	18 .3	0 .0	

1907 Dec. 14	10.45 a.	6,760	500 7.3	4,967 72.0	717 10.6	419 6.2	27 .4	623 9.2	68 1.0	14 .2	27 .4	0 .0	Deep stupor.
" 15	10.15 a.	7,160	500 6.9	4,965 69.2	945 13.2	383 5.0	72 1.0	697 9.6	96 1.2	43 .6	14 .2	0 .0	Normal.
" 27	10.15 a.	11,240	500 4.4	8,745 77.8	1,191 10.6	517 4.6	22 1.1	674 6.0	0 0	90 .8	0 .0	0 .0	Mild excitement.
1908 Jan. 30	4 p.	6,640	1,000 15.1	3,980 60.3	1,564 23.7	380 5.3	73 1.1	883 5.8	125 1.9	40 .6	103 1.3	0 .0	Normal; sitting in chair.
" 31	2.30 p.	6,908	1,000 14.4	4,464 64.7	987 14.3	485 6.3	55 .8	711 10.3	88 1.2	48 .7	117 1.7	0 .0	Do.
Feb. 1	11 a.	6,440	1,000 15.6	4,064 63.5	998 15.6	461 7.2	51 .8	672 10.5	45 .7	38 .6	70 1.1	6.4 .1	Do.
" 2	10.30 a.	6,320	750 11.9	4,265 67.7	764 12.0	303 4.8	57 .9	712 11.3	95 1.6	50 .8	57 .9	0 .0	Do.
" 3	10.30 a.	6,640	1,000 15.1	4,323 65.5	917 13.9	277 4.2	106 1.6	882 12.6	53 .8	26 .4	66 1.0	0 .0	Do.
" 4	2.30 p.	6,100	1,000 16.3	3,818 54.4	1,188 19.4	421 6.9	123 2.1	866 14.2	43 .7	43 .7	98 1.6	0 .0	Do.
" 5	10.30 a.	5,920	1,000 16.9	3,711 62.9	961 14.6	301 5.1	65 1.1	795 13.3	35 .6	59 1.0	71 1.2	11.8 .2	Do.
" 6	11.15 a.	6,640	1,000 15.1	4,006 60.7	1,089 16.5	870 5.6	125 1.9	818 12.4	46 .7	40 .6	106 1.6	0 .0	Do.
" 7	10.15 a.	6,860	1,000 15.6	4,830 60.8	1,046 16.6	323 5.2	95 1.5	825 13.1	69 1.1	38 .6	63 1.0	6.3 .1	Do.
" 8	9.45 a.	6,560	1,000 15.1	3,744 57.6	1,151 17.7	871 5.7	143 2.2	873 13.5	117 1.8	46 .7	46 .7	6.5 .1	Do.
" 9	10 a.	14,560	1,000 6.7	11,020 76.0	1,798 12.4	431 2.9	87 .6	969 6.2	29 .2	102 .7	145 1.0	0 .0	Excited since 1 a. m.
" 10	10.40 a.	14,160	1,000 7.0	9,898 70.2	1,607 11.4	747 5.3	99 .7	1,293 9.8	113 .8	85 .6	127 .9	42.4 .3	1 eosinophile myeloc.; excited.
" 11	8.30 p.	8,200	1,000 12.1	4,905 59.7	1,533 13.7	467 5.7	90 1.1	985 11.4	131 1.6	49 .6	98 1.2	0 .0	Excited.
" 12	10 a.	9,040	1,000 11.1	5,863 65.2	1,431 15.9	496 5.4	108 1.2	981 10.9	36 .4	45 .5	36 .4	9.0 .1	Do.

TABLE II.—Continued.

Date.	Hour.	Number of leucocytes in 1 cmm.	Number counted differentially.	Total number in 1 cmm.								Remarks.	
				Percentage of the total number.									
				Poly-nuclears.	Large lymphocytes.	Small lymphocytes.	Large mono-nuclears.	Transitionals.	Kosino-philes.	Basophiles.	Unclassified.		Myelocytes.
1908 Feb. 13	10 a.	7,760	1,000 12.8	4,289 55.7	1,571 20.4	562 7.3	77 1.0	1,001 13.0	69 .9	77 1.0	46 .6	7.7 .1	Excited.
"	14 10 a.	6,468	1,000 16.3	3,578 55.9	1,344 21.0	410 6.4	83 1.3	762 11.9	115 1.8	77 1.2	32 .6	0 .0	Do.
"	15 10.30 a.	5,980	1,000 16.6	3,457 58.6	1,257 21.3	384 6.5	77 1.3	578 9.8	83 1.4	18 .3	41 .7	5.9 .1	Do.
"	16 10 a.	5,580	1,000 17.8	3,113 56.6	1,194 21.7	242 4.4	66 1.2	769 13.8	50 .9	33 .6	44 .8	0 .0	Do.
"	17 10.15 a.	5,880	1,000 17.2	3,353 57.9	1,114 19.2	342 5.9	99 1.7	687 11.6	87 1.5	46 .8	37 1.6	0 .0	Resistive and stupid.
"	18 2 p.	6,820	1,000 14.7	4,379 64.4	1,081 15.9	469 6.9	46 .8	707 10.4	34 .5	34 .5	34 .6	0 .0	Excited.
"	19 10.30 a.	5,860	1,000 16.9	3,631 62.6	972 17.1	377 6.5	64 1.1	621 10.7	62 .9	23 .4	41 .7	0 .0	Stupor.
"	20 10.15 a.	5,900	500 8.5	3,564 60.4	968 16.4	342 5.8	47 .8	888 14.2	35 .6	47 .8	59 1.0	0 .0	Do.
"	21 10.30 a.	6,666	1,000 14.9	4,069 61.5	1,122 17.0	432 7.3	59 .9	700 10.9	86 1.3	53 .8	20 .3	0 .0	Do.
"	22 10.15 a.	6,220	1,000 16.1	4,111 66.3	992 16.0	267 4.3	43 .7	688 11.1	56 .9	19 .3	19 .3	6.2 .1	Excited and violent.
"	23 1 p.	4,564	1,000 21.7	2,232 50.7	1,017 22.6	531 11.8	45 1.0	627 11.7	63 1.4	18 .4	18 .4	0 .0	Normal at 12.45 p. m.; sitting in chair.
"	24 10.15 a.	7,280	1,000 13.6	4,594 63.8	1,063 14.7	461 6.4	50 .7	960 13.2	50 .7	14 .2	23 .3	0 .0	Normal.

2, February 9, these changes are shown; and it is also seen that the disturbance lasts but a short time, two days here, when, although the white blood corpuscles are still somewhat higher, the various percentages have resumed the proportions existing before the onset of the excitement. During this excited phase, although the percentage of large lymphocytes and small lymphocytes is decreased, the absolute number is increased. That this is not a constant variation may be seen from the examination of November 9, when the increase in both the percentage and absolute number of mononuclears is very decided, whereas the polymorphonuclears are only slightly increased. From other examinations shown in this chart, it will be seen that the polymorphonuclear leucocytosis when

Condition.	Total no. W. B. C.	P. m. m.	L. L.	S. L.	L. M.	Tr.	Eosin.	Baso.	Unclassed.
Normal. Jan. 30-Feb. 8. 10 days	6456.8	4072.5 61.8%	1055.2 16.4%	361.6 5.6%	89.8 1.4%	748.2 11.7%	71.1 1.1%	42.8 .67%	79.7 1.2%
Excitement predominant. Feb. 9-16. 8 days.....	8971.0	5764.7 62.2%	1466.8 17.8%	477.3 5.4%	85.8 1.0%	900.8 10.8%	78.2 1.0%	60.7 0.68%	71.1 0.76%
Stupor predominant. Feb. 17-22. 6 days.....	6216.0	3850.3 62.1%	1041.5 16.9%	379.6 6.1%	59.6 1.0%	708.5 11.4%	58.3 0.9%	37.0 0.6%	48.8 0.7%

it occurs, is but transient, and soon gives way to the more persistent lymphocytosis. This was noted in Case 1, and would seem to be in accord with Burrows' (25) findings in various types of convulsions, as has been noted previously. Tornow (26) finds that after continued exertion (forced marches of soldiers), the leucocytosis occurring is mostly due to a polymorphonuclear increase; whereas, Hasselbalch and Heyerdahl (27) show that short periods of exercise induce an increase in the mononuclear elements. It seems then, from these and my own findings, that exercise alone, would not be sufficient to explain the sudden increase in white blood corpuscles, particularly at the beginning of the excitement when the polymorphonuclears are higher, although it may suffice to explain, in part, the more persistent increase in the mononuclear elements.

The observation recorded February 23 (Table 2) is interesting, in that it tends to be in accord with the observations of Hasselbalch and Heyerdahl regarding "static" leucocytosis. A few hours before this examination, the patient was in a stuporous condition, and the blood examination then showed no change from that of the preceding day. When this examination was made, she had been seated in a chair for several minutes, having shortly before become "well." The hypoleucocytosis with decrease in polymorphonuclears, and increase in lymphocytes, is quite definite. The following day this had entirely disappeared. As no intervening examinations were made, it is impossible to say how long this persisted, although the observers mentioned above, point out that the disturbance is but transient.

The transitionals show a uniformly high percentage, although not outside the limits for normal. A slight decrease (per cent) may occur at the time of the excitement with an absolute increase. The large mononuclears show but little change, and the eosinophiles keep well to the lower limits of normal; and on three occasions, with the first day of excitement, disappeared entirely (October 19, November 28, and December 27—Chart 2), and with the onset of the attacks of November 9 and February 9, they decreased both absolutely and relatively. With the basophilic cells, no constant variation is to be noted.

Mononuclear granular cells have been seen in specimens from both of these patients. The granulations have taken the eosinophilic or neurophilic stains. In only one or two instances has the size been excessive, generally only about that of the ordinary polymorphonuclear cell. They have been classed in the tables as myelocytes. Pollitzer (28) has called attention to the fact that the definition of a myelocyte as proposed by Türk (29) may not be so simple in its application when a poor nuclear stain, such as Ehrlich's, is employed because with this stain there are a number of polymorphonuclear cells which will appear to have a single nucleus and Pollitzer thinks the five per cent of mononuclear neutrophils found by Arneth (30) in normal blood are discoverable only when a poor nuclear stain is used. In view of this doubt of the actual existence of these cells not much importance is to be attributed to their presence here.

The basophilic cells, the granulations of which with the Ehrlich method ordinarily remain unstained, occasionally show a few scattered large granules staining a deep reddish purple. These granules are very similar to those seen in these cells when the Jenner or Hasting stains are used.

So far, then, there has been found no one cause, or aggregate of causes, which will entirely and satisfactorily explain the blood changes which have been observed in connection with the cyclic variations occurring in the clinical condition of these patients. There is one factor remaining which has not been considered—have we here the evidence of some chemotactic substance circulating in the blood and acting to produce a hyperleucocytosis, and if so, what is its nature? One may postulate a micro-organismal invasion, a toxin or toxins resulting from a bacterial infection or from disorders of some general or particular metabolic process, or, a combination of all of these factors may be active.

Sweeping general conclusions from observations on two cases are not permissible. All that can be said, is

- (1) That a hyperleucocytosis has been noted in these patients, coincident with the onset of the "abnormal" phases, and,
- (2) That, so far as this work has gone, no fully satisfactory explanation for this variation has presented itself.

It was early suggested in this work, that anomalies of metabolism might possibly throw some light on the condition existing in these two patients; and consequently, hoping that something might be learned from an examination carried on from this point of view, such work is now in progress in this laboratory.

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