

Natural History and Treatment of Thirteen Pairs of Identical Twins: Schizophrenic and Schizophrenic-Spectrum Conditions

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Introduction

The basic work of Kallman (1946, 1953, 1959), Slater (1953), and others established the genetic basis of schizophrenia. Few can doubt that first-order relatives of schizophrenics are much more prone to schizophrenia than are people who have no first-order schizophrenic relatives. The relative importance of heredity and environment has also been settled. It is clear (Heston, 1970) that heredity is much more important and in my opinion may be tenfold as relevant as environment, if the term environment is restricted to the psychosocial environment as has usually been the case. People who have genes for the production of schizophrenia cannot protect themselves by seeking the best possible psychosocial environment.

The nutritional environment is, of course, another matter. Elsewhere I have shown (Hoffer, 1970) that schizophrenia and pellagra are so alike from a psychiatric point of view that they can only be distinguished by a therapeutic response to nicotinic acid or nicotinamide (collectively termed vitamin B3). If the patient suffering a schizophreniform psychosis responds quickly to near vitamin doses of this vitamin, he is said to have pellagra. I have arbitrarily used 1 g per day as the dividing line because chronic pellagrins require much larger doses than acute pellagrins.

Most acute schizophrenics suffer from vitamin B3 dependency (Hoffer, 1971). It is therefore apparent that the nutritional environment becomes equally as important as heredity since a diet enriched with megaquantities of vitamin B3 will prevent the expression of schizophrenia in the same way as a diet enriched with vitamin doses of B3 has prevented

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pellagra. It follows that a diet especially poor in proteins or exceptionally rich in purified starchy foods such as white flour or sugar will permit schizophrenia to appear more readily. Williams (1967, 1969, 1971) has shown that there is a wide variation in nutrient requirements. People who have average requirements for B3 will develop pellagra if the diet is deficient. Those who require say 50 mg per day may survive for a long time suffering from subclinical pellagra (Green, 1970, 1975). Those who require over 100 mg per day will develop schizophrenia early in life. These figures are arbitrary and probably grossly inadequate. The actual requirements will have to be determined.

When the fault is in the diet, the condition is called pellagra, the classical deficiency disease. When the fault is in the body's requirement for increased quantities of B3, the condition is a vitamin B3-dependency condition, usually called schizophrenia. Pellagra in animals which is maintained for a long time will no longer respond to small vitamin doses of vitamin B3. It will respond to and requires large maintenance doses. In other words, a deficiency condition has been converted into a dependency condition. Prolonged deficiency in humans will also produce dependency on vitamin B3 (Hoffer, 1973).

Recently it has become clear that Pyridoxine dependency is another cause of the schizophrenic syndrome, and other water-soluble vitamins may also play a role. In addition the early work of Randolph (1961, 1966, 1970) is receiving increasing attention. The brain can react to allergens as well as can the skin, and so on. These cerebral allergies produce a schizophrenic syndrome which is indistinguishable from the other syndromes. This is another reason why the genetics of schizophrenia is so difficult to interpret.

A comparison between identical and fraternal twins reared by their own or by foster parents has been of crucial significance in developing our present knowledge about

the genetics of schizophrenia. What has not been settled is the mode of inheritance, i.e., whether dominant or recessive genes are involved and how many. This will remain difficult if not impossible as long as the studies are restricted to so-called classical or Bleulerian schizophrenics. It will be essential to use all vitamin B3-dependent members of families in order to work out the mode of transmission. These may include schizophrenic and hyperkinetic children as well as adolescent and adult schizophrenics.

Emphasis will have to be given to something less vague and impossible to measure with our present tests than thought disorder, following Bleuler's imprecise formulations, and to replace it with changes in perception, following J. Conolly (1830). I have been collecting this kind of data for several years. It already suggests the following rules: (a) One-third of offspring of one vitamin B3-dependent parent will also be vitamin B3 dependent. (b) When both parents are vitamin B3 dependent, two-thirds of their children will also be. Vitamin B3 dependency is readily determined by the response to megadoses of vitamin B3 (Hoffer, 1971a).

There is an additional value in twin studies which has not been exploited in psychiatric research. They have not been used in therapeutic trials. Beveridge (1950) suggested that an economy of numbers might be achieved by using identical twins, one member acting as the control for the other. As an example, in one experiment involving butterfat yields, the results from one pair of identical twin cows were as valuable as those obtained from two groups of 109 cows each. For growth experiments, one pair of twin calves was equivalent to 25 pairs of ordinary calves. These considerations led Burrell and Osmond (1959) to suggest that identical twins having schizophrenia "can be used to reduce greatly the cost in time, money and labor of drug trials in psychiatry." A reasonable estimate is that one pair of identical twins, where one recovered on a drug

and the other did not, would be equivalent to two groups of 50 patients, one group on the drug and the other a comparison control. In other words, one identical twin pair yields results comparable to the usual clinical trial.

Over the past 10 years I have collected data on 13 pairs of identical twins. Of the 26 persons I have personally examined 19 and have reliable information about five; the remaining two have not been seen. The majority of treated patients have received Orthomolecular therapy initially, or following failure to respond to standard therapy.

Orthomolecular therapy is defined by Pauling (1968) as the provision of the optimum nutrient environment in the brain. It is achieved mainly by the use of megadoses of vitamin B3 supplemented by other water-soluble vitamins such as ascorbic acid, Pyridoxine, and thiamine, combined with a diet rich in protein and low in refined starchy foods. Attention is also given to a correct mineral balance. It also includes the use of any one or any combination of chemotherapeutic drugs as adjuncts (as well as ECT in a small proportion of cases). In most cases these adjuncts will eventually not be required and patients will remain well on the vitamin-nutrient combination only.

Standard therapy refers to the use of current tranquilizers, antidepressants, ECT, and psychotherapy in any combination, usually by psychiatrists who firmly believe they are using the most advanced and most efficacious treatment available. As a corollary they are as firmly convinced that Orthomolecular therapy is of no value even when they see their patients recover when so treated, or when they are informed of the recovery of the twin identical with the one they are treating but not under their care. They usually propose other explanations—old favorites such as spontaneous remission, or faith, or placebo responses. It is curious how strong a predilection there is for spontaneous remissions to occur once patients have started on Orthomolecular therapy.

In this report, the case history, treatment, and response of the 13 pairs of identical twins will be given. It will be shown that in every case where it was possible to follow the Orthomolecular therapy, the patient recovered. None of the subjects receiving standard therapy did.

Case Histories Twin Pair Number A

E. A., born January 11, 1939. He completed one year university, married, and was well established in the community. In 1959 he suffered one convulsion; for this he took dilantin and phenobarbital for several years. When examined in October, 1967, he had taken this combination only when very tense. He excreted kryptopyrrole in his urine (mauve factor, Irvine, 1961; Irvine et al., 1969; Hoffer and Osmond, 1961a, 1963). His HOD scores were all normal.

D. A., his twin, was very depressed and anxious. He had suffered a similar depression in 1963 for about six months. He suffered a number of perceptual changes (illusions), was paranoid and depressed. He excreted kryptopyrrole. As a result his personality altered. He was given nicotinamide 3 g per day, ascorbic acid 3 g per day, and tofranil 75 mg per day. Two weeks later he was well.

He continued steady intake of megavitamins only until the end of 1970 and remained well until May of 1973 when his nervousness and depression recurred. He became excessively concerned about a host of minor factors. In the meantime he had become vice principal of a school, had a son, and got on well with his family and community. When his depression recurred he resumed his vitamin intake and one week later began to improve. He was seen June 1, 1973, given etrafon D (one h.s.), and Pyridoxine 1/2 g per day. By July 9 he was much better, and by the end of the year was nearly normal with an occasional episode of depression.

His HOD scores (see Kelm et al., 1967), are shown on the next page.

| Total Score (TS) | | Perceptual Score (PerS) | Paranoid Score (PS) | Depression Score (DS) |
|---------------------|--------|----------------------------|------------------------|--------------------------|
| October 2/67 | 49 | 9 | 4 | 16 |
| October 16/67 | 10 | 2 | 1 | 0 |
| June 1/73 | 53 | 14 | 1 | 12 |
| July 9/73 | 18 | 3 | 0 | 5 |
| Normal | (0-30) | (0-3) | (0-3) | (0-3) |

Dr. M. El-Meligi was sent the EWI test results on both twins, Don when ill and after he had recovered. This is what he reported:

"The schizophrenic twins' scores fall within the normal range with remnants of sensory difficulty, none of which indicate any distortion. Even time engagement is quite adequate which suggests readiness to hold and enjoy a job. The retrospective profile (at worst) points to a severe schizophrenic with a strong affective element and paranoid ideation. It is remarkable how consistent are the scores of the retrospective profile as shown on parts one and two. It is encouraging that Donald does not appear euphoric nor overloaded as he used to be.

"Ernest appears essentially normal, but entertains self-doubts."

The EWI profiles are shown in Figure 1.

The twins were very close to each other, being nearly inseparable as children. For the first year the mother tied a ribbon on one so she could tell them apart. In school they used to confuse their teacher by switching classes. Speech was not alike, however, and people could distinguish them by their speech. Don began to speak more slowly.

Twin Pair Number B

Born 1921. These twins were so alike as children and young girls that they could exchange dates without their partners being aware of the change. They often exchanged classes in school, again with no awareness on the teachers' part of the deception. Mrs. M. G. married in 1944. Her first child was born six years later. A few months afterward she

became very depressed and delusional. She tried to kill herself by jumping out of a window. She was treated in a mental hospital in Boston for six weeks. In 1953 she began to receive treatment in Vancouver. By 1963 she had averaged two serious depressions each year having failed to respond to deep psychotherapy, repeated series of ECT, and drugs. In 1965 she was depressed again, but consulted a family physician for backache. He recognized her schizophrenia and started her on megavitamin B3 therapy.

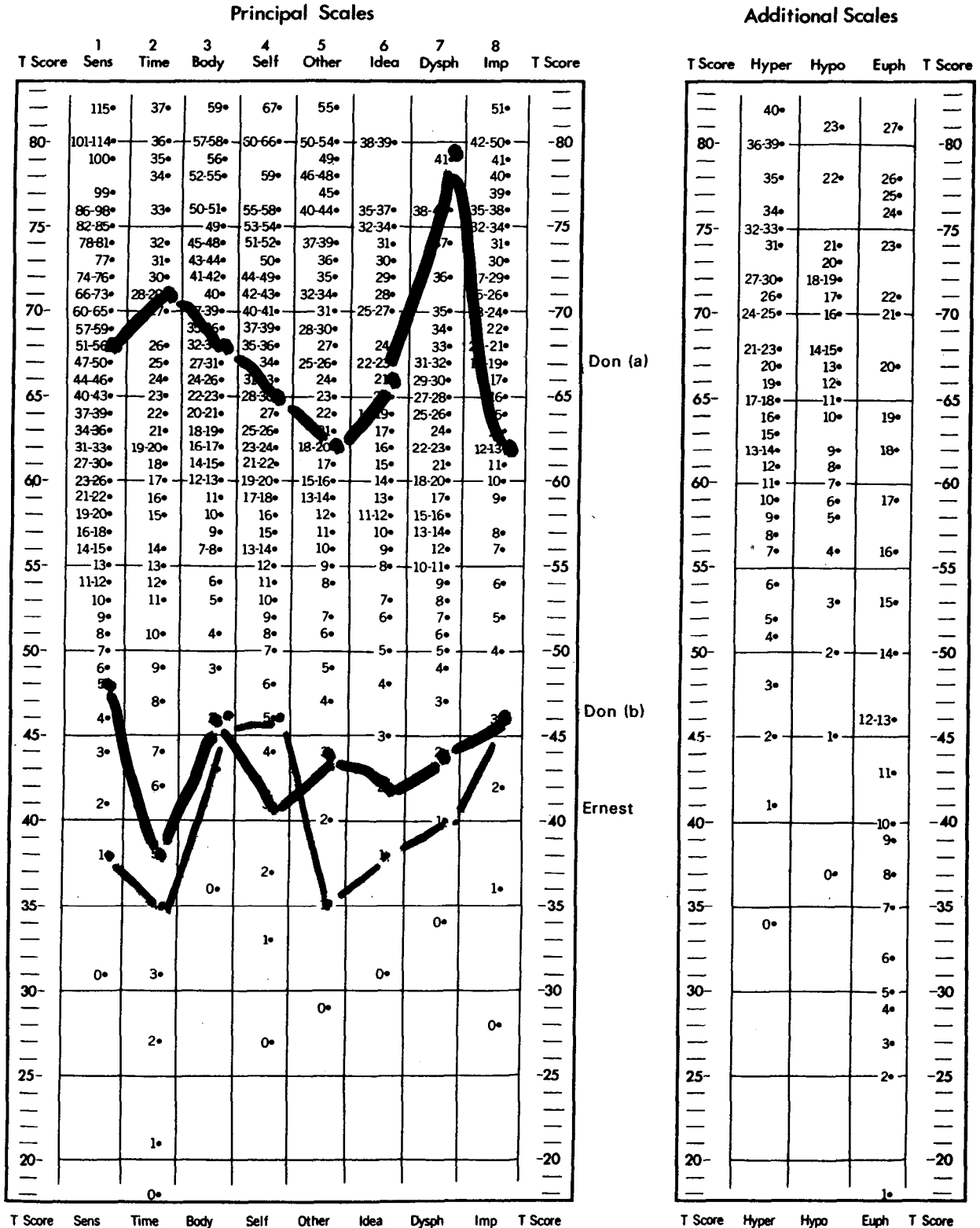
She came to me for a consultation in September, 1966, when she was normal. She estimated she had been in psychiatric wards 15 times in the previous 14 years, usually for a period of one month.

In June, 1970, her physician reported she had graduated from university with distinction and that during the 4½ years she had been on megavitamins she had suffered two minor relapses which were short-lived and did not require admission to hospital. Her son who had been diagnosed as mildly retarded had recovered on nicotinamide and was above average in school. Both mother and son are still well.

Her twin became ill a few months before M. G.'s first attack. Since then her history of frequent relapses was nearly identical with M. G.'s. The only difference was that she required fewer re-admissions, but averaged three months in hospital for each admission. Between 1961 and 1966 she did not go to a hospital. This twin had married a very successful businessman who was very protective. Whenever she became depressed, she retired to her home and remained in seclusion until her

FIGURE 1

MALE PROFILE



1st Test _____ Don (a) when ill _____
 2nd Test _____ (b) when well _____
 3rd Test _____ Ernest well _____

depression lifted. She refused to take megavitamins even though her normal twin had urged her strongly to do so. In June, 1970, Mrs. M. G.'s doctor reported that the twin not on vitamins had had 12 relapses over the 4¹/₂ years, averaging two or more months each. (This was while the vitaminized twin had two minor relapses). Mrs. M. G. wrote on November 17, 1967, "It just breaks my heart that even now they won't try this nicotinic acid." By the end of 1973 the twin on megavitamins was still well. This is a particularly striking response since I saw the twin who recovered only once after she had recovered, while her sick twin remained under the continuous care of a psychiatrist who firmly refused to treat her with vitamins.

Twin Pair Number C

Mrs. A. K., born November 12, 1920. This patient had always been shy and seclusive. In 1956 she began to deteriorate very quickly, following the birth of her fifth child. She lost interest in her work, often became lost due to disorientation, and heard voices. She was admitted to University Hospital on August 22, 1960, where she reported visual and auditory hallucinations, thought disorder both in content and process, and was depressed. She received 20 ECT and nicotinic acid 3 g per day. On discharge she was much better, being nearly free of her previous symptoms (November, 1960). The patient did not take the medication at home very long. On September 16, 1965, she was readmitted to the hospital for two weeks in much the same state as during her first admission. She was started on long-acting injectable fluphenazine which she still took in September, 1967, but remained ill except for her florid symptoms which were under control. Her doctor did not believe in vitamins.

I invited her to visit me for examination, offering to pay her way out of a research grant, but she did not answer the letter. The hospital following her up made no effort to encourage her cooperation.

Her sister, Mrs. L. H. (an identical twin), was treated in a mental hospital from June 2 to July 22, 1967, suffering from a recurrence of delusions and other symptoms. She received ECT and tranquilizers. On discharge she was given 800 mg chlorpromazine per day.

Her last contact was in October, 1967, and she was slightly improved, but the social situation at home was not good. The marriage was breaking up. She also refused to come to Saskatoon to be seen.

Twin Pair Number D

This family is a typical vitamin B3-dependent family. The father had been treated twice in a mental hospital, diagnosed as a depression. From a perusal of the literature he considered the proper diagnosis was schizophrenia. His marriage was on the verge of breaking up because of his bizarre behavior. One brother had received treatment in a mental hospital. He was started on the megavitamin B3 approach and became much better.

His wife was referred for consultation showing severe anxiety, depression, and schizoid features. She recovered on nicotinamide, 3 g per day. Later she separated from her husband because of his continual jealousy.

This couple of B3-dependent people had five children. The eldest, David, was referred to me in 1967 because of his schizoid personality. This interfered with his ability to acquire social skills, and his educational performance at university had begun to deteriorate. He was positive for mauve factor. He was started on vitamin B3 3 to 6 g per day. When seen in December, 1971, he was nearly well and had won and lost one girl friend, his first. He has remained well and has overcome the problems generated by years of illness. He had discussed his identical twin sisters whom he considered not well.

Beverly, born September 15, 1951, was the first-born twin. When I saw her in April, 1968, she was in Grade 11. She felt it was harder for her to maintain her record. She had always been better at

HISTORY AND TREATMENT OF IDENTICAL TWINS

school than her twin, Irene. I could not find any psychiatric abnormality, but as an experiment started her on nicotinamide, 3 g per day, a few months after her sister's improvement. On July 2, 1968, Irene wrote to me, "Before Beverly started to take the pills she would hardly talk. She has improved in school. She passed to Grade 12." Beverly is now a nurse's aide and is well.

Irene was born after her sister. She was always smaller and thinner and never did as well in school. Her marks always averaged 10 points below Beverly's. She had been paranoid at times and depressed and irritable. On nicotinamide, 3 g per day, she quickly changed her personality. On July 2, 1968, she wrote to me, "Since I have been taking them, I found it easier to learn and understand the teachers. Mother said my personality changed. I wasn't as crabby as before. I find it easier to talk to people. In school I improved in five out of eight subjects." Both girls were positive for mauve factor. Her outgoing personality has remained with her.

In 1971 the youngest sister became ill and required treatment in a psychiatric ward. Thus out of five children, four have been ill, two showed this by responding to vitamin B3, one was severely schizoid, and the fourth (diagnosis unknown) required psychiatric treatment.

Twin Pair Number E

Born May, 1942. In spite of a very difficult and disturbed environment this girl did well in school and was normal until in May of 1960 when she was diagnosed schizoaffective and received a series of ECT over a period of four months. After she recovered, she completed her B.A., became a teacher, and taught for three years. She was again admitted to University Hospital in January, 1970, because of bizarre behavior and received a series of ECT. She remained for several months as a day patient and then was followed at home. During August of 1970 she required two more admissions. This was ascribed to the presence

in the home of her identical twin. From November, 1970, to her admission she continued as a day patient, but there was no improvement. From November 23, 1970, to January 18, 1971, she was in hospital where she read her chart and discovered she was considered "paranoid schizophrenic." The prognosis on discharge was very pessimistic. It was said "she will continue to require the services of the University Hospital at frequent intervals."

On May 29, 1971, I saw her as an emergency. She was very confused and kept on insisting it was her right to see a psychiatrist every two weeks because a friend of hers had that privilege, but she denied that she was ill. Her speech was odd, she rambled, was distractible, irrational, and concrete. She was started on nicotinic acid, 3 g per day, ascorbic acid, 3 g per day, and Mellaril, 150 mg per day. By July 14, 1971, she was much improved and was making plans for seeking a teaching job. During a follow-up interview in August she reported that this was the first time since her first attack in 1960 that she felt normal. Between 1960 and 1970 when she had been considered well she suffered frequent if not continuous bouts of depression, was perpetually paranoid about her teaching colleagues, and was just able to function. At that time she considered she was getting about reasonably well as she had no basis for comparison. She had been well over two months and was now able to make a proper comparison. Her spontaneous account of her responses to tranquilizer and nicotinic acid medication illustrates clearly the difference in the quality of improvement one can expect.

Patient remained much improved until March, 1972, when she became more tense. May, 1972, she was admitted as an emergency for two days because of an overdose of tranquilizer. She denied it was a suicide attempt. She remained depressed after this and in July, 1972, was given 5 ECT unilateral as an out-patient. Her depression cleared. During this time her father died suddenly and she became more depressed. February,

1973, she again took an overdose of tranquilizers, was admitted and received another series of 7 ECT (unilateral and bilateral alternating). She was again much improved, but by the end of June became hyperactive, hypertalkative, paranoid. She was admitted to another hospital for two weeks, but after discharge remained very paranoid and ill. She was again admitted under my care for another series of 10 ECT, bilateral and unilateral alternating. However, she did not respond. Later she refused to cooperate with treatment and has remained ill since then.

Her sister had in the meantime come home and, seeing this rapid recovery, arranged to come and see me again with her identical twin sons.

This sister became very psychotic in October, 1961, and was admitted on October 7 to November 28, 1961. Her condition was very similar to her sister's at the time of her admission in January, 1960. She heard voices, showed a lot of thought disorder, bizarre behavior, and was overly excited. She was given 13 ECT. On discharge she was much improved.

She was readmitted from November 16 to January 26, 1963, in an acute relapse. She received another 10 ECT and she was discharged improved.

In September, 1965, she was diagnosed hebephrenic schizophrenia in Toronto and given tranquilizer medication. She returned to Saskatoon and came under my care in October, 1965, when she was started on megadoses of nicotinic acid. By July of 1966 she was much improved. By January 31, 1967, her improvement was sustained and when last seen February 27, 1967, she was normal.

She then returned to Toronto, a few months later relapsed, and was admitted to the Clarke Institute for about three months. There they immediately prevented her from taking the nicotinic acid because they knew it was of no value and began standard therapy which included an admission the next year for one month, another for three months in 1969, and steady outpatient support until 1972.

In the meantime she became pregnant, had twin boys, married, separated, and is now planning a divorce. She arranged to see me because having seen her twin sister recover, she wished herself to be as well. She had taken Largactil spansules, 150 mg, each day regularly for years and was apparently symptom free but did not feel normal. Her presence in the home no longer made Reg. S. ill.

She was started on nicotinic acid, 3 g per day, on ascorbic acid, 2 g per day. She had the typical phenothiazine pigmentation on her face which was purplish red—more red than purple. One month later the abnormal pigmentation was gone and she felt normal. Since fall of 1972 she has been teaching and was engaged to be married in 1974.

Twin Pair Number F

Mrs. Ren. A. (of the E twins) had twin boys age $2\frac{3}{4}$ years when seen in July, 1971. She maintained that her boys were not identical, but physically it was impossible to tell them apart if they were quiet and did not speak. She was concerned" about Eric who began to speak slowly and was much behind Mike. Eric was fidgety, had a brief attention span, had frequent temper tantrums, wet the bed, was irritable, and did not respond to discipline. On a hyperactivity scale that I use he scored 73. The normal range is 27 to 45. The mother could tell them apart when they moved or spoke because Eric spoke in a halting manner and his movements were abnormal. Because they behaved differently the family had considered them non-identical. Mike was normal and scored 27 on the hyperactivity scale. A colleague who was in my office could not distinguish one from the other if they stood quietly side by side. The twins were identical on blood typing. One month later Eric was nearly normal and his score had come down to 43.

Since then Mike has remained normal, but his mother placed him on nicotinamide, 1 g per day. Eric is nearly well on nicotinamide, 3 g per day, but occasionally lapses into nonsense speech. Eric

HISTORY AND TREATMENT OF IDENTICAL TWINS

now has a sense of humor. Both twins get along very well.

Twin Pair Number G

Linda and Lorraine, born June 14, 1949, were so identical in appearance that their parents for a long time distinguished one from the other with great difficulty. Photographs taken at ages 1, 4, 6, 8, 11, and 13 show they are still nearly alike except Lorraine's face was slightly fatter. When I examined them they were clearly identical. They began to walk at age 15 months (Linda) and at 18 months (Lorraine). They began to speak at age nine, but for two years spoke gibberish to each other. At age four they began to speak distinctly. Both were considered slow in school.

Linda: At age 10 she felt over a period of two months that she had rocks in her stomach. At age 16 in Grade 7 she lost interest in school. In 1968 she began to feel she was losing her mind. When examined in May, 1969, she felt as if she had taken LSD, feeling unreal. Words hopped about on the page. She was paranoid about her family, blocked, had defective judgment, had cancerophobia, and was depressed.

She was given a series of ECT and the megavitamin B3 therapy. After this, July 26, 1969, she was improved. One month later she remained about the same, somewhat better but still having a thinking problem. She was on nicotinic acid, 3 g per day, ascorbic acid, 3 g per day.

There was a psychiatric hospital much closer to her, and her parents decided she could not travel 100 miles per visit in order to keep in contact with me. This hospital does not believe in the orthomolecular approach so she did not get very far into the treatment program that I had laid down for her. A recent report from her parents showed she was very ill and heavily tranquilized.

Lorraine: When seen August, 1969, this girl had been unable to take her mind off her own breathing for six years. She had perceptual changes including visions, many

illusions, feelings of unreality. She was paranoid, blocked frequently, was confused and deeply depressed. She was given a series of 9 ECT, and on leaving the hospital was much better. Because of distance she did not come back for follow up. As with her sister, the megavitamin approach had barely gotten started.

In August, 1971, the father of these twins reported that his daughter had regressed when the vitamins were discontinued even though continuing to take standard therapy.

Twin Pair Number H

The course of their illness is best described by a report prepared by their mother, a nurse.

I first became aware of the history of these twins when their father called me in October, 1966. He stated his sons had then been ill over three years, had cost him over \$25,000 in care, and that one had been placed in a psychiatric hospital upon the advice of a psychiatrist who had diagnosed them as suffering from an "identity crisis" for which he recommended treatment consisting of separation. The twin at home had recovered on nicotinic acid, but the physician in charge of the twin in the hospital absolutely refused to consider using it for his patient.

MOTHER'S REPORT

May, 1963: B. and R. graduated from an Academy, a church-sponsored boarding high school, with scholastic honors. They had experienced a normal childhood and adolescence thus far.

June through August, 1963: B. and R. worked as youth counselors. They had some conflicts with authority, but many boys their age do.

September, 1963: B. and R. entered university, a denominational college, as freshmen. They had not taken ACT tests their senior year in high school as many do, and so they took them during freshmen week. On the basis of these tests, they were permitted to register for

only 12 semester hours credit. Later, when hospitalized and evaluated extensively, B. was reported to have above average intelligence.

Heartaches Begin —October, November, 1963: B. began to call long distance, collect, several times a week expressing much anxiety. I wrote my sister, who has a child with CP, that "we have a real problem." His Freshman Composition teacher and B. were not getting along. The teacher had told him that his ACT scores were very low and he might have to face the fact that he was not college material. B. was refusing to turn in assignments. At midterm he received a D in Freshman Composition, a B in German, and a C in all other subjects.

R. seemed all right at this time although he wrote letters expressing anxiety about B. and appealing for us to intervene in some way.

Late November, 1963: A letter was written appealing to the teacher to do what he could to help B. The teacher, a young instructor, seemed threatened by this because of B.'s father's status in the (anonymous) Conference. (He is executive secretary for one of the departments). He was overheard by another student discussing the problem with the head of the English Department and making the statement that he didn't care who B.'s father was, that B. was not college material. The student overhearing the conversation reported this to B.

My husband had several interviews with the Dean of Students, a brilliant man with a doctorate in English and not in behavioral science. He took what we considered a very rigid attitude toward the problem, laid down the law to B., was very supportive of the instructor with whom B. was having the conflict, and things got worse.

December, 1963: Christmas vacation was happy. We had a New Year's party. B. did the planning and inviting.

January, 1964: B. ran away from school. His departure was not discovered by the dormitory dean until the morning after he left.

R. had not reported it although he was B.'s roommate. B. turned up at home in the afternoon, reporting that he was joining the Navy—that he had taken the entrance tests and had passed them very well—that they wanted him there. Since Seventh-Day Adventists believe in non-combatancy, we talked long and hard to discourage this and have questioned the wisdom of doing this since B. was to sign the final papers the next day, but by that time we had persuaded him not to. It was semester test time, and B. was persuaded to go back to take his tests. He consented to take all except Freshman Composition and passed all of the courses except this. February, 1964: My sister invited B. to come to her house in Washington, D.C., and transfer to another college. He decided to do this. We had misgivings about what separation would do to the twins, but felt that there was no alternative. B. went to classes for a couple of weeks, but had really no desire to continue and so dropped out. He began seeing a psychiatrist—a friend of my sister's—and got a job on construction. We discovered a letter on R.'s dresser at school stating that after this time advisors had been assigned for freshmen. They had had none prior to this time. The university was having "growing pains" because of very rapidly increasing enrollment.

March, 1964: It was becoming apparent that R. was not doing well. He was sleeping much of the time. The second semester he had registered for only 11 hours credit. One course was art. He was doing well in this and average or below average in the others.

April, 1964: We received a notice from the Dean of Students that R. was on probation because of excess worship absences. My husband talked to the Dean, but he seemed to feel this was willful violation and must be punished. He received a "U" in citizenship, a thing which later seemed to prey on his mind and which his psychiatrist was successful in having removed from his permanent record.

HISTORY AND TREATMENT OF IDENTICAL TWINS

May through July, 1964: R. came home at the end of May. He had passed all of his courses, but his CPA was slightly less than average. He seemed withdrawn. R. decided to do counseling again as a summer job.

B. wanted to come home and work. Against the advice of his psychiatrist he came. He worked at the camp meeting site, preparing the building and grounds for the annual church camp meeting, and lived at home.

R. began to complain of stomach trouble at the youth camp and withdrew more and more. The director called us and said he should be seen by a doctor to determine what was wrong. On our way home he seemed to be in a daze. The remark he made that sticks in my mind is, "I will be a success, won't I, mother?" He was seen by a doctor who could find nothing physically wrong. He gave R. Elavil.

August, 1964: We took a trip to the World's Fair in New York. B. participated in seeing the sights, but R. did not after the first day. He seemed in a daze, was very much depressed, and slept a lot. We were staying on the sixth floor and were afraid R. might try to jump out of a window. He did not—just slept all the time.

September, 1964: B. called me at work and told me if I did not want a suicide to happen in the house I had better come home immediately. I did. R. seemed in a daze. He said he had heard neighbors in the living room talking about him. He asked me if I thought he was a homo. He said a boy at school had said to him, "You'd make a good homo." I called a psychiatrist of our faith, and it was arranged for R. to be admitted to a mental health unit the next day. In a few days the psychiatrist called and said R. was very depressed and needed electro-shock therapy.

B., in the meantime, had registered for courses at the local community college and was seeing a local psychiatrist. The psychiatrists conferred and decided that since one twin dominated and the other was dependent they should be separated.

They felt they should work it out so that B.

would decide to return to my sister's.

October, 1964: R.'s shock therapy was discontinued. R.'s doctor felt it was having adverse effects. He was not interacting very much in the mental health unit either, or participating in group therapy or individual therapy.

November, 1964: Thanksgiving R. was permitted to return home, and we visited my sister for a few days. He seemed to enjoy it, but withdrew and took to his bed after the first day. B.'s psychiatrist—the one he had been seeing when he was staying with my sister before—suggested we double the tranquilizer R. was on, and after another day he got up and at least sat in the room with the rest of us.

B. had quit school. He and his father had frequent quarrels. He told both of us that he was in love with me. He read anything related to psychology he could find, including my **Merck Manual**. He read the section on schizophrenia, showed it to me, and said, "Mother, that's what I really have."

December, 1964: We would have spent a very dreary Christmas, but we had visitors for dinner and that brightened it a little. R. had become violent a few days before Christmas, and although he had been home on several weekend passes, he was not permitted to come home for Christmas.

January through May, 1965: B. went back to Washington to stay with my sister and have therapy there. He got several jobs, but fought with every boss.

R. came home from the hospital, but slept most of the time. He called B. often. One day he burned his plastic suitcase in the recreation room fireplace, making a terrible mess with melted plastic. He also started to take the wood furniture apart and burn that, but did not get it in the fire before discovered. We told him we would have no more of that unless he wanted to go to the state hospital and stay there where they could make sure he did not harm himself or others. He said B. had told him he did not like the recreation room furniture

and for this reason he was getting rid of it. We forbade all calls between them, but at times felt sure they did talk with each other when we were not at home. In May we received a letter from B. stating that he had been in a theater when everything became silent and a voice said to him, "You are a psychiatrist." We sent the letter to his therapist who said it was advisable that B. be hospitalized for intensive psychotherapy. He was hospitalized at Sheppard-Pratt Hospital.

June and July, 1965: R. continued to see his psychiatrist, but did not seem to make any progress. He continued to have auditory hallucinations. He thought a neighbor across the street was an old girl friend. No amount of explaining or discussion could change that impression. He looked around the room at times and said, "Everything looks so funny. Something queer is going on here." He slept much of the time. In June, I visited B. at Sheppard-Pratt. He seemed glad to see me, but in July we received a letter asking us not to visit as we had planned in August.

August, 1965: Things were very dreary. B. was in the hospital—first making progress—then regressing. He was becoming very hostile to us and calling R. frequently and upsetting him. B.'s therapist said that the hostility was a sign of progress.

September, 1965: B. ran away from the hospital and hitchhiked to Lansing. He did not hallucinate or seem to have any false perceptions at home. His therapist persuaded him to return to the hospital on the phone, and he returned on the bus. Of course, he was restricted after returning.

October, 1965: B. complained in his letters that life had no meaning. His therapist wrote that he was encouraging B. to get a job, but B. did nothing.

November, 1965: We visited Washington, and B. was permitted to spend the day with us. He seemed to be doing fairly well.

December, 1965: B. was not permitted to come home for Christmas. His psychiatrist said it would be dangerous for R. It was a dreary Christmas. R. would say from time to time, "I have a little baby somewhere."

January, 1966: R. seemed a little better. He got a job in a car wash, but quit after a few weeks. B. tried to obtain a release from the hospital and was certified.

February, 1966: No change.

March, 1966: B. ran away again from the

hospital. He went to my sister's. He was returned to the hospital by the police after spending a night in jail until it was convenient for them to take him back.

April, 1966: My husband visited B. at Sheppard-Pratt, but B. refused to even speak to him. R. started to work in the woods at the youth camp. He enjoyed working in the woods. The camp superintendent's wife fed him, and he stayed in an unused apartment.

May, 1966: R. returned home near the end of the month. He seemed threatened and anxious when more people came to the camp to work. We learned about niacin therapy from a friend in Virginia who had heard Lowell Thomas discuss it in a news broadcast.

I visited B. in Sheppard-Pratt. He was hostile, would not enter into any conversation. His stereotyped reply to every remark was, "I don't care."

June, 1966: R. started taking niacin. His improvement was immediate. I asked him how it made him feel. He said, "I don't have a wild imagination anymore." He did not talk about unreal sounds or sights anymore.

July, 1966: R. attended our General Conference session in Detroit at which there were approximately 20,000 people. He came with his brother D. on two successive Saturdays. He perspired very freely, but did not withdraw. He seemed very tired after returning home. He got a job in a picture-developing lab evenings and kept it the rest of the summer.

August and September, 1966: My husband and I took a short trip (three days) and R., who stayed home, did not take his niacin. He was hyperactive when we returned. We told him that he would

HISTORY AND TREATMENT OF IDENTICAL TWINS

either take the niacin or go to a hospital. He took the niacin and became rational again. Our hearts ached because of B. My husband called Dr. H. and got Dr. B.'s name. He saw him and R. began therapy with him. R. continued to improve. I saw B.'s therapist at Sheppard-Pratt and asked that he try this kind of therapy with B. He refused.

October, 1966: B. returned home. All the family were tested for malvaria—the mauve factor test. The twins' test was positive.

November and December, 1966: B. began taking niacin. He got no flush from the initial dose as R. had. He got a job, but frequently changed. R. had been working steadily since the first of November at a furniture mill. B. also got a job at the mill after Christmas. This was not a good arrangement.

January through March, 1967: B. quit at the mill and began working delivering books and magazines for a news company. R. also quit the mill and began to work for Servomation.

April, 1967: B. got hepatitis and vomited everything he ate or drank. Doctor stopped his niacin. R. also had hepatitis, but was not so violently ill. He was switched to the amide form of niacin. He was able to stay on the job. B. became increasingly psychotic and hyperactive. He pulled the phone loose—said he had to rearrange the color of the wires and that people were listening to him, took the dishwasher apart, terrified his father, who woke up one night to find B. sitting on the side of the bed glaring at him, walked around dragging one foot carrying a statue of the thinker upside down, talked all night long, and many other things. B. and his father came to physical blows and I had to intervene because I was afraid that someone would be seriously injured. The situation was extremely dangerous. We thought it would be necessary to hospitalize B. in a state hospital, but Dr. B. was able to hospitalize him in Detroit—gave him double doses of niacinamide and a tranquilizer. In 24 hours, when I visited him, he was

rational again. His hepatitis improved gradually. The tranquilizer was gradually discontinued.

Summer, 1967: Both boys continued to improve. Their attitude toward authority is improving. They go to church voluntarily. They work quite regularly. Sometimes they tire easily. They seem to require more sleep than most people. Sometimes the schiz odor is present in their rooms, but their improvement seems sustained although gradual. There has not been any significant regression for several months.

-COURAGE-

Things are not roses by any means. We seem to be going through developmental stages all over again. B. and R. lack self-confidence. B. denies illness at times. He is just now recovering from an episode brought on because he did not take his medication regularly and was on the verge of another psychotic episode. However, we caught it before it was fullblown, and so avoided the psychosis we had when B. had hepatitis. Life is far from ideal, but we are trying to cope with a day at a time.

End of Report

In November the parents sent the following report:

"November, 1971: Our boys are doing very well. R. has had a civil service job for over three years now. We feel he still is learning how to live and has a way to go as far as maturity and use of judgment is concerned. His years of sickness prevented progress toward maturity, but he is going forward now. He still takes 6 g of niacinamide daily.

"B., the twin who was in the state hospital for over a year, has been out of the hospital over a year now. He is studying accounting at L. B. University and is doing well. He is still followed by the Mental Health Clinic. My husband was able to persuade the physicians at the state hospital to give B. niacinamide. At the time he was hospitalized he was having trouble retaining it and was

vomiting, etc.

"B. does not get the niacinamide in a large dose and it is made up in a potassium base, but he has no trouble now in retaining it. He gets 1 g per day along with Mellaril. He has no paranoid symptoms, is not depressed, and is not troubled with any incorrect perceptions. B. seems to be able to make decisions better than R.

"You might be interested to know that my husband discovered he has diabetes in August. Also, when his mother read your book, **How to Live With Schizophrenia**, several years ago she called to say that it described the illness my husband's father had had all of his life. My father and sister have diabetes. So it seems logical to assume that B. and R. could have inherited a carbohydrate chemical abnormality."

Twin Pair Number 1

Born 1950. Only one twin has been examined. She was seen in March, 1968, because of antisocial behavior, including stealing, lying, promiscuous behavior, etc. On examination she had the following symptoms:

Perception: visions, hearing another voice in her head, hearing her own thoughts, as well as a large number of illusions and other perceptual changes.

Thought: blocking, paranoid ideas, deja vu, easily confused.

Mood: very depressed.

I diagnosed her as early schizophrenic and started her on therapy. It soon became evident that it would be impossible to treat her at home because of her continual delinquent behavior, but even more because of her parents' attitude. The mother was intensely hostile and vindictive and seemed psychotic herself, while the father refused to purchase medication for her. She was admitted to hospital on March 27 to April 5, 1968, and received 5 ECT. For the next year her course was stormy. She fought with her parents, ran away, eventually was thrown out and went on social aid. It is doubtful that she took her medication, and she was very erratic about

keeping appointments. She began to drink heavily. In November, 1969, she was badly beaten by her boy friend and was brought to the emergency of the hospital and admitted. I took advantage of this and gave her another series of ECT (8). After discharge a week later she took an overdose of Mellaril, was again admitted and then committed to the Saskatchewan Hospital, North Battleford, where no evidence of psychosis was found. I have not seen her since then, but her behavior is no better. Her Orthomolecular treatment, which was never properly followed up because of an uncooperative family, was finally interrupted by this hospital, and she remains ill. Her HOD scores were:

| TS | | PerS | PS | DS | SF |
|-------------|-----|------|----|----|----|
| March 5/68 | 53 | 15 | 4 | 14 | 4 |
| March 11/68 | '36 | 6 | 0 | 8 | 2 |
| May 8/68 | 100 | 21 | 6 | 11 | 7 |
| June 9/68 | 68 | 14 | 2 | 8 | 5 |

Late in November, 1971, her twin sister was referred to me for consultation and treatment. However, she did not show up at the appointed time, apparently a habit shared with her twin. The referral suggests she is beginning to de-compensate.

Twin Pair Number J

Born 1951.

Lois: When seen in April, 1971, Lois gave as her chief problem jealousy of her twin, present for about two years. Lois was slightly lighter in weight than her sister at birth. Both twins were so alike physically it was difficult to distinguish them.

She was referred to a psychiatrist late in 1968 for treatment of hysterical spells, insomnia, and difficulty in getting along with her parents. He diagnosed her as a neurotic behavior disorder.

In 1969 Lois gave birth to a stillborn girl. One month later she was admitted to a general hospital and from there was transferred to a psychiatric ward in

HISTORY AND TREATMENT OF IDENTICAL TWINS

November, following a suicide attempt. She was depressed and hostile. She was given a series of ECT and chemotherapy and discharged in mid-December, diagnosed schizophrenic. A few days later another attempt at suicide led to another admission for a few days. In January, 1970, she was admitted a third time and received another series of ECT. Her fourth admission followed an overdose in June, 1970, after which she was followed as an outpatient.

When I first examined her (AH) she still saw visions, heard voices, was unreal, very paranoid, blocked, and was depressed. She was then started on the Orthomolecular approach.

For the next two months there was no improvement, and she was placed on the waiting list for admission for ECT. In the meantime her medication which had consisted of nicotinic acid, 8 g per day, ascorbic acid 2 g per day, thiamine 1 g per day plus amitriptylene 75 mg per day was altered by removing amitriptylene and replacing it with triavil. She was admitted August 27, but when I examined her August 28 she had over the three weeks apparently recovered and she was promptly discharged.

However, this apparent recovery was short-lived. A few days after discharge she became very depressed and confused. One day she appeared in my office very ill, and she was promptly admitted as an emergency and given a series of 9 ECT. She was discharged much improved. When seen one month later she was well, i.e., free of all symptoms, living at home and getting on well with her parents and her twin sister, and was making realistic plans for the future. Her maintenance medication consisted of megavitamins only. HOD scores were:

| Lois | TS | PerS | PS | DS | SF |
|-----------------|-----|------|----|----|----|
| March 971 14 | 160 | 41 | 9 | 14 | |
| August 10 | 208 | 50 | 13 | 16 | 16 |
| August 28 | 4 | 0 | 1 | 0 | 0 |
| Septembers | 35 | 5 | 3 | 8 | 5 |

November 10/71 10 0 1 0 0

Linda: Linda's parents became aware of the HOD test and tested both daughters. Linda tested in the schizophrenic range. Because of this and because they were aware of the genetics of schizophrenia, they started her on nicotinamide 3 g per day. Then they arranged for her to be referred to me. Linda was very reluctant to come because she had developed an aversion against tranquilizers, having seen their effect on Lois. They thought I would give her the same tranquilizers. She continued on nicotinamide for three months and then stopped because she began to suffer from headaches. When I saw her a month later she was much better, having fewer perceptual changes. She believed the nicotinamide had produced her improvement. She agreed to try nicotinic acid instead. Her HOD scores were:

| Linda | TS | Per S | PS | DS |
|--------------|-----|-------|----|----|
| March 13/71 | 57" | 11 | 8 | 6 |
| August 10/71 | 39 | 10 | 2 | 4 |

Twin Pair Number K

Born May, 1955. Dennis was a few ounces lighter at birth than Douglas, but both were so similar it was difficult to distinguish them until Douglas had a silver tooth placed. About one year before he suffered a series of dizzy spells and fainted once. A three-hour sugar-tolerance test showed severe relative hypoglycemia. While in hospital Dennis told his parents he hated being a twin and was hostile because of this toward his parents. Over the year he began to suffer episodes of depression which worried them. As the twins grew Dennis always remained lighter and thinner from front to back, but he performed better in school until two years before when Douglas surpassed him.

When Dennis was four he stuttered for about four weeks. Seven years ago (age 9) he began again to stutter whenever he became nervous. However, he was able to win an oratory contest in spite of this.

About eight months before Dennis was seen, his mother started him on nicotinamide, 1¹/₄ g per day, plus a general

multivitamin preparation. He promptly recovered and as long as he took the vitamins remained well. But he resented having to take vitamins, went off them several times, and on each occasion became depressed again. Dennis was not schizophrenic but was schizoid or, more accurately, vitamin B3 dependent.

His twin, Douglas, had been placed on a multivitamin preparation since age 12. In July, 1971, he went to camp and forgot to take them with him. When he came home he was very depressed, listless, and tired, much like Dennis during his depressions. Within two days starting them again he became well.

Neither Dennis nor Douglas was schizophrenic, but it is clear from their response to vitamin B3 that they were vitamin B3 dependent. Dennis had a hyperactivity score of 47. Normal range is 27 to 45. Douglas, when I saw him, was normal.

Twin Pair Number L

Albert C, date of birth, March, 1965, was referred because of a learning disability. He was very hyperactive, had a reading problem, and found it difficult to comprehend words. Words moved laterally, dots ran together. He had nightmares wherein he saw himself kicking people around. When someone called him he would hear the same call over and over. His hyperkinetic score was 85. He was started on nicotinamide, 3 g per day, Pyridoxine, V2 g per day, and the sugar-free diet. Two months later he was much improved, no longer had his nightmares, but still had a few perceptual illusions. His score had dropped to 51. When last seen August, 1973, he was nearly normal.

Tom C. also had the same learning disability and had difficulty understanding meaning of words. Remedial reading was of little help. His behavior at home was very bad. He suffered from insomnia, walked in his sleep.

If he was called, often he would hear the same call the next morning. He described this as if his brain was calling him. He also had a

slight speech defect, a peculiar lisp. His behavioral score was 79.

In two months on the same program as his brother he was much improved. His score came down to 59. He was much better in school, was able to read and enjoyed it. Before going on medication he could read poorly. Since then this mother reported he will read a book with it in one hand while doing something else. Teachers were impressed with changes in these twins.

Twin Pair Number M

Date of Birth, 1939. This patient began to suffer episodes of depression in 1958 for which she received a series of ECT, psychotherapy, and tranquilizers. She was then able to get by until 1960 when her depression was again very severe. On admission she also complained of auditory and visual hallucinations. She was given 10 ECT, nicotinic acid, 3 g per day, and improved. On discharge she was maintained on tranquilizers only. She was readmitted January, 1962, for six weeks, again very depressed with auditory hallucinations, and was treated by tranquilizer medication only. She was positive for mauve factor (kryptopyrrole), and her HOD scores were very high as shown below.

| TS | PerS | PS | DS | |
|--------------|------|----|----|----|
| May 1960 | 75 | 21 | 6 | 13 |
| October 1960 | 44 | 8 | 6 | 8 |
| January 1962 | 39 | 8 | 5 | 10 |
| March 1962 | 50 | 12 | 5 | 12 |

The patient married in 1962. Until 1971 she continued to suffer episodes of depression. She then sought help and received individual and group psychotherapy for 20 months with no improvement. During this period she continued to have episodes of hysteria when she would scream and fall down and cry. Her husband had long felt she required nutritional treatment and had her referred to me.

November, 1972, she still recalled the visual and auditory hallucinations, but she still felt her head was like a big

HISTORY AND TREATMENT OF IDENTICAL TWINS

balloon. She was paranoid, had blocking, and suffered from a defective memory and poor concentration. She was still depressed.

She was started on nicotinic acid 3 g, ascorbic acid 3 g, Pyridoxine $\frac{1}{4}$ g, and on a sugar-free diet.

Three months later she was free of depression, was no longer afraid to be alone, and had begun to enjoy life for the first time in many years. Her head felt like a balloon infrequently.

She lost her schizophrenic body odor which her husband had described.

On June 1, 1973, she was more depressed and again was troubled by her voices. The nicotinic acid was doubled, and she was started on triavil one TAB twice each day. By August 30, 1973, her voices were gone, but she still was tense just before her periods. She and her husband were pleased with her improvement so far.

| | TS | PerS | PS | DS |
|----------------|----|------|----|----|
| November 10/72 | 65 | 14 | 5 | 11 |
| March 5/73 | 70 | 13 | 5 | 12 |

Since then she has continued to improve and is well.

December 15, 1972, she brought in her son M., age seven. M. complained that he had difficulty understanding big words and had a reading problem. His mother reported a change two years before when he became hyperactive, began to wander around at night as if asleep, and would urinate into open drawers, etc. He got on fairly well in school, but at times seemed out of contact with reality.

He had a few visual illusions at night, was absent-minded, and had difficulty with math and reading. On hyperkinetic scale he scored 101. He was started on nicotinamide 3 g, Pyridoxine $\frac{1}{4}$ g, and the sugar-free diet.

About 10 weeks later he was slightly better, but his behavior remained bizarre. His behavioral score came down to 75. By June, 1973, he was nearly well and his score was down to 53. August 30, 1973, his parents reported that if he ate sweets and became

careless with diet he would become very restless. However, he remained nearly well when he was maintained on the program.

Mrs. Y., identical twin, Je P, was referred complaining of severe fatigue for the week preceding her periods. This had been present for one year. However she had first become very upset about six years before over the psychotic behavior of Mrs. J. She consulted a psychiatrist on two occasions who advised her not to visit her sister. After that her anxiety slowly began to clear. This time, in addition to her fatigue she also complained that she could not concentrate on reading, nor had she any interest in doing so. When she was tired her memory became very bad and she became very nervous and tense. It was obvious that she was not schizophrenic, but neither was she well. She was started on a vitamin program, but so far there has been no follow up. The third sister of this set of triplets was not identical and was well. She had not consulted any psychiatrist.

Discussion

The pairs of twins who received different treatment may be used for drawing conclusions about treatment. Each pair will yield data as reliable as can be obtained from two groups of about 50 patients. Thus each pair is equivalent to a clinical trial. Not all the twins from these 10 were available for treatment.

From twins B, one failed to respond to standard psychiatric care over nearly two decades of illnesses and therapy. Orthomolecular treatment restored her to normal and converted her son (considered retarded) to a healthy, mentally normal youngster. Her twin, whose history of relapse and partial recovery was nearly identical, was never given the benefit of Orthomolecular therapy and over the years of her twin's recovery has had even more frequent relapses. It is doubtful whether she has shown any period of well-being. Very few patients do with such a history of frequent admissions to hospital.

The E twins comprise another clinical

trial equivalent. R.S. recovered many years ago with ECT but, having relapsed, failed to show any improvement until megavitamins were added to her program. Her twin R.A. was nearly well on megavitamins, but was taken off by her psychiatrists in Toronto during a relapse. Since then she had become symptom-free, but had not been able to reach any level of normality, was dependent on social welfare, and felt generally ill at ease.

The H twins show a similar history. Each twin recovered only after going onto megavitamin therapy, having failed to respond to the best standard treatment.

Thus, out of these 13 pairs, we have the equivalent of at least three major clinical trials, all showing that Orthomolecular therapy is superior to standard psychiatric treatment.

Family D is a typical B3-dependent family. The twin girls were not Bleulerian schizophrenics, but were accurately classed as schizoid (see Heston, 1970) or latent schizophrenics. There is little doubt they would have been clearly psychotic in a few years like their father, brother, and younger sister.

I have suggested that there will be little additional progress in unravelling the mode of inheritance of schizophrenia until studies are done on entire families with every member who is B3 dependent. This is practical since a therapeutic trial will soon show which members are B3 dependent. The genetics may turn out to be quite simple.

Whether or not a B3-dependent person develops schizophrenia will be determined by the balance between need and supply. The extremes will range from situations where every person becomes ill by being on a B3-deficient diet (which will be then termed pellagra) to a situation where every member is B3 dependent. Saturation tests may be useful one day in measuring how much B3 is needed. In Table 1: (1) I am showing E.A. as well when in fact he suffers bouts of tension controlled by dilantin and phenobarbital.

(2) Relapsed three years after stopped

vitamins. On treatment recovered.

(3) Treatments are listed in chronological order. Thus Orthomolecular treatment (2) for M.G. came after standard treatment (1) had failed to prevent recurrent relapses in this twin B.

There was a perfect concordance between kind of treatment and response. None of the patients on standard treatment recovered although some showed varying degrees of improvement. When improvement was substantial it was usually short-lived. It is apparent standard therapy did not interfere markedly in the natural history of this disease. Only Orthomolecular therapy brought about lasting recovery. Where it was interrupted, usually by psychiatrists who ordered it discontinued, then relapses occurred and the natural progression of the illness resumed. Out of 23 patients, the 17 who were treated with Orthomolecular treatment are well or much improved. Six treated by standard treatment are chronically ill.

Animal experiments have shown that prolonged pellagra requires megadoses of vitamin B3 to control the condition. Similarly it is known that chronic human pellagrins require megadoses. A simple deficiency is converted into a dependency. This means that B3-dependent subjects who might require only twice average needs may in time require up to 1,000 times the average requirement. It also means that small preventive doses given to all B3-dependent families will prevent any further expression of the condition, i.e., it becomes feasible and economical to prevent any more attacks of schizophrenia and allied conditions by a proper supplementation of the diet.

Most of these children are now well, but require maintenance doses of vitamin B3. In these families the transmission of schizophrenia has been interrupted by environmental manipulation, i.e., by a change in the nutritional environment so that the gene or genes which predispose to schizophrenia are rendered inoperative, as far as pathology is concerned, with nicotinamide. The

HISTORY AND TREATMENT OF IDENTICAL TWINS

TABLE 1

Treatment and Response of 13 Pairs of Identical Twins, 8 Concordant For Schizophrenia

| Twins | Treatment | Condition |
|-------|-------------------------|---|
| A | E.A. D.A. | 1. None required(1) 2. Orthomolecular(2) well |
| B | M.G. O.G. | 1. Standard 2. Orthomolecular(2) 1. Standard no effect on disease well sick |
| C | A.K. L.H. | 1. Orthomolecular 2. Standard 1. Standard much improved sick sick |
| D | B.B. I.B. | 1. Orthomolecular 1. Orthomolecular well well |
| E | Reg. S. Ren. A. | 1. Standard 2. Orthomolecular 1. Standard 2. Orthomolecular 3. Standard 4. Orthomolecular sick much improved sick well improved well |
| F | M.A. E.A. | 1. None required 1. Orthomolecular well well |
| G | Linda D. Lorraine D. | 1. Orthomolecular 2. Standard 1. Orthomolecular 2. Standard improved deteriorating improved deteriorating |
| H | R.B. B.B. | 1. Standard 2. Orthomolecular 1. Standard 2. Orthomolecular sick well sick well |
| I | A.K. J.K. | 1. Orthomolecular 2. Standard 1. Referred improved sick no show |
| J | Lois Linda | 1. Standard 2. Orthomolecular 1. Orthomolecular no effect well well |
| K | Den G. Doug G. | 1. Orthomolecular 1. Orthomolecular well well |
| L | Albert C. Thomas C. | 1. Orthomolecular 1. Orthomolecular well well |
| M | J.J. Je P. Ji P. | 1. Standard 2. Orthomolecular 1. Standard 2. Orthomolecular (nonidentical triplet) according to family is well ill well slow response no follow up |

potential positive attributes of these genes can then operate. This is not fantasy because I have found this of practical use in my practice. Between July 1, 1967, and July 1, 1971, I treated 130 children under age 15 for various behavioral and learning disorders. Sixty-four (50 percent) came from vitamin B3-dependent parents. Of these, 56 had one parent B3 dependent and eight came from two B3-dependent parents. Twelve were adopted, and there was no information about their parents.

Out of 130 children, 12 had been adopted. For the past year I had the impression that adopted children were over-represented in my series, comprising 9.2 percent of my total population of children seen over one year. Thomas (1971) replied to my enquiry by listing the number of adoptions compared to the number of live births in Saskatchewan over the past 12 years. This is shown in Table 2. Over the 12 years about 2 percent of all babies born in Saskatchewan were adopted, the major increase occurring over the past six years. About five times as many adopted children appeared in my series. A more valid comparison would be by using the first six years since most of the children in my series were between ages six and 12. The adopted children in my series are therefore appearing

six times as frequently as one would expect by chance. This suggests that schizophrenic girls are more apt to become pregnant and give up their babies for adoption. Supporting this view is the observation by Hawkins (1972) that at the Youth Consultation Service of the Episcopal Diocese of Long Island 70 percent of the unwed mothers who applied for help had HOD scores in the schizophrenic range. Of the unwed mothers who applied for help with a second unwed pregnancy 90 percent had unrecognized schizophrenia. Pregnancy alone does not elevate HOD scores, but unwanted pregnancies will elevate the depression score of the HOD. An examination of 100 consecutive women requesting therapeutic abortions showed all scores, but depression scores were in the normal range.

As a corollary adoption agencies will have to advise potential adopting parents of the presence of schizophrenia in either of the parents. The adopting parents can then be instructed how to protect their adopted child against developing any of the schizophrenic-spectrum diseases by giving them prophylactic treatment with vitamin B3 and good nutrition.

The diagnostic criteria I applied to all the adolescent and adult patients were not those described by Bleuler, which I

TABLE 2

Finalized Adoptions (Fiscal Years) and Live Births (Calendar Years) in Saskatchewan 1959/60 to 1970/71

| Year | Finalized Adoptions | Live Births (1) | % |
|---------|---------------------|-----------------|-----|
| 1959/60 | 309 | 24,319 | 1.3 |
| 1960/61 | 350 | 24,088 | 1.4 |
| 1961/62 | 326 | 23,994 | 1.4 |
| 1962/63 | 326 | 23,341 | 1.4 |
| 1963/64 | 350 | 23,543 | 1.5 |
| 1964/65 | 366 | 22,682 | 1.6 |
| 1965/66 | 422 | 20,494 | 2.1 |
| 1966/67 | 609 | 19,037 | 3.2 |
| 1967/68 | 556 | 17,993 | 3.1 |
| 1968/69 | 557 | 18,197 | 3.0 |
| 1969/70 | 653 | 17,592 | 3.7 |
| 1970/71 | 598 | 16,490 | 3.6 |

(1) Live births during the calendar years of 1959, 1960, . . . 1970.

consider quite inadequate and archaic.

I follow the criteria recommended in the Report of World Health Organization Study Group in Schizophrenia (1957). They recommended five major kinds of changes after the cautionary statement "there is no single psychological abnormality which is indispensable for the diagnosis":

Geneva September 9 -14, 1957. Amer. J. Psychiatry 115, 865-872, 1959.

(1) An unmistakable change of personality, or an accentuation of those traits of personality commonly called schizoid, which lessens contact with other people and disturbs healthy understanding of what is really occurring in the patient's world.

(2) Autism. A condition of social withdrawal with permanent or sporadic preference for private modes of thought and behavior.

(3) Disturbance of thinking which may lead to bizarre statements, abnormal syntactical, grammatical, or other linguistic usages, incapacity to pursue a sustained train of thought (blocking), and to a use of private symbols or illogical ideas understandable only by those who have full access to the Psychopathology of the individual patient's state.

(4) Shallowness or inappropriate affect.

(5) Disturbances of perception.

(6) Anomalies of behavior. Certain peculiarities of posture, gesture, and movement, e.g., laughing to oneself, grimacing in front of a mirror.

Following Davison and Bagley (1969) major emphasis is given to items 3, 4, and 5. Items 1, 2, and 6 are also present equally often in organic-like psychosis. Everyone of the patients described here had one of the main symptoms from items 3, 4, and 5, and most had several. None of the patients had any of the organic diseases described by Davison and Bagley (1969) then, nor have they appeared since the patients were examined.

Another question has to do with proof of

the twins' identity. It was impossible to get blood typing or fingerprints. However, these are not essential.

I depended on the parents' description of their children. If the twins were physically so alike that even their parents or teachers could not distinguish them easily, I accepted them as being identical. The twins I was able to examine were physically identical. My assessment agreed with the parents and with the patients except for the $2\frac{3}{4}$ year-old twins who were so alike a colleague and I could not distinguish them if they were not moving or talking. As soon as they became active they became distinguishable because the one that was ill was ungainly, more erratic, and spoke very poorly. The mother also could tell them apart only by their motor activity.

Of the nine twin pairs with one or both schizophrenic, the diagnosis was established by other psychiatrists in six pairs. In six pairs both members were psychotic. Of the "remaining three pairs one was considered abnormal and referred for treatment, but she did not come. Another, the triplet, is considered nervous by her family, and the third, from the A twins, was normal but somewhat nervous. This was readily controlled by simple sedation. Of the four schizophrenic-spectrum conditions, one pair had a schizophrenic father and a schizophrenic brother and this pair were seen as clearly ill only after they had changed markedly when placed on vitamin B3 therapy. The twin boys (F) had a schizophrenic mother and aunt. Only the remaining twins had normal parents. These findings are similar to those reported by others, i.e., that many children with learning and behavioral disorders are clearly related to schizophrenia. All four were concordant. If one looks at the entire series of 13 pairs, only two persons are considered well simply because they have not been evaluated. However, one of them is nervous and the other was referred for psychiatric treatment but did not come. It is clear that if one uses very rigid criteria which excludes all schizophrenic-spectrum conditions, the concordance was 67

percent. If, however, one includes all subjects who were not functioning at a normal level the concordance is closer to 100 percent.

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