The Hyperactive Child Syndrome

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During the past 10 to 15 years, a growing body of research has focused on the hyperactive child. More than 2000 articles have appeared in the scientific literature (*1*), and five books on the condition (*2, 3*) have been published, three (*3*) written specifically for parents of hyperactive children with the aim of helping them to understand and to manage their children's difficulties.

The hyperactive child (under various names) was described more than 100 years ago in the medical literature (*4*) and is not a modern invention or myth created by doctors, teachers, parents, or drug companies, as has been recently suggested (*5*). The hyperactive syndrome is probably the most common behavior disorder of children and, not surprisingly, it has found its way into the popular classical literature for children in several countries. Stewart (*6*) quoted an English translation of Hoffmann's *Struwel Peter*, the popular German tale written in rhyme for children:

> Fidgety Phil
> He won't sit still
> He wiggles
> He giggles. . . ."

and when told off:

> The naughty restless child
> Grows still more rude and wild.

The research of the past years has given us a better understanding of the different etiologies of this disorder of childhood, and of the efficacies of various treatments. As expected, the body of research has raised as many questions as it has answered.

Problems of Definition and Terminology

The many diagnostic labels given to this disorder indicate the existing uncertainty about etiology. Names such as "minimal brain damage" suggest that there is actual structural damage to the central nervous system. "Minimal brain dysfunction" (*7*) reflects the view that localized damage may be absent, but that neurochemical or neurophysiological dysfunctions are present. The diagnosis of "maturational lag" or "developmental hyperactivity" expresses the concept of delayed development, and suggests that the children will in time "grow out" of their problems, a view that has recently been challenged (*8*).

Other terms such as the "hyperkinetic child," the "hyperkinetic impulse disorder," and the "hyperkinetic child syndrome" are purely descriptive and do not imply any etiology. Recently, the name of this diagnosis has been changed in the third edition of the American Psychiatric Association's *Diagnostic and Statistical Manual* (DSM III) (*9*) to "attention disorder deficit with hyperactivity" to emphasize that the attentional deficit may be a more fundamental disability to the child than the other symptoms of the syndrome.

In spite of the diverse terminology, there is a remarkable similarity in the clinical description of the syndrome, and DSM III defines operational criteria for the diagnosis. At different ages different symptoms emerge as being the worst difficulties seen at that particular developmental period of the hyperactive child.

Diagnosis

The diagnosis of a hyperactive child is never made on the basis of a single symptom. Clinically, a number of symptoms clustered together in one child form the syndrome. This syndrome is present from early life and is not a temporary reaction to a particular environmental trauma. Hyperactivity and related symptoms may also occur as concomitants of other diagnoses such as psychosis, autism, cerebral palsy, and mental retardation. Most studies of hyperactive children exclude children with the above primary diagnoses.

The following operational criteria for diagnosis are listed in DSM III:

1) Excessive general hyperactivity or motor restlessness for the child's age. In preschool and early school years, there may be incessant haphazard, impulsive running, climbing, or crawling. During middle childhood or adolescence, marked inability to sit still, up-and-down activity, and fidgeting are characteristic. The activity differs from the norm for age both in quality and quantity.

2) Difficulty in sustaining attention, such as inability to complete tasks initiated or a disorganized approach to tasks. The child frequently "forgets" demands made or tasks assigned and shows poor attention in unstructured situations or when demands are made for independent, unsupervised performance.

3) Impulsive behavior as manifested by at least two of the following: (i) sloppy work in spite of reasonable efforts to perform adequately; (ii) frequent speaking out of turn or making inappropriate sounds in class; (iii) frequent interruption of, or intrusion into, other children's activities or conversations; (iv) difficulty waiting for one's turn in games or in group situations; (v) poor frustration tolerance; and (vi) fighting with children in a fashion indicating low frustration tolerance rather than sadistic or mean intention.

4) Duration of at least 1 year.

Description of the Syndrome at Different Ages

Although not much is known about the infancy of hyperactives, two retrospective studies (*10*) indicate that poor and irregular sleep, colic, and feeding problems occur more frequently in hyperactive than in normal infants. Clinically, these infants are frequently not cuddly and do not enjoy being held for more than a few minutes. As might be expected, these problems not infrequently result in feelings of frustration in mothers who find themselves unable to comfort their infants. However, not all infants who later become hyperactive children have difficulties in the first year of life.

Hyperactive toddlers are described as children who never walked but ran, jumped up and down holding onto the crib bars wearing a hole in the mattress, or climbed over the crib bars even when extra bars were inserted. The hyperactive 2-year-old is into everything, but does not play more than seconds with one object; sometimes the child seems

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"driven" from one object to another. A combination of impulsivity and an unusual lack of fear results in children who dart onto busy streets or climb into medicine chests, getting into dangerous situations unless closely supervised.

When the hyperactive child reaches 3 to 4 years, parents complain that the child is very demanding and does not listen. He cannot play well by himself and changes his activity constantly. He does not play well with other children because of his lack of concentration, his aimless activity, and his poor frustration tolerance. Parents despair that neither praise nor punishment is effective, that "nothing works." By the time a family is evaluated, the parents have frequently alternated between being more permissive and more punitive in an attempt to help their child. Not infrequently, the parents will disagree as to what methods are most helpful.

At this age, parents frequently experience the first rejection of their child by others outside of the home. Friends and neighbors and even family members do not want the hyperactive preschooler in their houses because the child touches everything, frequently breaks things, and does not allow his parents to converse with other adults without constant interruption. The nursery school may find the child too difficult to tolerate and ask the parents to withdraw him. It is our experience that interested, experienced nursery teachers can do much for these youngsters; with some professional guidance to nursery teachers, the majority of hyperactive preschoolers of normal intelligence can be maintained in normal nurseries without medication, and benefit a great deal from the experience. The 3- to 4-year-old hyperactive in a school setting is most deviant when he has to engage in sedentary activity that requires concentration (*11*). Nursery teachers recognizing this can have many constructive alternatives.

The Hyperactive in Elementary School

Most hyperactive children are first referred for assessment during the first three grades of elementary school. This is not because the children's behavior is worse between 6 and 9 years, but because their specific handicaps make compliance to the demands of school particularly difficult. Behavior with which tolerant parents and an experienced nursery teacher can cope is frequently not tolerated in a class of 30 or more children, where discipline in a group, sedentary behavior, and concentration on cognitive tasks are required. Also, society begins to expect "achievement" at this time and teachers soon pick up not only that the hyperactive child is difficult to handle in the classroom but also that he is underachieving for his intellectual potential.

Hyperactive children in elementary school behave considerably better in one-to-one situations and demand individual attention from teachers. Their cognitive performance compared to normal children is less deviant in individual testing than it is in a school group test (*12*). The hyperactive's social behavior and peer relationships are hampered by difficulties with impulsivity, low frustration tolerance, poor concentration, and often poor self-esteem.

In adolescence, the most serious problems of hyperactives relate to school failure and to the frequency of antisocial behavior (*13, 14*). Court referrals for reasons such as theft and truancy are made for 25 to 50 percent of these adolescents. They continue to have difficulty with concentration, and this, together with decreasing motivation, accounts in large part for their school failure. They suffer from low self-esteem, having been subjected to failure in many situations. Both the hyperactive adolescent and his parents complain about his difficulty in making close friends, which can be the most troubling of all problems to the hyperactive during adolescence, when peer group relationships are very important. Poor social skills, frequently present in the younger years, take on new significance in adolescence. Restlessness at this age takes the form of more channeled activity; the adolescent hyperactive is always busy with something. Impulsive behavior continues to be a severe problem.

The above behavioral characteristics are seen typically at these ages. However, few individual children have all these characteristics. In practice, we see children who have most of these problems, but not all, and who in addition may have various reactive problems that are related to family interactions or are secondary to their experiences of rejection and failure at school, at home, and with peers. The difficulty these children experience with concentration gives an indication that concentration is not a unitary dimension of personality, but is inseparably linked to motivation and interest in the activity. Some hyperactive children have great difficulty with concentration in school and with homework and yet are described as concentrating well on certain hobbies they enjoy at home.

Statistical techniques (factor analysis) were not able to confirm the existence of a homogeneous syndrome (*15*). However, Loney *et al.* (*16*) demonstrated that when variables were selected from a single source (mother's description), factor analysis resulted in two relatively independent symptom complexes. Aggression accounted for 46.6 percent of the variance and hyperactivity, 23.4 percent. The former correlated significantly with parenting variables and with socioeconomic class. Loney *et al.* considered that aggression and related behavior are secondary symptoms, and should be distinguished in terms of treatment and outcome from the primary symptoms of the condition.

Summary. The behavioral characteristics of the hyperactive child are described at different stages of development. Recent and sometimes controversial research findings are discussed with respect to prevalence, etiology, treatment, and outcome. It is concluded that this syndrome can best be understood in terms of interactions between social, psychological, and biological variables.

Comprehensive Multidisciplinary Assessment

The following types of evaluation are desirable in the diagnosis and formulation of treatment strategy for suspected hyperactive children.

1) A careful history of the pregnancy, delivery, and the child's development from infancy on.

2) Assessment of the child's behavioral aberrations; the specific symptoms present, their severity, frequency, the degree to which individual symptoms are situational, and the duration of the problem.

3) An educational assessment to determine if a specific learning disability is present and if so, its nature.

4) Assessment of the intrapsychic processes of the child: how he views himself, his family, his peers, his school, and what his personality strengths are.

5) Assessment of the interaction of the child's family. Cause and effect are irrelevant here, because of their constant interaction. Parents should be helped to interact constructively, and their guilt

and sometimes blaming of one another reduced if possible.

6) Assessment of the child's school. Is the child in an environment conducive to learning? Can a specific remedial program be incorporated into his regular school curriculum? How well is the teacher coping with the child who has these difficulties? The teacher needs to be brought into the treatment team as an important member for assessment, diagnosis, and management (*17*).

7) Assessment of the child's neurological status if a neurological lesion is suspected. Routine neurological evaluations of hyperactive children frequently reveal "soft signs" such as right-left confusion, clumsy gait, and strabismus. The significance of these "soft signs," and of electroencephalographic abnormalities is not known.

Prevalence of the Hyperactive Child Syndrome

Boys are affected much more commonly than are girls; ratios of 5:1 to 9:1 have been reported. The reasons for this disparity are not known.

Hyperactive children exist all over the world, in industrialized and in developing countries, in rural as well as urban communities. The prevalence data vary greatly; an incidence of 1 in 1000 for 12-year-olds has been reported for the Isle of Wight (*18*) whereas values of 5 to 6 in 100 have been given for American cities (*19*). There are several possible reasons for this discrepancy. The diagnostic criteria vary from country to country. For example, Stewart (*20*) found that 34 percent of children seen in a child psychiatry clinic in Iowa had unsocialized aggressive behavior as well as typical symptoms of the hyperactivity syndrome. In contrast, British workers would be likely to diagnose these children as having "conduct disorder" rather than the hyperactive child syndrome. The discrepancy also reflects differences in procedures for collecting prevalence data. Finally, actual differences in prevalence probably exist between inner city urban schools and stable rural communities.

Questionnaires concerning children's behaviors were sent to a large random sample of parents in Buffalo, 49 percent of whom reported that their child was overactive (*21*). When teachers in Urbana, Illinois, were asked to rate a random sample of children by questionnaire, their responses indicated that they viewed 48 percent of the children as distractible, 30 percent as hyperactive, and 50 percent as restless and unable to sit still (*22*). This indicates that parents' and teachers' expectations of normal children may be unrealistic, and points to the need for an adequate multidisciplinary assessment before a diagnosis is made.

In a comprehensive prevalence study in the East Bay area of San Francisco, Lambert *et al.* (*23*) attempted to reconcile the widely varying estimates of hyperactivity in children. Parents, teachers, and physicians were asked to identify hyperactive children in a random sample of more than 5000 children encompassing different socioeconomic and ethnic groups. Approximately 5 percent of children were considered to be hyperactive by at least one defining system (parents, teachers, or physicians), and 1.2 percent were considered to be hyperactive by all three defining systems. Lambert *et al.* recognized the difficulty of investigating the prevalence of a condition defined by behavior characteristics that are reported subjectively. They suggest that those who report the deviant behaviors (teachers and parents) contribute to the child's environment, and that their attitudes affect both the child's behavior and their perception of it. Robins and Bosco (*24*) in their work on estimating prevalence of treatment of hyperactive children, also stressed the importance of recognizing that hyperactive behaviors are defined by the child's social environment.

Etiologies

Although the etiology of the condition is unknown, there are probably various etiologies, with the syndrome representing a final common pathway for different antecedent variables. Historically, the cause was considered to be some form of brain damage, and many children were diagnosed as having the syndrome following the epidemic of encephalitis lethargica after the World War I (*25*). Because brain damage could not be demonstrated in many children with hyperactivity, brain dysfunctions, possibly genetic in origin, were considered as possible etiological factors; some evidence of the role of hereditary factors has been found (*26*).

Shaywitz *et al.* (*27*) presented evidence suggestive of decreased turnover of dopamine in the central nervous system of hyperactive children. They demonstrated a lower concentration of homovanillic acid in the cerebrospinal fluid of six hyperactive children, compared to normal children, after oral administration of probenecid. Shekim *et al.* (*28*) reported on the possibility of decreased norepinephrine activity in the central nervous system of seven hyperactive children compared to 12 normal children. Urinary excretion of 3-methoxy-4-hydroxyphenyl glycol (MHPG) was lower and that of normetanephrine (NM) was higher in the hyperactive children. Administration of *d*-amphetamine for 2 weeks to the hyperactives depressed the urinary levels of MHPG, NM, and metanephrine. Despite the widespread belief that hyperactive children have a disorder in the catecholamine system, there is no conclusive evidence for it.

Recent clinical theories that food additives or cerebral allergy contribute to hyperactive behavior have not been confirmed by research (*29*). However, these possibilities are still being investigated. High lead concentrations in the blood may be causal for a few hyperactive children (*30*).

The role of environmental factors remains largely unknown. However, the family and school environment are crucial variables affecting the child's behavioral aberrations. It has been suggested that in some cases the condition is the result of biological variations in children, made manifest by universal compulsory education (*31*).

Treatment

When environmental manipulations (such as parental counseling, behavior modification, and remedial education) do not suffice, medication, particularly stimulant therapy, is frequently prescribed. Many children, particularly those with mild forms of the syndrome, can be managed without the need for medication. For others, medication becomes very helpful and is usually used as an adjunct to various other environmental measures.

In the 1960's and early 1970's, many well-designed studies with placebo controls indicated that stimulant drugs—particularly methylphenidate (Ritalin) and dextroamphetamine—improved various symptoms in about 70 percent of hyperactive children. These studies confirmed earlier clinical work (*32*) which had demonstrated the efficacy of stimulants for hyperactivity. With respect to behavior, aggression was decreased (*33*) and purposeless activity became more goal-directed (*34*). With respect to cognitive tasks, there was an improvement in sustained attention (*35*) and less impulsivity (*36, 37*), better learning of rote material

(*36*), better discrimination of foreground and background (*37*), and improved performance of fine motor tasks (*38*).

The enthusiasm generated by these generally favorable short-term drug studies (3 to 6 weeks) resulted in widespread use of the stimulants, particularly in the United States. In 1970, the news media reported that 20 to 25 percent of children in Omaha schools were receiving stimulants. Although the figure was later found to be false, it led to congressional hearings and also to careful surveys as to how many children were being medicated. One such survey in 1971 indicates that 2 to 4 percent of school children were receiving drug therapy for hyperactivity (*39*), that Ritalin was the most frequently used drug, and that stimulants accounted for 88 percent of the drugs used (*40*). It was further estimated that approximately 600,000 children in the United States were receiving psychoactive drugs to control hyperactivity (*41*). Whether these figures represent overuse of drugs is a matter of personal opinion. Our own bias is that short-term drug studies lead to unwarranted enthusiasm about the efficacy of stimulants in affecting outcome of hyperactive children, and that stimulants should be used more conservatively and their use should be accompanied by careful monitoring. In our opinion, stimulants should not generally be used when there is evidence that the source of the problem lies primarily in a poor school or home situation. A careful assessment does much to avoid indiscriminate use of medication.

Long-Term Effects of Stimulant Therapy

Only a few studies have been addressed to the issue of long-term efficacy of stimulant therapy. Yet it is vital for physicians to know at what age the child should stop taking stimulants, to what degree stimulants are helpful for older children, and whether a child continues to benefit over the years from the same drug. It is possible (but not investigated) that tolerance develops to improvement of some target symptoms; indeed, clinical practice sometimes seems to indicate that the initial very positive effect becomes increasingly less dramatic with time.

In one study (*42*), when placebo was substituted for methylphenidate for 1 month in the year, only 17 out of 42 children were rated by their teachers as being worse during the placebo period, and yet teachers were found in this study to be more sensitive than parents at detecting drug-induced changes. Thus, many children who initially benefited from Ritalin gradually benefited less or required the drug less.

In a second study, the outcome in adolescence of a group of hyperactive children who had been treated with Ritalin for 3 to 5 years was no more favorable than that of two matched groups of hyperactive children, one of which received no medication and the second, chlorpromazine for 18 to 36 months (*43*). No differences were found in the following outcome measures at adolescence: reduction of hyperactivity, emotional adjustment, antisocial behavior, school performance (report cards and number of grades failed), and mothers' views of overall improvement. These measures were relatively crude and may have hidden more subtle favorable changes. In addition, random assignment was not made to the three treatment groups (for ethical reasons). The chlorpromazine and no-drug groups were first assessed, treated, and evaluated for 5-year outcome several years before the stimulant group, at a time when stimulants were not used in our clinic. The authors concluded that Ritalin continued to reduce some of the symptomatology of hyperactive children even after several years, but that the drug as the only form of treatment was not of sufficient efficacy to change outcome measures in adolescence. The only finding which favored the Ritalin-treated group was that an initial good mother-child relationship predicted outcome only in this group, which perhaps indicates that a good mother-child relationship interacts with a useful drug to predict outcome.

Side Effects of Stimulant Drugs

Reduced appetite and weight loss are frequent side effects at the beginning of treatment with stimulant drugs, but may wear off with continued use. Medication is usually given only at breakfast or at breakfast and at noon, to lessen these effects. Some children become dejected and more sensitive to criticism and others become irritable—side effects that often respond to dosage reduction. Other unpleasant effects are rare and include stomach aches, headaches, and urticaria; even more rarely, tactile hallucinations or severe regressions have been described. These disappear when stimulant treatment is discontinued.

Safer and Allen (*44*) were the first to describe that growth suppression can occur with continued use of stimulants. This effect was more apparent with dextroamphetamine than with Ritalin and was related to the amount of stimulant given daily, number of doses per day, as well as the duration of treatment. Ritalin doses of 20 mg daily or less did not result in growth suppression. The authors recommended drug holidays, since they demonstrated that discontinuation of the stimulant produced a spurt of growth. Others have found no suppression of growth as a result of stimulant medication. Roche *et al.* (*45*) summarized all available studies related to the growth-suppressant effect of stimulants and concluded that particularly when high doses are used, "there is evidence of a moderate suppression of growth in weight. There may be some minor suppression of growth in stature during the same period but the evidence is less certain."

Heart rate increases both at rest and with exercise, an effect for which no tolerance is apparent (*46*). An increase in systolic and mean blood pressure has been reported (*47*). It is not known whether these small elevations of heart rate and blood pressure produced by stimulants given over a long period of time affect the subsequent health of the child, but such effects seem unlikely since these changes are small compared to those produced by normal physiological demands on the cardiovascular system.

The dose of stimulant is generally adjusted until an optimal therapeutic response is achieved with minimal side effects. A peak enhancement of learning in hyperactive children (as measured by a short-term memory task) was found at a dose of 0.3 mg per kilogram of body weight; learning declined with higher doses. On the other hand, peak improvement of social behavior, measured by the abbreviated Conners Teachers' Rating Scale (*48*), occurred at a dose of 1 mg/kg (*46*). This suggests that different target symptoms of the hyperactive child syndrome respond to different doses, an important finding that may apply to other psychoactive agents used for children and adults.

Use of Stimulant Medication for Preschool Children

Although stimulants are used fairly often for hyperactive preschool children (*49*), they are generally considered to be less useful at this age. In one study (*11*) children showed behavioral side effects such as whining and separation anxiety, clinging to their mothers. Nursery teachers observed that the children were less exuberant. Objective cognitive tests as

well as mothers' ratings of activity level showed improvement; nevertheless, only 3 of 28 mothers wished to continue the medication for their children after the study was completed. Several of the preschoolers in this study responded favorably to stimulants after they were 6 or 7 years old. Mothers in this study reported improvement in their children from the experience of a therapeutic nursery and from mothers' groups. In a second study by Conners (*50*), parents viewed their preschoolers as having less restless and disturbing behavior when taking Ritalin compared to placebo, and Ritalin also produced an improvement on selected tasks of intelligence and visuomotor integration. Nevertheless, Conners concluded that although significant drug effects were noted, these were more variable and unpredictable than in similar treatment of older hyperactive children.

It was once widely believed that stimulants had a paradoxical effect on hyperactive children, in that they calmed rather than excited them. It was further believed that a good therapeutic response to stimulant therapy on the part of a child whose diagnosis was in doubt was evidence that the child was indeed hyperactive. The work of Rapoport *et al.* (*51*) has disproved these beliefs. They found that the response of normal children to a single dose of dextroamphetamine was the same as that of hyperactive children: namely, a reduction in motor activity and an improvement of performance on various cognitive tasks.

Other Forms of Therapy

Ritalin is superior to both chlorpromazine and thioridazine in reducing most of the symptoms of the hyperactive child (*52*). Forms of therapy other than medication have been sought and their efficacy studied. Long-term studies of stimulant medication make clear that drugs alone are not enough to produce a favorable outcome. While stimulants do not seem to have any serious side effects, and addiction has not been reported in children, stimulants have not generally been used for "hyperactive" adults. There is strong doubt that children outgrow all of the problems of the hyperactive syndrome by the time they reach adulthood (*7*), so the concept of a medication tiding the child over the difficult years of childhood—until maturation takes care of the problems—is not based on the facts available. Moreover, withdrawal of medication generally results in a return of symptomatology.

Behavior therapy may be helpful for some hyperactive children. In one report, children were given positive reinforcement based on quality of school work achieved in a given time, rather than a reinforcement scheme based on unacceptable behaviors (*53*). While behavior modification is useful (*54*), one study indicates that during the first 8 weeks of therapy at least, it is less useful than stimulant medication (*55*). There is no evidence that the therapeutic effects of behavior modification after discontinuation of the treatment are more lasting than are those of medication. Furthermore, behavior modification is sometimes unsuccessful unless it is combined with stimulant medication.

Attempts have been made to train hyperactive children—through modeling, self-verbalization, and self-reinforcement techniques—to use less impulsive strategies for cognitive tasks (*56*). So far, the results on cognitive strategies have been encouraging, and beneficial effects have been demonstrated to last at least 3 months after training is discontinued.

Other traditional methods of helping hyperactive children, such as parental counseling, parents' groups, remedial education methods, and so forth, are frequently indicated along with the above therapies.

Outcome

Five-year follow-up studies at the Montreal Children's Hospital indicated that the prognosis for hyperactive children as they mature into adolescence was relatively poor. Despite a decrease of ratings of hyperactivity over a period of 5 years, as adolescents they continued to be distractible, emotionally immature, and unable to maintain goals, and they had developed a poor self image. The school records of the hyperactive children showed a greater incidence of school grades failed and lower ratings on all subjects on report cards compared to matched control children in the same school. They continued to use impulsive rather than reflective approaches to cognitive tasks and over a period of 5 years they showed no improvement on tests of intelligence or visuomotor tasks and a decrement of performance on motor skills. About 25 percent of a group of 64 had delinquent behavior, a far higher percentage than that for matched controls (*12, 13*). Similar findings were obtained by Mendelson *et al.* (*14*).

We have completed a comprehensive 10- to 12-year follow-up study on 75 hyperactive subjects not treated with stimulants and 45 control subjects (*8*). The hyperactive subjects had a significantly more impulsive life-style, as suggested by a higher rate of geographic moves and car and motorcycle accidents, and inferior results on cognitive style tests. Significantly more hyperactive subjects had impulsive and immature personality traits on psychiatric evaluation. The hyperactive subjects were a mean of 1 year behind the control group in education completed.

No differences were found, however, between the two groups with respect to drug abuse (or use of nonmedical drugs, such as marijuana) and court referrals within the year preceding evaluation. Within 5 years preceding evaluations there was a trend of more court referrals for hyperactive subjects, but no difference between the two groups with regard to drug abuse. Controls used significantly more hallucinogens than did hyperactives within the year before evaluation.

No subjects were psychotic, but two hyperactive subjects were diagnosed as borderline psychotic. The latter difference between groups did not reach statistical significance. Two hyperactive subjects have died in motor accidents; no controls have been injured or have died in car or motorcycle accidents.

Rating scales containing almost identical types of questions regarding behavior and competence were sent to high schools and employers of the subjects. On the teacher's rating scale (for the last year of high school) hyperactive subjects were rated inferior to controls on all seven items, whereas there was no difference between hyperactive and control subjects for any item on the employer's rating scale. This suggested that the setting in which hyperactives are evaluated significantly influences the degree to which they are considered deviant (*57*).

The use of two different types of self-rating scales gave interesting results. On a self-rating scale of psychopathology, SCL-90 (*58*), there was no difference between the hyperactive and the control subjects on any item of psychopathology. On the California Psychological Inventory (*59*), which was designed to measure "folkloric ideals of social living and interaction," control subjects scored significantly better on a majority of items. This inventory was a most sensitive instrument for distinguishing differences in self concept for hyperactive and control subjects (*57*).

Between the ages of 6 and 12 years, at initial assessment the electroencephalo-

grams (EEG's) of the hyperactive children showed more slow diffuse dysrhythmias compared to the EEG's of matched normal controls. By young adulthood, at the 10-year follow-up assessment, no significant differences were found between the EEG's of hyperactives and normal controls. Sequential EEG's of hyperactives taken over the 10-year period suggested that many readings had become normal, mainly in adolescence. This supports the hypothesis that many of the EEG abnormalities of hyperactive children represent immature patterns which correct with age (*60*).

We have evaluated self-esteem, social skills, and moral development by means of laboratory tasks in 18 matched pairs of hyperactive and control subjects. Hyperactive subjects showed significant impairment of self-esteem and poorer social skills (*61*).

This outcome study indicates that while few hyperactive children become grossly disturbed or criminal adults, they continue as young adults to have various symptoms of the hyperactive syndrome—for example, impulsivity, poor social skills, and lower educational achievement. At the same time, unlike the delinquency of the true antisocial child or adult, in our study the majority of hyperactives who as adolescents had committed delinquent acts gained sufficient control of impulsivity by the time they were young adults that they did not commit significantly more delinquent acts than control adults.

Conclusions

Engel (*62*) has challenged the traditional biomolecular model of illness and has suggested that all diseases be viewed not in terms of biochemical aberrations, but in wider terms by use of biopsychosocial model. Nowhere does this wider concept of a medical model apply more aptly than to the hyperactive child. This can be seen from the various studies, reviewed here, with respect to the prevalence, phenomenology, etiologies, treatment, and outcome of this condition.

For example, the discrepancy between prevalence figures in American cities and the Isle of Wight suggests that qualities of the community may influence the actual incidence of the hyperactive child syndrome, perhaps in part by the degree of tolerance to what is considered deviant. In describing the typical phenomenology of the syndrome, we pointed out that many children were not "typical." They were, for example, symptomatic in some situations and not in others, and some had what were probably various secondary symptoms related to reaction of the family and school to their primary problems.

Various etiologies of an organic nature have been proposed for the syndrome. Whether or not the environment is for some children the primary etiology is not known, but in many hyperactive children the environment is a highly significant antecedent variable even when not the primary cause. With respect to treatment, the observation that chronic administration of stimulant drugs in the absence of other forms of therapy does not significantly affect outcome in adolescence indicates the complexity of the condition, some manifestations of which are not necessarily influenced by stimulants.

Finally, as indicated by the questionnaires answered by high school teachers and employers for adult hyperactives, the degree to which hyperactives are viewed as deviant depends on the demands of the environment in which they function.

In conclusion, the hyperactive child syndrome can only be understood in all its complexity when viewed from social, psychological, and biological standpoints, and the traditional biomolecular medical model does not fit the various manifestations, etiology, and course of the disorder of childhood. Multidimensional or interactional models are required which take into account the complex interaction between the child's environment and his psychological and biological status (*63*).

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63. This article is not intended to be a complete review of research on the hyperactive child syndrome. Opinions expressed, unless attributed to a specific investigator, are the opinions of the authors and are not necessarily shared by others working in this field.

Scientific and Technological Exchanges Between China and the United States

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On the eve of the establishment of diplomatic relations between China and the United States, scientific exchanges and friendly contacts were made between members of the Scientific and Technical Association of the People's Republic of China (STAPRC) and members of the American Association for the Advancement of Science (AAAS). Members of other Chinese and U.S. scientific and technological circles have also been contributing to the development of scholarly communications and friendly relations between the two countries.

To help the American people and U.S scientific and technological circles know more about STAPRC, I will give in this article a general account of the organization in an attempt to deepen our mutual understanding. STAPRC came into being in 1958 when the All-China Federation of Scientific Societies and the All-China Association for the Dissemination of Scientific and Technical Knowledge combined to form a single national organization embracing all science and technology groups under the leadership of the Communist Party of China.

In July 1949, on the eve of the founding of the People's Republic of China, the Chinese government appointed Wu Yuzhang to be in charge of preparations for the National Conference of Natural Science Workers (known as the "Science Conference") with a view to developing science and technology in China in an organized way and to mobilizing scientists, engineers, and technical personnel to take part in the building of the new China. After a year of preparation, the first conference of science ever convened in China's history was held in Beijing (Peking) in 1950. During this conference, two organizations were founded, namely the All-China Federation of Scientific Societies and the All-China Association for the Dissemination of Scientific and Technical Knowledge. As leaders of the many scientific and technological groups throughout the country, the two organizations helped in the restoration of China's national economy and in the execution of the first Five-Year Plan by initiating scientific exchanges and organizing activities designed to popularize science.

The merging of the two scientific organizations in 1958 was proposed by the Chinese Communist party and our government as a means of better utilizing the efforts of our many scientists, engineers, and technical personnel in achieving ahead of schedule the Twelve-Year Plan mapped out in 1956 for science and technology. It was in this way that STAPRC came into being. Some well-known scientists participated in the early success of the organization. For example, Li Siguang (Lee Ssu-kwang) was elected chairman, and Hou Debang (Hou Teh-pang) and Zhu Kezhen (Chu Ko-chen) were elected vice chairmen of STAPRC. Peking was chosen as the seat of STAPRC. As Professor Li Siguang has passed away, I am now the acting chairman.

Since its founding, STAPRC, together with its subordinate societies, has regularly sponsored scientific and technological exchanges and has held, in various forms, academic meetings, symposia, and forums. Some of these were held for the purpose of pooling the achievements and experiences in particular fields of science; others were devoted to the exploration of specific topics. The academic discussions were conducted in accordance with the policy of "Letting a hundred flowers blossom and a hundred schools of thought contend," so that different views concerning the development of science could be freely exchanged and participants could make suggestions concerning the main target for scientific research in the years to come.

In the past few years, the work of STAPRC and its subordinate academic societies was seriously disrupted by the Gang of Four. The downfall of this group marked the beginning of a new period of development in China and ushered in the spring of science. STAPRC and its subordinate academic societies have resumed their work, and one of their major effects has been to increase the number of nationwide societies of natural science (such as the Chinese societies of mathematics, physics, agronomy, and medical sciences) to more than 70. Membership in these societies is rapidly increasing and publication of more than 90 scientific journals has been resumed. Positive efforts have been made to conduct scientific activities: 184 national scientific meetings were held in 1978 alone.

Dissemination of scientific and technical knowledge among the workers, peasants, and schoolchildren is an essential task of STAPRC, the aim being to raise the scientific and cultural level of the entire nation. Departments in charge of popularizing science have been instituted in both STAPRC and its subordinate scientific societies. In addition, such organizations as the Association for the Creation of Popular Science Writings and the Association of Science Films have been created for the purpose of mobilizing qualified popular science writers to extend the work of dissemination of science by using various kinds of popular science facilities. In both urban and rural areas, a variety of programs, including technical investigations and demonstration projects, has been organized in an effort to promote industrial and agricultural production. Key problems in pro-

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