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Research links nutrition to behavior disorders

By Alexander G. Schauss

Social and medical scientists have begun studying the affect of biochemical and nutritional factors on deviant behavior. Due to the complexity of nutritional biochemistry in humans there are few easy answers. Numerous carefully controlled studies, however, are showing dramatic effects on antisocial, especially violent, behavior.

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There is much research and numerous theories regarding the causes of violence in American society. Significant evidence indicates the most violent-prone individuals have a history of alcohol abuse, drug abuse or familial dysfunction (e.g., physical and/or emotional child abuse). Other studies point to physical brain dysfunctions caused by abnormal lesions, and/or genetic determinants as contributors to violent behavior.

In recent years, however, social and medical scientists have been studying deviant behavior not only in terms of an individual's sociological and psychological history (*sociogenic*), but also in relationship to biological factors (*biogenic*). Among the biogenic areas studied have been biochemistry and nutrition.

Recent surveys suggest some alarming changes and trends in the eating habits and nutrition of Americans. In 1950, 29 percent of women were in the civilian labor force. By 1984, this increased dramatically to 54 percent. Many of these working women find it difficult to follow in their mothers' footsteps as the traditional homemakers. The effect of this shift and its relationship to an increasing market for processed/refined and convenience foods was predicted by Princeton University anthropologist Ashley Montague in a 1957 paper in the *American Journal of Clinical Nutrition* titled "Nature, Nurture, and Nutrition." He stated that: "...the current use of convenience

foods and the move away from family meals towards individual snack eating can be seen in attitudes of and to women, in the role of women in the family and in society, and in the relationship within the family group, rather than being caused by the availability of convenience foods, which merely make it easier for women to fulfil a different role. The day of the man-the-provider and woman-the-domestic-drudge has passed and with this change the mechanics of meal preparation need to change..."

The result of this transition has been the development of a sophisticated and profit-oriented food industry focused on "convenience foods." "Fresh" foods have been largely replaced by canned, bottled, frozen and packaged foods, which can be purchased in quantity once or twice a month and "popped" into the oven or microwave when needed. Such "convenience" foods have increasingly depended on new additives such as artificial food colors, flavors, preservatives, enhancers, stabilizers and others. Some of these additives have come under increasing attack as potentially harmful to various sub-populations. Today, over 60 percent of the American diet is processed and refined, a remarkable change from a half century ago.

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America's adolescents in the future.

The findings of recent studies suggest that the areas of nutrition and biochemistry merit the considerable attention of those in the American educational system concerned with the behaviorally disordered student and school violence. We bring to your attention what has been reported.

Research on nutrition, biochemistry and behavior disorders

Derek Bryce-Smith, Professor of Chemistry at the University of Reading (England) published an article entitled "Lead, Behaviour and Criminality." Studies of animals and humans which demonstrated correlations between lead exposure and impaired behavior or specific learning disabilities were cited throughout the article. In 1976, the United States Environmental Protection Agency (EPA) saw a direct association between air lead levels and blood lead levels of inner city Black and Hispanic children.

Shortly thereafter, Drs. Pihl and Parkes of the Department of Psychology, McGill University, Montreal, discovered, through a relatively new assessment procedure - "hair trace mineral analysis" - significant differences in hair element levels in learning disabled (LD) versus nonlearning disabled children.² In their study, small samples of hair were cut near the scalp and around the nape of the neck from 31 LD students. Later, the hair of 22 "normal" children was analyzed. They found they could differentiate the LD and non-LD children, with 98 percent accuracy, by simply noticing the variations of the hair trace mineral levels. Elevated lead and, particularly, cadmium levels were almost always found in the LD children. (Note: Current research indicates that in most psychoneurological measures of children,

exposure to lead is associated with a decrement in performance.³ Moderately elevated lead levels in children can cause hyperactivity.⁴)

Our Institute (American Institute for Biosocial Research) has duplicated these procedures and found similar results of elevated lead and cadmium levels in numerous LD school children. Through the same process, other irregularities were noted, particularly high copper levels, in behaviorally disordered (BD)/LD students.

When we next selected and tested only hyperaggressive students, this pattern was found so often we referred to this "marker" as the "copper aggressive child." Our next step was to lower the copper level of these hyperaggressive students through a technique called "zinc repletion therapy" (involving zinc and vitamin B-6 or B-1 supplements). The results, according to veteran school psychologists, educators

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and parents, were startling behavioral improvements in numbers of formally unmanageable BD special education students.

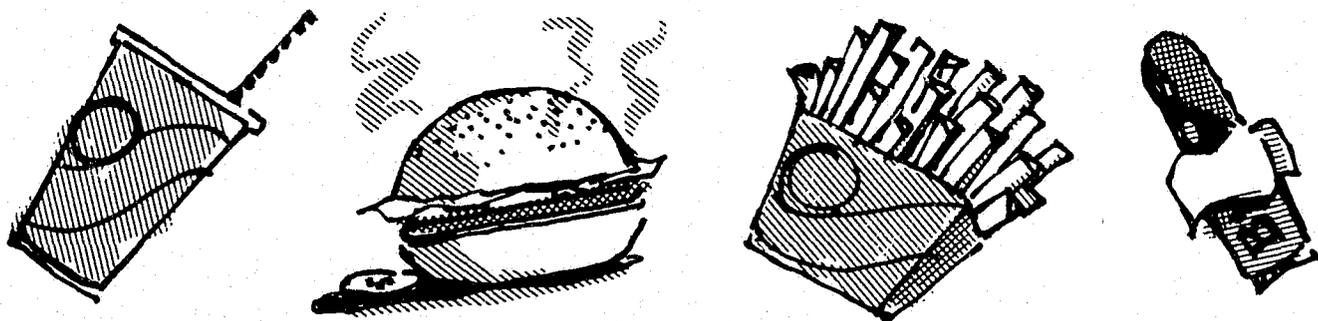
Another study appeared reporting on hair analysis of incarcerated delinquents in an intensive California Youth Authority (correctional) facility. This study suggested that certain toxic metals like lead, cadmium, copper (toxic only at high levels) and aluminum could contribute to deviant behavior.

Following this report, we proceeded

to study violent criminals and more violent BD students in institutions and public schools in the states of Washington, Oregon, California, New Mexico and British Columbia, Canada. Our studies confirmed that certain trace element patterns in head hair samples might indeed correlate with hyperaggressive or hyperkinetic behavior and learning impairment. Of significant interest were the same three neurotoxins: lead, cadmium, and the essential trace element, copper. For comparison, we collected hair samples from over 1,000 fully functional, nonviolent/noncriminal children and adults, over a three-year period.⁵

The differences between the behaviorally disordered students and offenders and the "normal" control population were striking and statistically significant. Through careful study, we began to apply our findings toward the treatment of the deviants' behavioral dysfunctions, having occasional dramatic results. A four-year follow-up study of 112 such cases revealed a significant rate of success as compared to an untreated population. In other words, students, previously described by their respective school districts as some of the most behaviorally disordered, were now apparently well adjusted and complying with school rules while attending *regular education* classes. It was simply remarkable to see these "intractable" students improve as they did. The cost savings of this assessment technique and treatment approach to school districts providing special education services for such students became obvious.

These initial studies have been reported in papers and works, including *Diet, Crime and Delinquency*,⁶ and through the published proceedings of numerous national and international conferences.⁷ After these studies were presented and published, numerous physicians, psychologists, educators and



social scientists confirmed or corroborated our reports, based on their clinical observations or research.

There is, however, a problem with "hair analysis." It is not a "diagnostic" test. Although thousands of studies have been made of animal and human hair, inter-laboratory reliability and reproducibility have been a continuing problem. This can be particularly true of commercial laboratories.

Recently, the United States Federal Trade Commission (FTC) prevented one American hair analysis laboratory from doing business directly with the public because of unethical practices, including exaggerated claims. Hair analysis *cannot* measure vitamin levels, suggest a diet or supplement, reliably predict a degenerative disease, or be used as a diagnostic technique by itself. Lack of proper hair analytical techniques or proper sampling methods can lead to "garbage in - garbage out" data. Although the technique, as we will show, is highly promising to the study of violence, analysis and interpretation of results requires the expertise of trained scientists and properly certified facilities, equipment and staff.

Human biochemical "markers" of violence proneness?

In a 1982 university comparative study of trace element levels in the hair of violent and nonviolent criminals, violent offenders were found to have higher hair lead and significantly lower hair cobalt levels than nonviolent offenders.⁸ Cobalt is an "ultratrace" mineral found in the body in very small amounts. Its sole function is thought to be as a constituent of Vitamin B-12 (cyanocobalamin). Cobalt levels in hair must be measured with great care; otherwise, the reliability of the results is highly questionable.

In violent offenders, cobalt levels were consistently found to be unusually low as compared to nonviolent offend-

ers or "normals." In this small study (n⁵²⁹), the possibility that these differences were due to chance were less than 1 in 10,000. A power analysis of this data by this author, however, concluded that such a finding was possibly spurious due to inadequate sampling size and lack of randomization. Nevertheless, the question remains: Could low cobalt levels in human hair be predictive of violence-proneness?

In 1983, a team of investigators at one of America's leading research facilities, Argonne National Laboratory (IL.), confirmed the findings of the 1982 study just cited. (Note: Argonne National Laboratory houses some of the most sophisticated analytical equipment and facilities in the world. Its staff numbers over 1,200 research scientists, many of whom are physicists.)

Type A, Type B offender's biochemical "markers"

Few studies may have as much impact on the treatment of violence in humans as that of analytical chemist, William Walsh, Ph.D., and research chemist, Ronald Isaacson, Ph.D. of Argonne National Laboratory; and Carl Pfeiffer, M.D., Ph.D. of Princeton (NJ) Brain Bio Center. They report they have identified a profile of trace elements in human hair that might be *predictive* of violence-proneness or criminality in humans.⁹

Using sophisticated electrochemical equipment, Walsh and Argonne Epidemiologist, Robert Lundy, Ph.D., compared the hair trace element levels of 96 sets of similar-aged male siblings raised under relatively the same environmental stressors (i.e., parents, schools, housing, diet, water supply, etc.). Of each set, one sibling had a life-long history of criminality or violence-proneness and was either incarcerated, an ex-offender, or a violent child; and the other sibling was "normal" and had no such history.

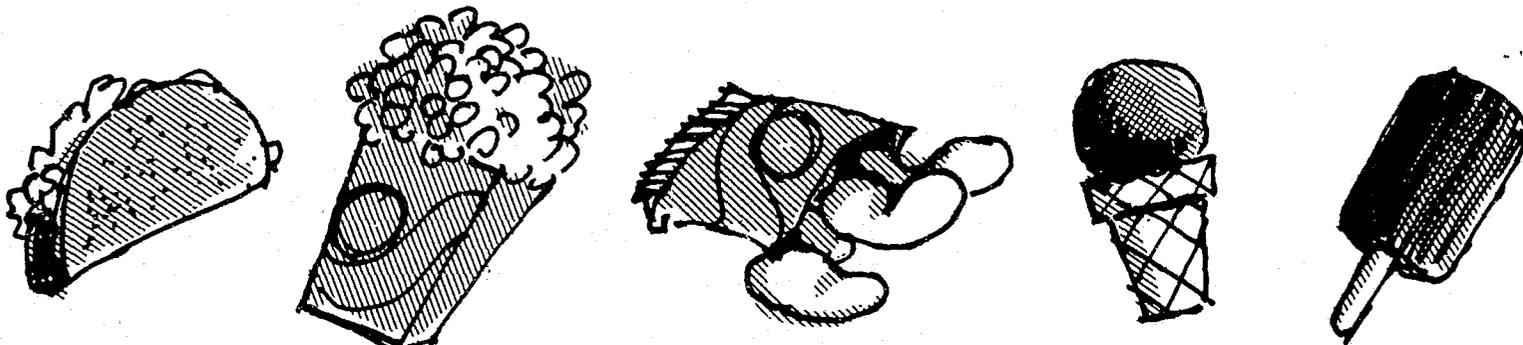
The researchers divided their "offender" subjects into either *Type A* (episodically violent until manhood, then often quiescent), or *Type B* (frequently and inexorably violent). The Type B are characteristically referred to as "sociopaths," the more uncommon type of criminal offenders.

By examining more than 20 trace elements in the siblings' hair of which nine were found to be consistently reliable, they were able to correctly pick the 96 violent males from their 96 nonviolent siblings (with a rate of less than 2 percent false positives). A separate study of 24 violent boys and their siblings revealed similar findings.¹⁰

Working with Princeton research physician, Dr. Carl Pfeiffer, Walsh selected some Type A and B nonincarcerated offenders for treatment. The analyzed hair profiles were correlated with other traditional analytical techniques involving blood and urine. Once these evaluations were completed, a treatment plan was developed to correct the measured hair eccentricities and other abnormal laboratory findings. It became clear that each offender required a slightly different treatment plan. (As a rule, each person's biochemistry is unique ["biochemical individuality"].)

Usually, as nutrition therapy takes time, the treatment takes several months before consistent and favorable results are seen. Also, it takes time to extinguish old negative behaviors, even after cognitive functioning has improved. Walsh reports that behaviors improve markedly as the abnormal hair mineral levels are adjusted.

Since most of the Type A and B offenders had a number of abnormal trace element levels, specific vitamin and mineral supplements were employed as part of treatment (no drugs have been used to date). The dosages of supplements were carefully selected for



their specific physiological effects. Each nutrient, given in dosages well above that found in a diet, is selected for its therapeutic use, much like a drug. But since nutrients are not pharmaceutical drugs, most have few side effects.

For example, it is known that zinc competes with copper in the body. Therefore, in larger doses it can displace copper, which might be contributing to the observed hyperaggressive behavior. By careful laboratory monitoring of blood or urine levels, the clinician can follow the progress of the changing ratios of zinc to copper in the body until it approximates the desired ratio of 8.5 parts of zinc to every 1 part of copper in blood cells. However, if too much zinc is given for too long, the copper levels can get very low, which could cause serious side effects, including injury to the heart.

This is why use of selected nutrients for "therapy" should only be done by trained and licensed health specialists. Even dieticians generally lack the skills to conduct such trials, since they concentrate on adjusting diets to suit the needs of patients and have rarely, until recently, used supplements therapeutically to ameliorate behavior disorders.

According to Walsh, using these new assessment and treatment approaches has resulted in "fantastic, anecdotal" improvements in the violent-prone males.¹¹

So successful have these clinical trials been that a placebo-controlled study of 100 violence-prone children is on-going in several geographical locations. Further confirmation from such controlled studies is imperative before broad-based application of this work should begin in this country.

Implications

What are the implications of these find-

ings to our nation's school systems? The California Child Study Foundation¹² has suggested that for preventive programs to be cost-effective while impacting upon the problems of violence in our schools, they must meet four criteria:

1. "The group to be treated must be identifiable before they become delinquent." (The potential is obviously here. We have observed profiles in some under-five-year-olds that are now displaying hyperaggressive behavior in grade school. Civil libertarians need to become involved in the ethical questions that will surely surface from the suggestion of such early screening.)
2. "The group to be treated must be at high risk for developing delinquency." (Numerous studies funded by the United States Department of Justice have found a relationship between learning disabled and

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behaviorally disordered students and delinquency.)

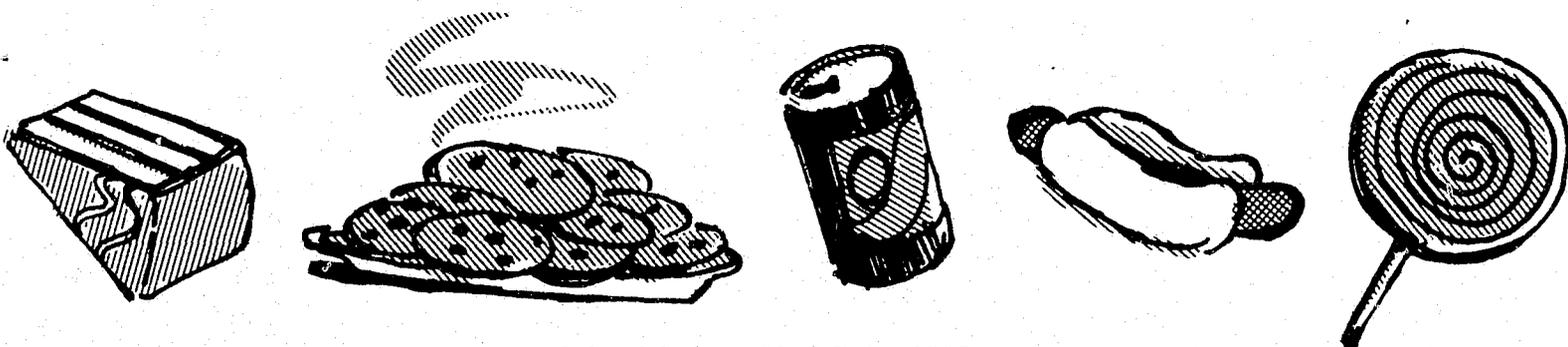
3. "The group to be treated must contribute a sizeable proportion of the total delinquency problem." (Juvenile and youthful offenders represent a disproportionate number of offenders in the criminal justice system. That biochemical differences were consistently found in both the "offender" population and "normals" is significant. Less than 2 percent of the "normal" siblings had the biochemical "markers"

found in the deviant siblings. If this research continues to hold true, *when* treatment is to be recommended and *by whom* is again an important ethical question that needs to be discussed.)

4. "There must be a cost-effective treatment method." (Hair analysis done on a mass scale costs between \$2-\$35 per hair sample. Certified commercial laboratories that are members of the American Society for Elemental Testing Laboratories (ASETYL) charge \$12-\$15 for an analysis of over 25 trace elements. Blood and urine tests will cost upwards of \$12 at certified commercial laboratories.

Additional tests for blood vitamin levels, etc., would be additional when required. Consider these expenses when comparing them to the cost of psychodiagnostic and psychometric testing and consultations required under Public Law 94-142 of the United States Department of Education ("Special Education Act").

As researchers continue to isolate specific factors in the body, it would be reasonable to expect in the future, that schools will include a biochemical/nutritional evaluation of behaviorally disordered students. This would, of course, be in addition to traditional assessments of a student's social, psychological and environmental stresses and states. From our experience, school districts and communities across the United States will experience significant benefit from applying these new assessment techniques. For those students whose biochemical problems are not assessed in the schools, and hence remain undiscovered, the probability exists that some may become a part of the criminal justice/mental health system where they will continue to be a financial and social burden to our society.



Recent nutrition studies of chronic delinquents

A surprising number of controlled studies in recent years indicate that diet affects rates of antisocial behavior. A more comprehensive review of these studies has been published elsewhere.¹³ We shall focus on a series of controlled studies conducted between 1979-1984 in three states at 14 correctional institutions involving over 8,000 incarcerated youthful offenders. These studies represent the largest controlled studies of nutrition and antisocial behavior. To date, no study has been reported that refutes these findings, in spite of numerous evaluations by qualified research scientists.

Double-blind and controlled studies of diet and youthful incarcerated offenders

To challenge the assumption that diet might affect rates of antisocial behavior in a known offender population of incarcerated delinquents, criminologist/sociologist Stephen Schoenthaler, Ph.D., conducted a series of controlled studies in Virginia, Alabama and California.

The first study involved the removal of most refined sugar (sucrose) from the diets of incarcerated juveniles in a regional detention facility in eastern Virginia. This initial double-blind study of 27 cohorts of juvenile offenders (N=276) over a two-year period resulted in a measurable 45 percent decrease in the rates of antisocial behavior within the facility (e.g., assaults, thefts, refusal to obey, fighting, etc.).¹⁴ In other words, simply reducing the amount of refined sugar from the diets of the experimental population of offenders (N=174) resulted in a significant decrease in antisocial behavior as compared to the population on the control diet (still consuming the same amount of sugar) (N=102).¹⁵

The study was replicated in east central Alabama on a more economically disadvantaged population¹⁶ of 488 incarcerated juvenile offenders. After 22 months, the experimental group (less sugar) demonstrated a 36 percent drop in antisocial behavior, with the reduction ranging between 17 and 53 percent depending on gender, race or type of offense ($p=.018$). Examination of the data revealed that while all antisocial behavior decreased, property offenders and *violent* offenders benefited most from this change of diet in both Virginia and Alabama.¹⁷

To strengthen the reliability of these findings, the investigator added a within-group subject design. Twenty-eight subjects experienced both diets (12 crossovers and 16 crossbacks to the control diet). This group also showed a 35 percent decline in antisocial behavior when sugar was reduced, virtually identical to the larger group.

To allow for an even larger sample size with various institutional conditions and juveniles from various socioeconomic backgrounds, Los Angeles County (California) was selected for the next study in this series. The County Board of Supervisors had unanimously recommended changes in diet within their juvenile institutions placing emphasis on reducing the amount of "junk food" consumed by the incarcerated youths. This presented researchers with the opportunity of examining the "before" and "after" behaviors of the institutional population. (Approximately 4 percent of the entire United States' institutional offender population is found within Los Angeles County.)

The Los Angeles diet-behavior study

This study involved 1,382 incarcerated delinquents in 3 juvenile detention centers and 289 delinquents in 3 juvenile rehabilitation camps.¹⁸ Com-

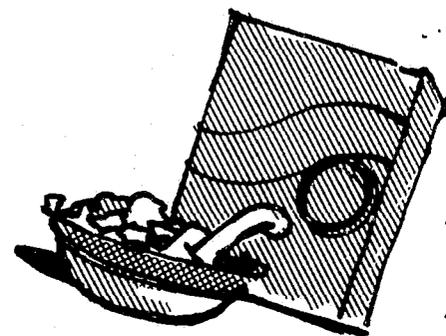
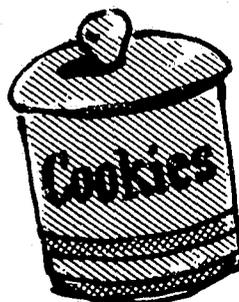
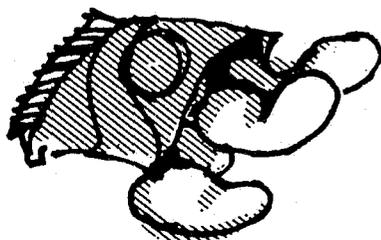
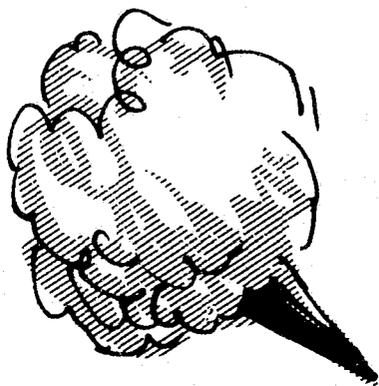
paring those incarcerated delinquents consuming the new low-refined/processed-food diet against previous residents eating the "old" diet revealed a 44 percent drop in antisocial behavior (.0001 level, paired correlated t-test). These results were very similar to both Virginia and Alabama ($p=.001$).¹⁹ The most significant reductions in antisocial behavior were recorded for those offenders charged as repeat offenders (86 percent), narcotics violators (72 percent), rapists (62 percent), burglars (59 percent), murderers (47 percent) and assault offenders (43 percent).

A 54 percent reduction in rates of antisocial behavior was recorded ($p=.019$) among the 289 participating juvenile offenders in the 3 juvenile rehabilitation camps.

The most surprising finding from this series of studies of 6 correctional facilities was that the reduction of processed/refined foods had little or no effect on *female offenders'* rates of antisocial behavior! No clear explanation for this observed difference has been proposed to date. Therefore, if the rates of antisocial behavior among the offender population is controlled for gender, an even greater reduction in antisocial behavior is revealed among males in Virginia, Alabama and California.

The Northern California offender diet-behavior study

In the final published study in this series, 3,399 incarcerated juveniles participated,²⁰ of whom 25 percent were charged with Part I (serious) felony crimes ($n=850$). In this study, the levels of not only refined sugar but also artificial food additives and sugary snacks and foods were significantly reduced during a 12-month experimental phase. Again, antisocial behavior decreased as had been reported at the other sites. Further, there were other



important findings from this study: a 100 percent reduction in attempted suicides (no suicides occurred during the experimental phase); a 75 percent reduction in the use of restraints to prevent infliction of self-injury (from 100 to 25); and a 25 percent reduction in assaults and physical fights.

These series of studies suggest that the reduction of refined sugar (sucrose) and/or processed/refined foods from the diets of incarcerated juvenile offenders can result in a significant measurable decrease in rates of antisocial behavior in such populations.

No evidence, however, was found to suggest that sugar *causes* antisocial behavior. Too many variables still remain to be studied before such conclusions can be made with any conviction. In one random controlled study, delinquents were found to consume more refined sugar than nondelinquents,²¹ though the difference was not statistically significant. To date, no study has shown there is a statistically significant difference between delinquents and nondelinquents in the consumption of refined sugar.

Although these studies report observable and replicable changes in behavior when diet is modified, we cannot conclude that diet caused the changes. All we can be sure of is that somehow it works; how and whether the changes are due only to the diet changes are different questions.

Could some antisocial behavior be due to subclinical deficiencies of nutrients?

It has been suggested by this author in previous works that the underlying reason why such improvements in behavior occur in some offenders is due to:

1. the elimination of "empty calorie foods" resulting in the correction of borderline subclinical deficiencies of various vitamins and minerals essen-

2. the reduction of artificial food additives that have a detrimental affect on brain metabolism and activity.

As the issue of food additives' contribution to disordered behavior is far from resolved, we shall concentrate here on recent studies of "sub-clinical nutritional deficiencies" and behavior.

As has been discovered by researchers in the last decade, many children, youth and adults in this country suffer from *overconsumption-malnutrition*. They get more than enough calories, but many of them come in the form of foods that provide far too few nutrients, creating a relative deficiency of certain essential vitamins or minerals.

To test for this possibility, fresh squeezed orange juice, a food rich in some nutrients essential for brain functioning, was added to the diets of incarcerated youthful offenders in a seven-month double-blind crossover study conducted in Fairfax County, Virginia.²² This county has one of the highest per capita incomes in the United States, making it reasonable to expect that the offender population was not suffering from underconsumption malnutrition.

The study involved 242 offenders offered orange juice for breakfast, lunch and dinner, as compared to 239 "controls" not given orange juice. The result was a 47 percent decrease in the recorded rates of antisocial behavior in the experimental group ($p = .001$).

Why this change may have occurred has been discussed by this author elsewhere.²³ For this discourse, it would be useful to look into the biochemistry of the involvement of certain nutrients in proper brain functioning as it relates to appropriate behavior.

The role of certain nutrients in appropriate behavior

Orange juice is adequate in numerous

nutrients, as are many foods, but of particular importance here is its vitamin C, thiamine (vitamin B-1) and folic acid content.

Vitamin C is required for many metabolic functions in the boy. Some consider it a "stress" nutrient, as it is more rapidly used under conditions of stress. But it also plays a vital role in increasing *iron* absorption. Let us examine why this would be important.

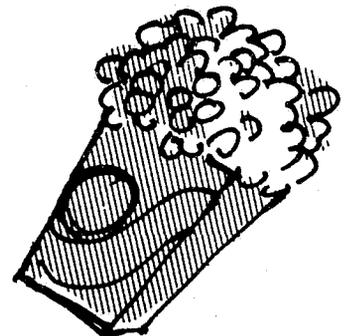
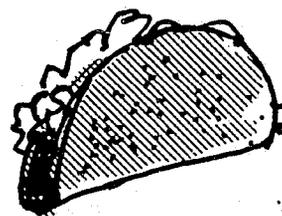
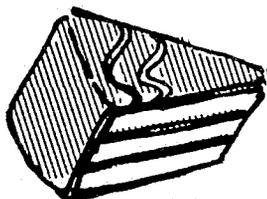
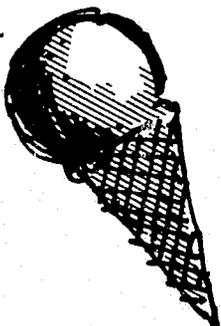
When a liberal amount of vitamin C (i.e., 75 mg.) is taken with a meal containing non-heme iron, considerably more iron is absorbed. Some estimate that this additional vitamin C would increase iron absorption *sixfold*.

According to the 1978 U.S. Department of Agriculture's (USDA) random study of American diets, minors received less iron, regardless of socioeconomic background, than any other nutrient in their diet. (Also found 100 percent or more below the RDA were vitamins A, B-6, zinc and C.)

Iron has only recently been shown to be intimately involved in cognitive function²⁴ and discipline problems.²⁵ These new studies suggest, among recently discovered factors, *impairments in judgment and reasoning may be due to iron deficiency*.

Earlier studies of junior high school students found youths with iron deficiency anemia, especially in males, had significantly lower scores on batteries of school-achievement tests than did nonanemic controls from the same school.

In a 1973 Philadelphia study of economically disadvantaged youths evaluated by pediatric physicians and educators unaware of the junior high school students' blood iron levels, *conduct problems* were found far more frequently among anemic students than nonanemics.²⁶ They found that the selective effect of iron deficiency may involve heightened activation manifesting as restlessness, irritability and even



disruptive behavior. The behavioral patterns reached such levels of severity in the most deficient students, that the ability to learn in a regular classroom setting was severely impaired. It is suggested this was due to the iron-deficient or anemic child being *less attentive to environmental cues that facilitate problem solving*. In terms of cognitive theory, low iron levels can result in altered attentional processes leading to inappropriate behavioral responses.

In the beginning of this paper, we noted that familial dysfunction, including child abuse, was commonly found in the backgrounds of violent children/adults. Recent studies conducted at the New York Foundling Hospital's Temporary Shelter Child Abuse Treatment Program found "abusive mothers are insensitive to the moods and signals of their children." Could these mothers be suffering from undetermined iron deficiencies/anemia or other nutrient deficiencies that affect their problem-solving ability and behavior? Since these mothers' actions are often considered "impulsive" rather than deliberate, could other nutrients be involved?

In an uncontrolled study of intractable neurotic 3- to 45-year olds, researchers at the Cleveland Psychiatric Clinic discovered many suffered from overconsumption of "junk foods" (calorie-rich, but nutrient-poor foods). This, they discovered, resulted in a subclinical deficiency of vitamin B-1 (thiamine), eventually known as the "junk food syndrome."

Those adolescents in this study found to be low in vitamin B-1 were described as "impulsive, highly irritable, aggressive, angered easily, and sensitive to criticism."²⁷ When the researchers supplemented these adolescents with vitamin B-1, their behavior gradually improved until no longer labeled as "neurotic." Why this improvement?

Vitamin B-1 is required in the secondary metabolism of all carbohydrates. However, many "junk foods" (e.g., soft drinks, candies, desserts, etc.) are not fortified with additional vitamin B-1. In a diet that is high in refined carbohydrates (e.g., white sugar, white flour), the body soon requires more vitamin B-1 to metabolize all the carbohydrates. If the carbohydrates are not adequate in vitamin B-1, the body may have to "borrow" some from the central nervous system and certain brain tissue, such as the cerebellum, medulla and pons.²⁸ This "borrowing" of vitamin B-1 from critical brain tissue may result in undesirable behavioral patterns like those described in the adolescents.

These examples give the reader a brief glimpse of the possible value of a nutritionally adequate diet, low in processed and refined foods, as it relates to disordered behavior.

But does this suggest that "megavitamin" supplementation of vitamins and minerals would resolve the problems of many behaviorally disordered children and youth? The answer is yes, and no!

Recent studies of vitamin/mineral supplements in behaviorally disordered children

A decade ago many claims were made by clinicians and parents that "megavitamin therapy" was effective in the treatment of children with learning disability and hyperactive behavior.²⁹ These claims, however, lacked serious "scientific" support, based on rigid controlled studies. As a result, until recently, both "sides" of the argument have advocated their positions without adequate supportive documentation.

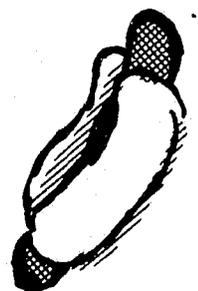
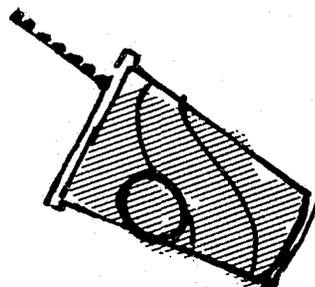
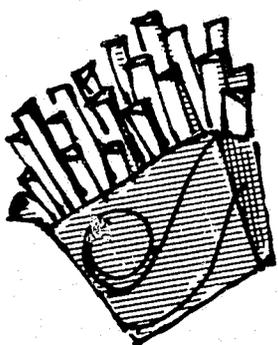
In a recent (1984), carefully controlled study³⁰ of hyperactive children, and two studies³¹ of hyperactive and learning disabled children, megavitamin therapy was found to have no positive effect on behavior. One would assume

from the negative results of these three studies that such treatment cannot be recommended. But such a position may be premature due to the complexity of nutritional biochemistry in humans. Many seemingly well-designed studies might actually confuse the issue rather than clarify it. Rippere (1983) has recently provided an excellent examination of these methodological problems.³²

Previous research with hyperactive children has found that vitamin B-6 supplementation may have a great value if the child has a low *serotonin* level.³³ (Serotonin is an important chemical in the brain involved in aggression, depression, etc.) Unless the serotonin level is first determined, the amount of vitamin B-6 given might actually make the child worse, not better.

In another study, half the children improved when given megadoses of vitamin B-1 but worsened when given vitamin B-6 at the same time.³⁴ Conversely, half the B-6 responders worsened when given B-1 treatment. It was found that when large quantities of B-6 were given, *zinc* levels had fallen. When a zinc supplement was given with the B-6, symptoms disappeared! Other researchers have found much better results when both zinc and magnesium are given with B-6. Further, best results with "megadoses" are achieved if careful consideration is given to the best dosage required by the individual child or adult. Such treatment is potentially far more beneficial than an "across the board" equal level vitamin dosage for a group of children (as was done in the three prior-mentioned controlled studies).

The point is, nutritional research can be constructed on excellent designs and yet fall far short for lack of an appreciation of the complexities of nutritional biochemistry. Until controlled studies adequately take into consideration the various confounding variables and bio-



chemical idiosyncracies of nutrient interactions in the body, and their variations from person to person, making judgments based on "double-blind" studies may be highly premature.

Following is a case history that demonstrates these baffling variables. A 14-year-old male youth was referred by a local school district to our Institute for severe behavior disorder. Every special education resource of the district had been exhausted. His behavior was said to be "the worst in the school district's history." The parents had just completed paying for a three-and-a-half week "exhaustive" physiological and psychiatric inpatient study of their son. Every imaginable study and test was done on this youth, both at the hospital and during several months of outpatient evaluation. Remarkably, the hospital eventually labeled the child's behavior as "adjustment reaction of an adolescent with periodic hyperaggression." When the parents asked what could be done, the staff suggested *they* get further counseling so they could learn to cope better!

Immediately upon referral, we requested a series of blood tests for levels of various brain chemicals and vitamins and minerals in his blood. Through this testing, we discovered a vitamin B-6 deficiency. Additional tests confirmed our preliminary findings. No matter what combination of B-6, zinc, magnesium or other nutrients we gave this youth, his behavior did not improve. As each month went by, he became increasingly less manageable at home and in the community. Several contacts with the police and juvenile court during this period for vandalism, theft, fighting, etc., suggested we were losing the battle.

At the same time, new nutritional research involving lipids (oils), an essential fatty acid not previously thought to be vital to human health or behavior, provided the dramatic break-

through we were looking for. It turned out that some individuals have certain water-soluble B vitamins at deficient levels due to an inadequacy of certain types of "fats" in their diet. This was particularly more likely if a person ate too much of certain other fats common in today's diet. This imbalance, we discovered, could affect the levels of certain vitamins and minerals in some people.

Initially, getting the youth's cooperation proved to be the most difficult task. To allow the oil to work, we had to have the youth's glucose intolerance reduced through reductions in refined sugar. He also had to abstain from alcohol consumption. Fortunately, introducing the oil was an easier process. It could be added unobtrusively to his salads and other foods with barely a perceptible taste. Once his parents added a small amount of this oil to his diet along with B-6 and zinc supplements, remarkable improvements were noted by his family and school personnel. A blood B-6 test showed significant cellular absorption and utilization had finally occurred.

To be sure the oil made the difference, a "blind" experiment was conducted by substituting another similar tasting oil. Within days, the behavioral improvements diminished. Placed back on the correct oil, his behavior again quickly improved.

Thereafter, results were impressive. Within two months, the youth was back in a classroom for socially maladjusted children. Two months later, upon recommendation of his two teachers, the school psychologist and director of special education, he was placed in various resource rooms. The following term he was in regular classes. In spite of being at least three or more grades behind in every subject, he rapidly caught up in all areas over the next two years. Four years after the proper treatment was initiated, he is a successful

senior in high school.

During the six-and-a-half years prior to his referral to our Institute, he had been placed on 11 different drugs to control his behavior. Few had resulted in any long-term improvements.

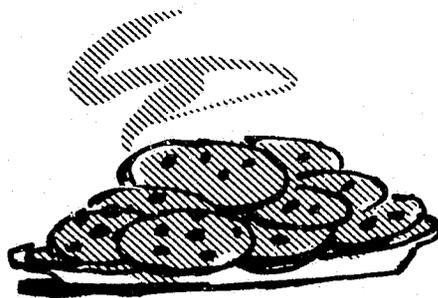
The lesson is this: it is imperative that parents, physicians, therapists and school personnel begin to consider the potential benefit of finding the *underlying cause* of behavioral disorders.

No one, least this author, would denigrate the importance of sociogenic factors in the etiology of behavioral disorders in children. A child's response to stress is dependent on the type, number and magnitude of stresses experienced, genetic predisposition, frequency of exposure, age, cognitive abilities and many other factors. This is why no two children will respond identically to stressors or treatment.

If an individual is marginally deficient in nutrients, any stress may exacerbate the condition. In general, well-nourished individuals are better able to cope with stress. Any form of under-nutrition is itself a stress to the body. A child's reserve capacity to adapt to stress may be taxed to the degree that his/her behavior reaches an unacceptable level.

Given today's nutrition knowledge, allowing students to receive empty calories through school cafeterias, canteens or strategically placed vending machines should be considered unacceptable.

Children need models, however, not critics. If we expect students to improve their diets, parents and educators must first improve their own eating habits and lifestyles. This may actually be a greater challenge than getting children to eat better. We teach students in our schools the harm of cigarette smoking, yet schools throughout this country allow teachers and staff to smoke. Students see our behavior. We ask well intentioned



students to earn money for school-related extra-curricula activities by selling candies and cookies, suggesting perhaps that money is more important than good health. As an educational system, trusted by both parents and the community, we must closely examine our priorities.

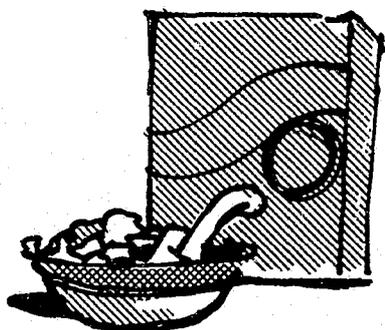
Conclusion

It seems that with new research into diet, nutrition and biochemistry, much is being learned that may be of great potential value to resolving the behaviors of many students in this country's educational system. Yet this information is very new and is apt to engender much discussion.

It is up to the educational system, medical and social scientists, and the community to recognize the potential benefits of applying these findings to the problems of violence and disordered behaviors in our schools. Are we prepared to utilize this new information to assist our schools in ameliorating the problems of violence and disorderliness?

No simple cures or panaceas are offered. Behavior is much too complex to be reduced to "what you eat is what you are." But diet and biochemistry have a place in our understanding of the variety of factors affecting human behavior. Through research, the relative importance of diet on behavior is now better understood.

It will take administrative skill, financial resources and a trained body of professionals to introduce these new approaches to the educational system. Some schools have already begun applying this knowledge by modifying school diets and offering nutrition education courses.³⁵ Yet with over 50,000 school districts in this country, we have a long way to go toward a more scientific approach to the problems faced by our educational system today. □



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