Evidence of the importance of the biological aspect of crime and violence continues to mount. And with the escalation of crime, disseminating information involving all disciplines to those who could help has become critically important. Research about the link between aberrant behaviour and neuro-chemical imbalances, toxic environment, diet, food and chemical sensitivities, learning problems and hypoglycaemia has been conducted to show its relevance and importance in the fight against crime.

More than twenty years ago the American Congress set up the Law Enforcement Assistance Administration within the Department of Justice, in an all-out effort to reduce crime and violence. Funding was provided to build more jails, to obtain more police and police cars, to increase street lighting, to help the disadvantaged, etc. After a few years and hundreds of millions of dollars, funding was stopped; the effort was a failure, and crime and violence continued to escalate. They have found in the USA that incarceration and rehabilitation with out nutritional intervention has a mere 20% success rate- most criminals end up in jail again and again. The basic diet in a prison environment includes cigarettes, coffee, sugared foods and processed nutrient-poor foods. On the other hand nutritionally rehabilitated criminals has a success rate of 80%. Up to 90% of criminal offenders in one study are shown to be suffering with Hypoglycaemia, food-, water-, or air born allergies.

It has been established that four to six percent of boys of a given age will commit over half of all the serious crime produced by all boys of that age. That four to six percent is not going to be helped by counselling or tougher laws. To assume so overlooks the fact that most of these individuals lack the innate ability to benefit because of their dyslogic, lack of insight, lack of fear, impulsivity, and inability to realize the consequences of their actions or learn from experience.

Their basic problem is not TV violence, poor parenting, poor teaching, broken homes, or poverty. There are too many good, law-abiding citizens who have grown up under these same circumstances. Such problems most certainly can contribute to crime and violence, but the basic problem in the offender is more than likely to be a malfunctioning brain, which is aggravated by influences such as lack of nutrients, elements in their diet, toxins in the environment or studying difficulties.

Some people fear that biological causes must be treated with radical medical interventions such as heavy psychopharmacological agents or even psycho-surgery. But research shows that measures as simple as better prenatal care, better nutrition, reduced exposure to environmental toxins, or remediation of neuro-chemical imbalances can be highly effective in correcting problems in behaviour. Unless the physiological functioning of the brain is included in the quest to alleviate crime and violence, we suggest that any effort will be a failure.

Researchers investigating dietary and supplement interventions for behaviour-disordered children, troubled teens, and anti-social adults are excited about the accumulating evidence showing that these simple measures may have profound impact, but they are also frustrated by a lack of interest on the part of most clinicians.

Why then has so little research looked at the effects of nutrition on crime prevention? In part, the answer is money: millions of dollars in funding are available for studies of drugs, while funds for nutritional research are scarce. Although research on diet and behaviour is still in its infancy, studies to date show convincingly that nutrition may influence our mental health as much as it influences our physical health. Isn’t it time to look at the criminal from all the different angles and treat it accordingly?
Literature Review: Constructing the Argument

Is There A Relationship Between Diet, Nutrition And Criminality?

The following factors have been known to have a relationship with conduct disordered or anti-social behaviour. A brief overview will assist in illustrating the importance of attending to these factors, as a means of reducing conduct disordered or anti-social behaviour.

Intelligence Coefficient

Low IQ is a known risk factor for crime and delinquency. But a new study by Robert Goodman suggests that even when IQs are in the low normal range, these scores are linked to stealing, lying, and other symptoms of conduct disorder.

Tests revealed that lower IQ in his sample of "normal-IQ" subjects was linked to conduct disorder, a link which was stronger in teens than in younger children. In Goodman's sample, the mean IQ of children with conduct disorders was nearly 10 points lower than that of children with emotional disorders and children with mixed disorders of conduct and emotion fell in between. The IQ effect remained true when Goodman controlled for socio-economic status and for reading ability, which he says indicates that "the link between low IQ and conduct problems was not wholly attributable to social class or entirely mediated by scholastic attainments.

Other studies also link low IQ to violent behaviour, delinquency, and adult crime. In fact, as Bruce Bower recently noted in Science News, "Intelligence deficits make up one of the most firmly established characteristics of criminal offenders as a whole." But critics suggest that this may simply mean that high-IQ criminals are more likely to avoid capture. A new study by Peter Giancola and Amos Zeichner, however, suggests that IQ and aggression are strongly linked even in non-criminal males. The results of their study bolster the hypothesis that a higher IQ or being able to think clearly protects against the expression of anti-social or aggressive behaviour.

Can One Reverse Low IQ?

A growing body of research, however, suggests that more direct approaches, aimed at actually improving IQ, may be effective in the fight against crime. Goodman's findings suggest that even small gains in IQ might make a major dent in the rate of aberrant behaviour, delinquency, and crime. Approaches, which could lead to improve IQ, will be discussed. Research studies suggest that dietary improvements, treatments to reduce toxic lead levels, and similar interventions can cause small to moderate gains in IQ.

Supplementing Brain Nutrients

A number of researchers report that simply improving the diets of lower-IQ children can improve their intelligence scores. Among the studies:

In 1991, Stephen Schoenthaler and colleagues tested the effects of vitamin/mineral supplements on 26 subjects at a juvenile treatment centre. After a 13-week double-blind, placebo-controlled trial, Schoenthaler found that "the group of 15 subjects on supplements produced significantly larger gains in non-verbal IQ than the group of 11 subjects on placebos."
In another study, Schoenthaler tested the effects of vitamin/mineral supplementation on 615 school children. Treated subjects in this study showed an average nonverbal IQ gain of four points.

In a study reported in The Lancet in 1988, David Benton and Gwilym Roberts supplemented the diets of 30 school children, while giving placebos to 30 others (and no tablets at all to another group of 30). After eight months, the nonverbal IQ scores of the treated subjects had increased significantly, while the nonverbal IQs of untreated children were unchanged. Benton and Roberts noted that nonverbal IQ is more changeable than verbal IQ. "Inadequate nutrition," they said, "would be expected to show its earliest effects on the more biological intelligence measured by the nonverbal intelligence test."

A 1991 study by Benton and Richard Cook, of 47 six-year-olds, produced similar results: the IQ scores of children taking the supplements increased by 7.6 points, while the placebo group's scores fell by an average of 1.7 points.

Children receiving vitamin-mineral supplements in each study, Schoenthaler and Bier say, "Performed better, on average, than placebo in nonverbal IQ, regardless of formula, location, age, race, gender, or research team composition." Furthermore," they say, "the standard deviation in the variable 'IQ change' was also consistently larger in each active group when compared to its controls, confirming that a few children in each study, presumably the poorly nourished minority, were producing large differences." Schoenthaler and Bier say their data show that a poor diet may lead to impaired intelligence, and that even low-dose vitamin-mineral supplementation "may restore the cognitive abilities of these children by raising low blood nutrient concentrations."

Since hyperactivity, hyper aggressiveness, depression, and low IQ all are associated with criminality, some researchers have investigated whether or not diet may be useful in treating criminals (and, in particular, young delinquents). To date the research is encouraging.

Neuro-Chemical Imbalances In The Brain

The researchers note that the manufacture of brain chemicals involved in attention is dependent on nutrients in the diet. They say, "It is noteworthy that the ingredients for relevant neurotransmitters (including vitamins and minerals) have [not only] been found deficient in active alcohol and drug abusers but often remain in deficit well into recovery."

Researcher Joseph Hibbeln notes that eating increased amounts of omega-3 fatty acids can raise concentrations of serotonin in the brain. Hibbeln and colleagues currently are studying the relationships between omega-3 fatty acids and serotonin and dopamine metabolites in healthy subjects, violent subjects, and early- and late-onset alcoholics. Preliminary research indicates that these relationships are significantly different in healthy subjects than in violent or early-onset-alcoholic subjects.

In France, Frederic Saudou et al. engineered a different type of mice: their experimental animals' brains lacked one type of receptor for the chemical serotonin. Low levels of serotonin, a neurotransmitter, have been linked to impulsive violence, suicide, alcoholism aggression, and depression. Their findings, they say, indicate that serotonin receptors may be activated in response to stressful situations.

Other studies also link aggression, impulsiveness, antisocial behavior, depression, alcoholism, suicide, and even fire-setting to low levels of the neurotransmitter serotonin. Now a large-scale
study indicates that even among mentally healthy individuals, reduced serotonin system responsiveness is linked to aggression and impulsivity.

These findings from a general-population sample are significant, Manuck et al. say, because they indicate that serotonin levels are associated with individual differences in aggression and impulsive behavior. Their data support earlier research by Terrie Moffit and colleagues, who studied 781 young men and women selected from the general population, and found a strong relationship between altered serotonin functioning and violence in men. Furthermore, Moffitt et al. say, the effects serotonin on aggression remained significant after the researchers controlled for a host of factors including gender, diurnal variation, diet, psychiatric medications, illicit drug use, season during which the blood test was done, plasma levels of tryptophan (the dietary precursor of serotonin), alcohol and tobacco use, psychiatric diagnoses, platelet count, body mass, socioeconomic status, IQ, and history of suicide attempts.

Barbara Stanley et al. noted that aggressive subjects with low serotonin levels were also more impulsive than non-aggressive subjects, which is consistent with evidence linking reduced serotonin levels and impulsive behavior. They also say their finding suggest that impulsive aggression could be reduced by drugs targeting the serotonergic system.

“Diets low in or otherwise blocking the uptake of tryptophan or tyrosine (the precursors of serotonin and norepinephrine, respectively) have been found to lower the levels of these transmitters in the brain. In addition, even when returned to a normal diet, brain serotonin levels are never fully compensated. Poor nutrition possibly occurring in individuals of lower socio-economic status, including dietary care during pregnancy, may very well influence neurotransmitter levels throughout life.”

Adrian Raine, Ph.D., in The Psychopathology of Crime, 1993

Diet And Aggression

While most studies on diet and behaviour have focused on reducing hyperactivity, there is evidence that diet also has a strong influence on aggression. Physician Melvyn Werbach sites several research studies on diet and aggression. He concludes that:

Epidemiological studies have repeatedly found associations between overaggressive behaviors and deficiencies of several essential nutrients: niacin, pantothenic acid, thiamin, vitamin B6, vitamin C, iron, magnesium and tryptophan.


This evidence, he says, "Argues that a nutritional approach should be considered in the treatment of the aggressive behavioural syndrome."

During the early 1980s, Stephen Shoenthaler instituted dietary changes in a dozen juvenile correctional institutions. His data showed that following these dietary interventions, which involved 8076 delinquents; the institutions had a 47% reduction in antisocial behaviour including assaults, insubordination, horseplay, suicide attempts, and general rule violations. Schoenthaler notes,
additionally, that "the more violent the bad behaviour before dietary interventions began, the more the improvement."

In a typical study, Schoenthaler supplemented the diets of 71 residents of a state juvenile treatment facility. During the treatment phase of the double-blind, placebo-controlled, crossover study, Schoenthaler reported, "overall violence fell 66 percent from 306 incidents to 104. Total AWOL and escape attempts fell 84 percent from 79 to 13 incidents and destruction or theft of state property dropped 51 percent from 49 to 24 incidents." He concludes "the trial demonstrated, rather convincingly, that supplementation at dose levels which pose no risk whatsoever can produce a significant reduction in violence and antisocial behaviour in incarcerated juveniles."

Schoenthaler et al. studied working-class children in two primarily Hispanic elementary schools in Phoenix, Arizona. One study focused on 80 of the children who had been formally disciplined for violating school rules during the school year. Half of these children received daily vitamin-mineral supplementation for four months, while the other half received a placebo. During the study period, the researchers report, the children taking the supplements exhibited a 47 percent lower mean rate of antisocial behavior than the children who received placebos. Only one subject taking the active supplements committed more than two violations during the study, as compared to nine of the placebo-group subjects.

These findings, the researchers say, are comparable to previous studies by Schoenthaler et al. showing up to a 47 percent decreases in disciplinary actions in incarcerated children or adults receiving vitamin-mineral supplementation. These studies, too, revealed that most of the change was explained by the reduced infractions of a minority of “hard core” rule-breakers.

Shortage of magnesium, copper, zinc, calcium, iron occurs more often among hyperactive children than among those being healthy, and deficiency of magnesium is the most frequent in this respect.

In one study a group of 110 children with magnesium deficiency was divided into two groups according to the other mental disorders that coexist with ADHD: 1) the group where hyperactivity coexists with disorders typical for developmental age such as enuresis, tics, separation anxiety, stuttering, selective mutism (63 children); 2) the group where hyperactivity coexists with disruptive behaviour disorders: conduct disorder and oppositional defiant disorder (47 children). The zinc content was lower among children with ADHD and disruptive behaviour disorder. The findings herein presented indicate that it is necessary to take into consideration a bio-elements deficiency among children with ADHD. Consequently, this as well as other studies proves that there is a need of magnesium supplementation in ADHD children irrespectively of other mental disorders. The supplementation of that kind of magnesium supplementation gives us the opportunity to extend the methods of therapy of ADHD children who are the "children of the risk" in connection with their educational, emotional and social problems.

Learning Problems

Earlier research suggests that iron deficiency impairs not only cognitive skills, but also behavior. In 1992, researcher Melvyn Werbach reported that iron deficiency has been shown to be directly associated with aggressive behavior (conduct disorder) and Jun-bi Tu et al. reported in 1995 that iron treatment led to significant improvement in the behavior of violent and destructive teens. An earlier study by G. M. Rosen et al. found that nearly a third of a population of incarcerated delinquents, most of them male, showed evidence of iron deficiency.

The inclusion of plentiful DHA (the full name please) in the diet improves learning ability, whereas deficiencies of DHA are associated with deficits in learning. DHA deficiencies are associated with
foetal alcohol syndrome, attention deficit hyperactivity disorder, cystic fibrosis, phenylketonuria, unipolar depression, aggressive hostility, and adrenoleukodystrophy. DHA is present in fatty fish (salmon, tuna, mackerel) and mother’s milk. Studying 6- to 12-year-old boys, L. J. Stevens and colleagues found that "a greater number of behavior problems, assessed by the Conners’ Rating Scale, temper tantrums, and sleep problems were reported in subjects with lower total omega-3 fatty acid concentrations." In addition, they say, more learning and health problems were seen in this group.

These data do not imply that human behavior is not largely a learned phenomenon. However, for a minority of children, neither rewards nor official sanctions produces conformity. This data provides evidence that undiagnosed and untreated malnutrition may be impairing their brain function to such an extent that normal learning from discipline does not occur.

William J. Walsh organized an ex-offender program for prisoners leaving Statesville Penitentiary. Most people believed that criminals were the product of their past life and family nurturing." Walsh realized that these people were different from the rest of the population, and the difference is physiological." Many of the prisoners, Walsh noted, came from caring families and had law-abiding siblings; in addition, parents often said the children who grew up to be criminals were "different from birth."

Walsh founded the Health Research Institute to study links between behaviour and biology. In one of the Institute’s first research projects, Walsh studied 24 pairs of brothers. Each pair lived together, and included one violent, delinquent sibling and one sibling with no academic or behavioural problems. Hair samples taken from the non-delinquent siblings revealed no abnormalities, while samples from the delinquent siblings showed two markedly abnormal patterns. One pattern of biochemical abnormalities ("type A") was seen in subjects who exhibited episodic violence, while another ("type B") was found in psychopathic subjects who showed no conscience or remorse, were pathological liars, and often tortured animals or set fires as children.

A controlled study by Walsh et al. of 192 violent and non-violent males found the same pattern: 92 of 96 violent subjects had type A or type B biochemical profiles, while only five of the 96 non-violent subjects had abnormal profiles. According to Walsh, type A subjects have elevated serum copper, depressed plasma zinc, high blood lead levels, and abnormal blood histamine levels. Hair analysis reveals an elevated copper-to-sodium ratio that Walsh calls “quite striking.” Type B subjects have elevated blood histamine, low plasma zinc, and elevated lead levels. Walsh says that only of one percent of the general population, but up to 60% of studied prison populations, exhibit the type B pattern.

Could the violent acts these criminals committed have been prevented? Walsh says that treatments aimed at remedying the biochemical abnormalities his studies associate with criminality and violence often are highly effective. He and his colleagues have treated a large number of violent and/or delinquent children and say that about 70% of their patients experience a marked drop in assaultive behaviour. They found that this treatment is complementary with existing behaviour modalities. Therapists told them that biochemical treatment often results in marked improvement in the effectiveness of behaviour modification, counselling, and other techniques.

Learning Disorders

Cognitive problems are strongly linked to delinquency, criminality, and behavior problems. In addition, cognitive deficits, and in particular weaknesses in language skills, play a role in drug and alcohol abuse. But new research adds to evidence that cognitive skills, far from being unchangeable, can often be improved significantly through simple, inexpensive biological interventions.

Researchers note that iron deficiency is epidemic: despite the current fortification of cereals and other foods, as many as 25% of adolescent American girls have inadequate intakes of the nutrient.
"Animal models," Bruner et al. say, "have revealed several mechanisms by which iron deficiency may affect cognition; these include changes in brain iron content and distribution, and in neurotransmitter function."

Ann Bruner and colleagues recently studied the effects of iron supplementation on 73 high school girls who were deficient in iron, but not anaemic. When these girls’ cognitive skills were tested following treatment, Bruner et al. say, "girls who received supplements... performed better on verbal learning and memory tasks than the girls who had not taken iron supplements." Bruner et al. conclude, "Even in the absence of anaemia, iron supplementation improves some aspects of cognitive functioning in iron-deficient adolescent girls."

Criminal behaviour is strongly linked to learning disabilities, and a new study indicates that some learning disabilities, in turn, are linked to vitamin A deficiency. The good news: the problem is not just preventable, but also reversible. Ronald Evans et al. at the Salk Institute found that vitamin A-deficient diets diminished chemical changes associated with learning. Remarkably, these changes were reversed within two days when the mice received vitamin A in their diets. Vitamin A, the researchers say, directly affects the brain area, which plays a primary role in memory and learning. Nearly 190 million children worldwide suffer from vitamin A deficiency. Studies show that inner-city children have low levels of this nutrient. Survey data also indicate that nearly half of adult men and women consume less than half the recommended amount of vitamin A. Effects of vitamin A deficiency can be reversed.

One explanation for failure to learn is that of reduced IQ. Researchers found a significant difference of 2.5 nonverbal IQ points between children taking active supplements for three months, and those taking placebos. Moreover, they note that this overall gain was due almost entirely to 24 children who exhibited an average 16-point higher net gain in IQ scores than matched placebo controls.

A separate research group has published a study indicating that supplementation can dramatically improve learning-disabled students' school performance. The findings are of interest to criminologists, because learning disabilities are a very strong risk factor for delinquency and adult criminality. "Some children gained three to five years in reading comprehension within the first year of treatment," they note, "and all children in special education classes became main-streamed, and their grades rose significantly." The researchers next enrolled 12 of their subjects in a one-year double-blind study of the nutrients' effects, after which about half of them remained on the nutrients for at least an additional two years. The subjects all continued to exhibit upward trends in academic performance until the group that discontinued the nutrients had been off them for a second year. At that point, Carlton et al. say, "the group off the nutrients dropped 7.3 points on a scale evaluating grades and academic placement changes from the previous year, while the group that remained on the nutrients continued an upward trend by rising 3.2 points above the previous year." They add, "The declines in grades for the seven children who discontinued nutrients after the end of the closed trial were so severe that their respective schools took three of them out of the academic track in which they had been placed earlier in the study, and placed them in a vocational track." Unlike Schoenthaler et al, who found significant IQ increases in their nutrient-treated subjects, Carlton and colleagues did not see IQ gains in supplemented children. Rather, they say, the nutrients helped the children "to approach fulfilment of their capacity," In addition to improving subjects' academic performance, the researchers say, nutritional supplementation resulted in marked changes in mood and behaviour. "For example," they note, "three of the boys and one of the girls had classmates visit at home for the first time in their lives."
While the researchers initially believed that the gains in their subjects were due to an increase in the raw materials available for the synthesis of neurotransmitters, or to enhanced cellular metabolism and energy production, they note that the long-term positive effects seen in subjects who stopped taking the nutrients suggest a more permanent effect. They speculate that nutritional supplementation may affect gene expression of proteins that are involved in the formation of dendrites (the branching extensions of neurons).

Dyslexia, Attention Deficit Hyperactivity Disorder And Behaviour Problems

How many criminals is dyslexic? Previous studies have revealed rates of dyslexia ranging from 41 to 78 percent in prison populations. In addition to causing reading difficulties, left-right confusion, mirror reversals of letters and words, and sequencing and memory problems, dyslexia is often linked to movement impairments and to behavioural problems resembling attention deficit hyperactivity disorder (ADHD). Research by B. Jacquel line Stordy suggests that the cognitive, behavioural, and motor problems of dyslexics may stem in part from deficiencies of long-chain polyunsaturated fatty acids (LCPUFAs), substances critical for brain and eye functioning.

Like dyslexia, ADHD is a risk factor for delinquency and later social and career failure—a finding that appears to be true even for ADHD children with no co-existing symptoms of conduct disorder. In a recent article, Stevens and colleagues suggest that a subgroup of hyperactive children—those who show physical signs of EFA deficiency, such as dry hair, frequent urination, and excessive thirst—may have metabolic defects that make it difficult for their bodies to use fatty acids efficiently. Their research shows that children with both ADHD and these physical symptoms have lower plasma proportions of certain fatty acids and a higher ratio of fatty acid precursors to metabolites than control subjects or other ADHD children, suggesting that their bodies are not efficiently processing the precursor substances.

Hypoglycemia

Hypoglycemia refers to low blood sugar. Normally the body maintains blood sugar levels within a narrow range through coordinated effort of several glands and their hormones. Reactive hypoglycemia is characterized by development of symptoms three to five hours after a meal. Research shows a strong connection between hypoglycemic symptoms and criminal behaviour. Reactive hypoglycemia is a common finding in habitual violent and impulsive criminals. Reactive hypoglycememia was shown to induce fire setting behaviour in one study. In several studies, involving over 6,000 juvenile delinquents, simple dietary intervention for the control of hypoglycemia has revealed very promising results. In the studies the experimental groups were placed on a sugar restricted diet while the juvenile delinquent in the control group were placed on a control diet. Antisocial behaviour was reduced by 45%. These studies were conducted for a period of 2 years.

Some hypothesize that most crimes are committed while in a hypoglycemic state. The reason for this is because then the higher brain centers (Critical thinking, socially acceptable behavior, conscience) fail to function because they are deprived of the much needed glucose then.