VIOLENT CRIME, HYPERACTIVITY AND METAL IMBALANCE

A review of Neil Ward's work by Nicholas Kollerstrom

Abstract

Do violent criminals have a distinctive profile of their body metal burden? Such a thesis was advocated by Professor Derek Bryce-Smith in 1974, who hypothesised that criminals, where the crime involved loss of self-control, had a similarity in this respect with the condition known as 'hyperactivity.' Evidence in support of this thesis has come from a survey by Dr Neil I. Ward (1995, University of Surrey School of Biomedical and Molecular Sciences), whereby multi-element hair and blood analyses of incarcerated criminals were compared with a matched control group of 'normals'. Ward and colleagues have used a similar methodology for a British group of ADHD ('hyperactive') children, published in 2002. The Bryce-Smith thesis was primarily focused upon lead toxicity, whereas Ward has assayed eleven metals. Also, the enhanced accuracy of assay procedures mean that reliable measures of toxic metals, especially cadmium, and essential trace elements have, within the last decade or so, become available for the first time. Options for displaying such multi-element data-sets, from blood, hair and from urine, are here considered. While methods of chelation-therapy for remedying such imbalances are outside the scope of this article, these results indicate a beneficial use of chemistry for decreasing crime, curing criminals and promoting social well-being, which now appears as a quite practical proposition.

Foreword

A hypothesis first proposed in 1974 by Professor Derek Bryce-Smith in a discussion of hyperactivity and criminality reached its still-ignored conclusion that '*... offenders of this type would be better treated with penicillamine than prison*'[1]. Upon being awarded the John Jeyes Lectureship, Bryce-Smith developed this thesis in an address to the Royal Society of Chemistry in 1986: as to why society should be so loath to adopt a more 'humane approach' of tackling the biochemical imbalances that predispose to crime. It was suggested that this could be because it 'blurs the sharp distinction which Society finds it convenient to draw between illness and wickedness.'[2] His view was that '*...few appear to perceive any inconsistency between the assumption of non-chemical causation on the one hand, and the widespread adoption of chemical remedies or palliatives on the other*.' Such ideas were based upon decades of research in the field of lead toxicity, but it is now possible to test this thesis in a larger context, spanning eleven metals. The charity 'Foresight', which was founded in 1978 and dedicated to pre-conceptual care, has long emphasised that these are vitally important matters for mothers-to-be[3].

Lead and toxic metal measurements

Population lead levels have plummeted during the last twenty years, as lead has been removed from pipes, paint and petrol. Does that mean that lead is now in the clear? Perhaps surprisingly, both UK and US surveys conducted during the 1990s indicate that a negative gradient endures in correlation between body lead levels and I.Q., right through general population levels, with no evidence yet appearing of a threshold[4]. The issue had erupted into public debate around 1979-81, when the assaying problem over measuring blood lead around the 'normal' levels of 0.1-0.2 parts per million in serum was in some ways just as severe as the evaluation of whether such levels could be toxic[5]. Nowadays, European Union mandates specify toxic thresholds in parts per billion, because in the last decade or so measurement at these levels has become reliable. The percentage differences we will here examine, especially for cadmium, require confidence that measurements can be reliably made to the order of ten parts per billion. It is a cause for optimism, if assay procedures have finally reached the levels required for estimating maximal tolerable body levels for the toxic metals.

Present-day imbalances derive from two different kinds of causes:

1. toxic metal environmental pollution (if one may include aluminium from cooking utensils[6] and cadmium from cigarette smoke[7] in this broad category)
2. depletion of arable topsoils from modern agricultural practices, resulting in food lacking in essential micronutrients[8].

If we indeed have a generation of 'toxic metal kids' roaming the streets, then our society needs greater awareness of the effect which metal imbalances can exert, in predisposing towards violence and lack of self-control. The chemistry departments of Reading (Derek Bryce-Smith) and Surrey (Neil Ward) Universities have provided, it will here be argued, a key whose significance needs to be more widely appreciated, whereby the science of chemistry may come to be more associated with human well-being. Dr William Walsh, addressing the Well Mind Association (US) in 1991, remarked: '*The answer to crime prevention is not in bigger prisons and more stringent penalties but in identifying children and intervening biochemically before their lives are ruined*[9].' The UK has of late achieved Europe's highest rate of citizen incarceration[10], and if the study of body-metal imbalances can, even to a small extent, remedy this situation, it is worth investigating.

The Researches of Neil Ward

Dr Neil Ward successfully gained permission to obtain hair and blood samples from a group of 68 incarcerated young criminals (males, aged 16-19 years), and compared them with a group of controls matched for age, sex and geographical location[11]. Hair samples provide a 'diary' of long-term exposure and tend more to show whole-body accumulation of toxins[12], whereas blood samples tell a more transient story concerning recent absorption of nutrients before they have been stored or excreted. Within that criminal group, there were 28 whose crime involved violence, and they will here be called VYCs (violent young criminals). Ward assessed eleven metals per sample, using an inductively-coupled plasma mass spectrometer.

Hair sample analyses showed mean values for lead and aluminium in that sub-group elevated by a factor of about four, while the cadmium levels were doubled. No less remarkable were the deficits displayed in certain essential trace metals (such as chromium, selenium and zinc) in the hair samples:[13] two of these, zinc and chromium, were *reduced* by just as large a factor, as the 'toxic' metals were raised. Each of these six group-differences was significant at over 1 in 1000 (with the student's t-test giving values of >10). Merely comparing these six metal

Table 1: Hair sample analyses, dry weight (Ward 1995) mg/kg or ppm

Metal		Normal	Violent Young Criminals (VYCs)
Aluminium		1.8 ± 0.7	13 ± 6
Lead		2.7 ± 0.4	8.6 ± 2
Cadmium		0.11 ± 0.04	0.27 ± 0.11
Chromium		0.9 ± 0.3	0.23 ± 0.2
Selenium		1.8 ± 0.7	0.3 ± 0.2
Zinc		167 ± 42	137 ± 27

means for VYC versus controls would enable the separating out of these two groups more or less completely.

To what extent were these results replicable in blood samples taken from the same group? Figure 1 displays both the blood and the hair analysis results, expressed as % excesses or deficits[14]. It shows how the magnitude of the blood-group differences were on average smaller than those from the hair samples; and that 8 of the 11 different elements had the hair and blood level excess/deficit in the same direction. This graph summarises over two thousand elemental values,[15] of both the control and criminal group. Presentation of the data as excess or deficiency trends maybe seen as being more meaningful than the mere statistical values.

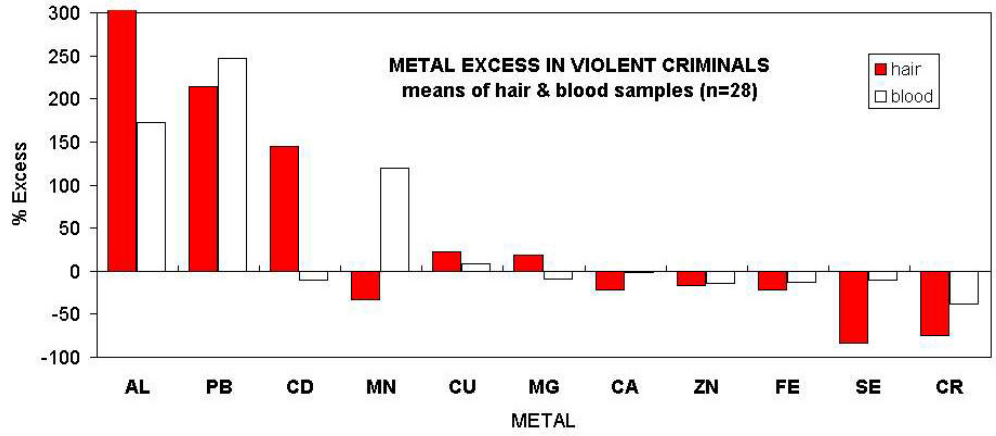

Figure 1: Element means of 28 violent young criminals (n=28) compared to those for a control group age and sex-matched (n=68), using both hair and blood samples, for: aluminium, lead, cadmium, manganese, copper, magnesium, copper, magnesium calcium, zinc, iron, selenium and chromium.

Hyperactivity

Ward also reported remarkably similar 'metal-profiles' for children diagnosed with 'Attention-Deficit Hyperactivity Disorder' (ADHD), using a survey of over 500 such children from Oxfordshire: significantly *lower* chromium, iron, selenium and zinc, with *raised* cadmium, aluminium and lead. These are the same metals raised and lowered that were earlier found in the pilot study on violent criminals[16].

Table 2 shows the results, using the same six elements given in Table 1.

Table 2: Hair sample analyses, dry weight (Ward 2002) mg/kg or ppm

Metal	Normal (n=436)	Hyperactive (n=1238)
Aluminium	2.2 ± 1.4	8.3 ± 2.4
Lead	2.7 ± 1.3	6.7 ± 3.1
Cadmium	0.3 ± 0.15	1.8 ± 1.2
Chromium	0.72 ± 0.18	0.38 ± 0.12
Selenium	0.78 ± 0.17	0.38 ± 0.12
Zinc	141 ± 35	94 ± 31

In this study it was possible to sample hair, blood and urine from these hyperactive attention-deficit children, and Figure 2 shows the breakdown of results. This time all three samples were in the same direction for *every one* of his eleven metals, and it may be that this merely reflects the larger sample size.

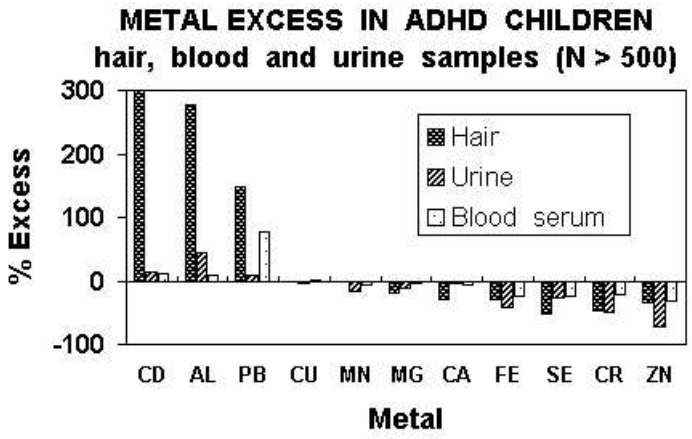

Figure 2: As for figure 1, but sampling urine (n=687), hair (n=1238) and blood (n=518), from a group of ADHD children, comparing with smaller control groups, respectively 198, 436 and 178

Further Studies

An earlier and somewhat comparable study by Ward and Bryce-Smith looked at birth-weight and head circumference of 79 newly-born live infants around Merseyside[17 18]. They found that levels of iron, chromium, cobalt, calcium, zinc and copper all correlated positively, while lead and cadmium were negatively correlated with these two parameters. Aluminium and mercury showed no correlation. The level of cobalt - which does not appear to have relevance for crime and hyperactivity - was here affecting both body weight and head size at birth. It was found that cigarette-smoking was directly associated with cadmium levels (other smoking-associated toxins, e.g. nicotine or carbon monoxide, being non-elemental)[19]. Ward and Bryce-Smith followed this up with a study of 42 stillborn foetuses from South Wales[20], which confirmed the well-documented antagonistic relation between raised levels of lead and cadmium, and lowered levels of zinc.

More recently, Ward has investigated a small group of hyperactive 'problem' children (n=32) in Roca, Argentina[21]. He reported fairly comparable results using just hair samples, except that some of the population-means were rather different: both the control and the hyperactive groups had elevated aluminium levels, and there was hardly any zinc deficit amongst the hyperactive group, whereas they had on average doubled mercury-levels.

One study has found elevated levels of manganese in violent prisoners compared to non-violent[22]. That may well be so, but it is here being argued that a more integrated view which

places the different 'likely suspects' together in a multi-element analysis is necessary if this modern problem is to be resolved.

Data Presentation

For an initial inspection, there may be a case for combining the percentage excesses (of hair, blood and urine) to give an overall indication of body burden (Figs 3 and 4). One could add other elements (such as lithium, vanadium, arsenic and mercury) but it may be preferable not to have too many to start with. For reaching busy social workers and doctors, concerned with promoting well-being and diminishing the number of violent-crime re-offenders, some such guidelines in graphical presentation may help. If Figures 1 and 2 each summarise over two thousand measurements, then optimal presentation of the data is worthy of serious consideration.

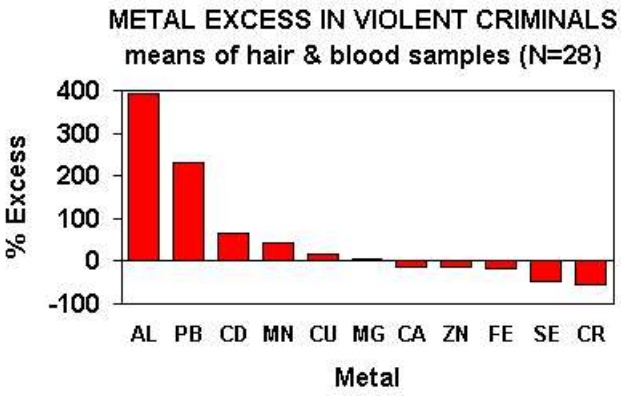

Figure 3: As for Fig 1, but averaging hair and blood sample ratios together

These comparisons group together essential elements - such as copper and zinc, which are homeostatically regulated by the body's biochemistry and which therefore have well-defined 'normal' ranges - with toxic metals, such as cadmium or lead that are not subject to such, so their 'normal' range merely reflects the ambient pollution. It excludes mercury, which Neil Ward found (somewhat surprisingly) to be 'in the clear' i.e. not showing any toxic effects in these groups: its toxicity has long been associated with 'mad hatter' symptoms, so this is in itself rather remarkable. It also excludes arsenic, even though in many parts of the world this is an important water-borne toxin, because it is not easy to measure by most modern analytical instruments. Figure 3 shows the averages of the blood and hair groups given in Figure 1[23].

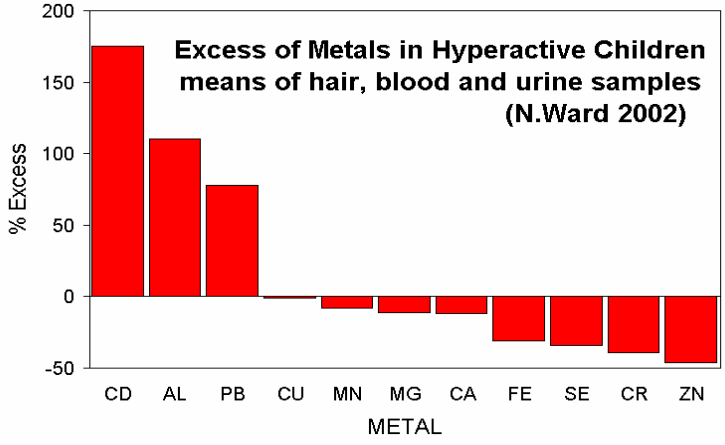

Figure 4 As for figure 2, but averaging the mean hair, blood and urine sample ratios per metal.

A Partial Replication

A group of 20 imprisoned offenders were compared with the same number of soldiers living in barracks, using multi-element analysis of blood samples, by ex-policeman Peter Bennett in his M. Phil. dissertation at Exeter University in 2002[24]. This work does not test the hypothesis here formulated concerning violent criminals, hyperactivity and metal imbalances, nor has it been published in any journal, but it is the nearest thing to a replication of Ward's study that exists.

Bennett found that all 20 prisoners had high lead and aluminium, and high ratios of lead to iron, and 18 had a high ratio of aluminium to zinc. Nine had a high cadmium to zinc ratio. From a test and questionnaire the prisoners showed high scores of irritability, short temper,

poor concentration, aggression, hyperactivity, depression and migraine. Bennett's work emphasises the synergistic manner in which elements work, e.g. cadmium becomes less harmful if adequate zinc levels exist, and it focuses more on the individual cases of imbalance and treatment. At a 'Food and Mood' Conference, Bennett (as director of the Restorative Health Company (www.rehealth.com)) presented some blood/hair analyses of criminals[25]: he cited high levels of cadmium and lead found in two mass murderers[26]. For one disturbed youth repeatedly criminally convicted, the blood analysis showed he was deficient in calcium, chromium, manganese and selenium, while high in aluminium, cadmium and lead.

The London-based 'Biolab' performs hair-sample analyses for the public[27] and it kindly provided the author with the hair element-means used to assess samples treated. For the six elements cited in Tables 1 and 2 these are in parts per million (or, mg/kg): aluminium 2.3, lead 4.3, cadmium 0.17, chromium 0.69 and selenium 1.9. These agree with the above-cited means, which is encouraging and indicates a concordance in the hair-washing and cleaning protocols prior to the analysis (For comparison, another hair-analysis clinic consulted was using far higher aluminium and cadmium mean hair levels: the former being widely present in dust and the latter in cigarette smoke).

Discussion

For today's 'Ritalin generation[28]' these results are vitally important, showing comparable 'metal profiles' for one single batch of VYCs and a larger sample of hyperactives. The main difference was that the criminal group had a larger excess of lead and aluminium than was found within the ADHD children. Reports in this area often comprise statistical comments upon whether results are 'significant' but without citing the raw data; here, a different approach has been advocated. The evidence here presented supports the action taken by the charity 'Natural Justice'[29] by way of dietary adjustment to incarcerated criminals, one component of which involved supplements containing selenium and zinc (at Aylesbury Young Offenders Institute, Bucks). A significant decrease in antisocial behaviour was found to result[30].

The Home Office has not approved of such investigations being performed in British prisons, and the governors generally refuse. Home Office officials need to understand that no blame or guilt inheres in the fact that a major cause of violent crime derives from biochemical imbalances that can readily be treated and cured. It took a while for a scientific consensus to be reached, that levels well below one part per million could possibly exert such an effect. It is OK for politicians to move slowly while scientists are making up their minds: the results need to be well-established before they can or should be translated into legislation. The EU has, for example, made removal of cadmium from batteries a priority, but without alluding to its presence in cola drinks and cigarette smoke. If replicated, the results here described could indicate that there are no other factors, social or environmental, which predispose to criminality more than the influence of these several metals. Therefore, there would be only a limited value in social reform programs for violent criminals, unless these metal levels were also addressed and corrected.

It has been argued that '*violent adults have only one thing in common, poor childrearing*.'[31] No doubt, this approach is vitally important. But, the above results tend to suggest that a remedy for the problem will not be found within it, unless pertinent biochemical imbalances are also taken into account. Tackling crime, Bernard Gesch concluded, must 'involve getting tough on the causes of antisocial behaviour, i.e. getting tough on nutrition.'[32]

About the Author
Nicholas Kollerstrom PhD wrote the book *'Lead on the Brain: a plain Guide to Britain's No. 1 Pollutant*' back in 1984, and this article shows just how much the subject has developed since then. He used to live in Guildford, and thereby came to take an interest in Prof Neil Ward's work at Surrey University's chemistry department. Currently Nicholas is a member of staff at University College London, in the Science & Technology studies department, where he works as a science historian.

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23. Each bar on the graph represents $100x\{(H_c-H_n)/H_n+(B_c-B_n)/B_n\}/2$ where H and B are hair and blood concentrations, H_n being the 'control' mean and H_c the mean of the criminal group
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