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# Long-term validity of biological markers of psychopathy and criminal recidivism: follow-up 6–8 years after forensic psychiatric investigation

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**Abstract**

This study is a follow-up investigation of a forensic psychiatric sub-population 6–8 years after forensic psychiatric evaluation. The aim was to examine the long-term validity of biological markers of psychopathy and antisocial behavior over time. Data on criminal records were obtained at follow-up from the National Council for Crime Prevention. Basic data included findings of psychiatric and psychological assessments, as well as values for serum triiodothyronine (T3) and free thyroxin (FT4), and platelet monoamine oxidase (MAO) activity, all obtained during the forensic psychiatric examination. Criminal recidivists at follow-up had higher serum T3 levels than non-recidivists, and much higher values than normal controls, while their levels of free T4 were lower. The T3 levels in criminal recidivists correlated to psychopathy- and aggression-related personality traits as measured by the Karolinska Scale of Personality. In violent recidivists, a remarkably high correlation was noted between T3 levels and Irritability and Detachment, traits that have previously been linked to the dopaminergic system. Stepwise multiple regression analyses confirmed the relationships of T3 levels and platelet MAO activity with personality traits in criminal recidivists. The predictive validity of biological markers of psychopathy, T3 and platelet MAO, measured during forensic psychiatric investigation, is stable over time. The results indicate chronic alterations of the hypothalamic–pituitary–thyroid axis in this group of subjects.


*Keywords:* Triiodothyronine; Thyroxin; Platelet MAO activity; Karolinska Scale of Personality; Criminality; Follow-up

## 1. Introduction

The hypothalamic–pituitary–thyroid (HPT) axis has been the focus of numerous studies of somatic disorders and of depression. Nevertheless, little is known about how thyroid hormones influence personality and its behavioral manifestations. Levander et al. (1987), in a study of criminally active boys who were institutionalized and who had been exposed to severe psychosocial strain from early infancy, found that these boys had significantly higher levels of triiodothyronine (T3) than did normal schoolboys. In a long-term follow-up of another group of delinquents, individual T3 levels were shown to be risk indicators for per-

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sistent criminality (Alm et al., 1996b). Previous studies of the present sub-population indicated that there is an intimate relationship between the thyroid hormones T3 and free thyroxin (FT4) and abuse and antisocial behavior (Stalenheim et al., 1996). Moreover, serum levels of thyroid hormones measured in adult life have been found to be retrospectively related to a history of conduct disorder (Ramklint et al., 2000).

There has long been evidence of a close relationship between stress and thyroid function (Mason, 1968). Of special interest for the present investigation is the fact that an unusual thyroid profile characterized by high T3 levels has been observed in refugees. This finding has now been confirmed in studies of Vietnam combat veterans, Israel combat veterans and World War II veterans, and also in refugees from East Germany (Bauer et al., 1994; Mason et al., 1994, 1996). The elevated levels of T3 in persons with post-traumatic stress disorder (PTSD) have been related to the personality trait of Novelty Seeking and hyper-arousal symptoms. The observed alterations of thyroid function associated with PTSD symptoms seem to be chronic, as they can be detectable even after 50 years (Wang et al., 1995, 1997; Wang and Mason, 1999). However, the robust elevations observed in veterans with combat-related PTSD probably would not be discovered in routine clinical thyroid function tests. The elevations of T3 are still within the normal range as defined in the field of clinical endocrinology and do not indicate glandular pathology but point to a potentially clinically significant hormone–symptom relationship (Wang et al., 1997).

Several studies have also revealed associations between alcoholism and thyroid hormones (Baumgartner et al., 1994; Heinz et al., 1996). In a previous report, we have shown that the relationship between T3 and criminal behavior and alcoholism persists after adjustment for liver function (Stalenheim et al., 1996). The reason for the deviant hormone levels in the populations referred to is still unknown.

Decreased monoamine oxidase (MAO) B activity has been related to characteristics such as Impulsiveness, Sensation-Seeking and Aggressiveness (Buchsbaum et al., 1976; Puchall et al., 1980; von Knorring et al., 1984; Zuckerman, 1984; Schalling et al., 1987). However, it is also related to disinhibited symptoms of conditions such as psychopathy, suicidal behavior and hyperactivity, and to alcoholism, especially type II alcoholism as defined by von Knorring et al. (Schalling et al., 1987; von Knorring et al., 1991; Devor et al., 1993; Oreland and Hallman, 1995). The relationship between platelet MAO activity and psychopathy, criminality and criminal recidivism is now well documented, although the exact mechanisms are still unknown (Lidberg et al., 1985; Alm et al., 1996a; Garpenstrand et al., 2002). In the present study population, previous research has confirmed this relationship of platelet MAO activity with psychopathy and suicidal behavior (Stalenheim et al., 1997; Stalenheim, 2001).

Previous studies of forensic psychiatric patients in Sweden have indicated the presence of different biological markers of vulnerability for criminality (Alm et al., 1996a; Belfrage et al., 1992; Stalenheim et al., 1996, 1997, 1998). The stability of these findings needs to be established by means of prospective studies. Follow-up studies of forensic psychiatric populations have mainly aimed at prediction of violent recidivism. Psychopathy has been found to be one heavy risk factor for recidivism in violent criminality in Sweden, as in other countries (Grann et al., 1999; Hare et al., 2000). Several biological correlates of psychopathy and socially deviant behavior have been reported, but the relevance of these findings and the biological background of antisocial behavior are still unknown.

### *1.1. Aims of the study*

The aims of the present study, using a clear-cut prospective design, were to investigate

- whether previous data defining thyroid hormones and platelet MAO activity as biological markers of psychopathy and antisocial behavior are valid over time and
- whether these relationships are mediated through personality characteristics that may indicate underlying biological mechanisms.