

SECTION IV

Some Associations of Enuresis

## The Genetics of Enuresis

HARRY BAKWIN

The family occurrence of enuresis is well-recognized. Some child psychiatrists regard the symptom as an expression of emotional dissatisfaction, the misbehaviour following a pattern set by family custom. Others consider the basis for the high family incidence to be genetic. The study of twins provides a means of clarifying this problem.

The meagre data on enuresis in twins were assembled by Hallgren (1960). Of thirty pairs of monozygotic twins, twenty-one (70 per cent) were concordant (*i.e.* both twins were enuretic); all ten pairs of dizygotic twins were discordant (*i.e.* only one twin was enuretic).

Enuresis was included as part of a study of various behavioural deviations in twins by Bakwin (1971*a*). The group consisted of 338 pairs of like-sex twins. Zygosity was determined by matching sixteen blood types (ABO, Rh (CcDEe), MNs, Fya, K, and Jka). Blood typing was omitted only when dizygosity was clinically self-evident. The children came from middle-income families, residing in towns surrounding New York City.

A child who wet the bed after his fourth birthday was considered to be enuretic. The bed-wetters encountered in this survey were, by and large, not as severely enuretic as those seen in medical practice. Most of them wet nightly, but some wet only once or twice a month. Day wetting accompanying night wetting was less frequent in this study than in most reports from pediatric and psychiatric clinics, occurring in only eight per cent of the children.

Enuresis was equally frequent in monozygotic and dizygotic twins. It was slightly more common in boys than in girls, the male: female ratio being 1.17 to 1.

The percentages of the monozygotic and of the dizygotic twin pairs who were concordant for enuresis are compared in Table I. Monozygotic twins were concordant for enuresis about twice as frequently as dizygotic twins ( $p < 0.01$ ), a finding which points strongly to a genetic basis.

TABLE I

The percent pair-wise concordance for enuresis in twins by zygosity and sex\* (From Bakwin 1971*a*)

	Monozygotic	Dizygotic	P
Both sexes	68 (53)	36 (42)	< 0.01
Boys	70 (27)	31 (26)	< 0.01
Girls	65 (26)	44 (16)	NS†

\*Figures in parentheses represent the number of twin pairs.

†NS = not significant.

In seventeen of the 53 pairs of monozygotic twins one of the co-twins was enuresis-free. Three of the enuresis-free co-twins rose nightly to empty the bladder, an unusual need after the fourth birthday. Three others were trained late for bladder control. In three others, there were various irregularities in attaining urinary control. In the remaining eight pairs, urinary control in the enuresis-free co-twins was normal. They were trained early for bladder control, they had no urgency, no nocturia, and no 'occasional accidents'.

A search for environmental factors to account for the enuresis in the seventeen affected monozygotic twins whose co-twins were normal was unrewarding. Of eleven pairs in whom birthweights were available, the proband was heavier in four, lighter in six and, in one, both twins weighed the same. Numerous cases of enuresis occurred in the families of these twins, just as they did in the families of the twin pairs where both were enuretic. Complaints of behaviour disturbances were no more frequent in the enuretic twins than in their non-enuretic co-twins.

It is of interest that, in a study of constipation (Bakwin 1971*b*), 70 per cent of the monozygotic twins as opposed to 18 per cent of the dizygotic twins were concordant for the deviation, a statistically significant difference ( $p = 0.005$ ). As with enuresis, a sizeable percentage of the monozygotic pairs (30 per cent) were discordant for constipation. In reading disability, too, concordance in monozygotic twin pairs is 84 per cent, 16 per cent being discordant (Bakwin 1973).

### **The Family Incidence**

Data on the family incidence of enuresis were obtained as part of the study of twins. The parents, usually the mothers, were asked whether bed-wetting was a problem among the children, and whether they themselves or their husbands had been enuretic during childhood. The investigations were not limited to families with an enuretic twin.

Information about enuresis in the parents is necessarily incomplete. Many adults are hesitant about admitting having had the symptom in childhood. Forgetfulness should also perhaps be taken into consideration. Since the mothers were usually the informants, they were often unable to tell whether or not the fathers had been enuretic.

Data on the family incidence of enuresis are presented in Table II, in order of decreasing genetic relationship. In the six families where both parents had been enuretic in childhood, 77 per cent of the children were enuretic, a larger percentage than among the co-twins of enuretic monozygotic twins. The lowest incidence of enuresis (8.5 per cent) was among the siblings of non-enuretic twin children. The incidence of enuresis in children whose parents had given histories of having been enuresis-free (15.0 per cent) is probably too high, since it is likely that many of the parents had in fact been enuretic.

### **Discussion**

A source of error is implicit in all comparisons of monozygotic and same-sex dizygotic twins which are designed to establish genetic relationships. Monozygotic twins, being so nearly alike, are more likely to be treated in the same way by their parents and other individuals than are dizygotic twins who are no more alike than

TABLE II  
Family incidence of enuresis

<i>Relationship</i>	<i>Total No. of children</i>	<i>Enuretics</i>	
		<i>No.</i>	<i>Per cent</i>
Co-twins of enuretic monozygotic twins	53	36	68
Children both of whose parents were enuretic	22	17	77
Children whose fathers were enuretic	47	20	43
Children whose mothers were enuretic	85	37	44
Co-twins of enuretic dizygotic twins	42	15	36
Siblings of enuretic twins	190	48	25
Siblings of twins neither of whom are enuretic	388	33	9
Children neither of whose parents were enuretic	988	150	15

same-sex siblings. To circumvent this source of error, studies have been made on monozygotic twins reared apart. Although enuresis has not been studied in this way, intelligence quotient (Burt 1957) and schizophrenia (Heston 1966) have. The results obtained from such studies have not differed materially from the results obtained in studies of monozygotic twins reared together.

In studies of twins, a genetic basis is assumed to exist when concordance for the deviation under consideration is significantly greater in monozygotic than in dizygotic twins. It is assumed too, that, when monozygotic twins are discordant, environmental factors are at work in creating the deviant behaviour, a concept originally proposed by Galton.

Mittler (1971) has questioned the concept that the genetic make-up of monozygotic twins is identical, a point of view previously expressed by Darlington (1954). He points to the well-known differences in handedness and in the direction of the hair whorl in monozygotic twins. Dermatoglyphics, too, are not always identical in monozygotic twins. Darlington (1963) concluded that 'comparisons of one-egg and two-egg twins do not give us the uncontaminated separation of heredity and environment which Galton and his successors have hoped for'.

A number of studies (Frary 1935, Stockwell and Smith 1940, Hallgren 1957, Bakwin 1961) agree that enuresis is a family disorder occurring with high frequency in the parents, siblings and other near relatives of bedwetters. In a study of the families of physicians (Bakwin 1961), in whom errors of history-taking are reduced, one or both of the parents of enuretic children gave a childhood history of enuresis in 72 per cent of cases. Frary (1935), basing her observations on 59 clans in which one or more children were bed-wetters, concluded that the occurrence of enuresis is determined by a simple recessive gene substitution.

Relevant is the study of children reared apart from their parents in the kibbutzim of Israel (Kaffman 1962). Among 89 enuretic kibbutz children, a significantly greater prevalence of enuresis was present in other members of the family than in the families of non-wetters. One out of four enuretic children had a sibling who was a bedwetter. Parents of enuretics were the only ones who gave, spontaneously, a history of enuresis in childhood. In one family, all the female members for three generations had enuresis until the age of eight to twelve years.

How the genetic factor expresses itself in the process of urination is unclear. According to Broughton (1968), nocturnal enuresis takes place during arousal from slow wave sleep, rather than in or during arousal from rapid eye movement (REM) sleep. The act is associated with mental confusion and disorientation, automatic behaviour, relative non-reactivity to external stimuli, poor response to efforts at provoking wakefulness, amnesia for many current events, and fragmentary or absent recall of dreams. He states 'there is no evidence whatsoever that REM sleep and its concomitant dreaming play a rôle in the genesis of enuretic episodes.'

Broughton has described contractions of the bladder in normal and enuretic children during the non-rapid eye movement or dreamless stage of sleep. The contractions are more frequent and more intense in enuretics. Bed-wetting is preceded by an increase in the frequency and magnitude of the contractions. They can be evoked by stimuli such as clicks, hand-clapping, and other noises. The occasional occurrence of 'spontaneous' contractions is attributed to interoceptive stimuli.

It is unlikely that emotional factors play an important part in the genesis of enuresis. Studies by Hallgren (1957) and by Werry and Cohrssen (1965) and others failed to show an excess of behavioural disturbances in bed-wetters, and this is consistent with general clinical observation. Moreover, enuresis usually occurs during the non-REM or dreamless stage of sleep. Relinquishing the symptom, either spontaneously or after treatment, is not accompanied by substitute symptoms as one would expect if enuresis is a manifestation of emotional unrest.

According to Hallgren (1957), day wetting unaccompanied by night wetting is exceptional in that it is not genetically determined. It is a rare occurrence. On the other hand, boys, but not girls, with persistent day wetting accompanied by night wetting show nearly the same pattern of family incidence as do the children with simple nocturnal enuresis, but emotional factors are prominent.

### Conclusions

Nocturnal enuresis is a family disorder, occurring with high frequency in the parents, siblings and other near relatives of bedwetters. The frequency in other members of the family is directly related to the closeness of the genetic relationship. Further support for a genetic (rather than an environmental) explanation comes from the fact that monozygotic twins are concordant for enuresis twice as frequently as dizygotic twins.

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