PERSISTENT ENURESIS: A PSYCHOSOMATIC STUDY.

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THE congeries of etiological theories and alleged cures that has accumulated round the subject of nocturnal enuresis in children proves only one thing—that we know little of the causes and treatment of enuresis. Since the war many cases of nocturnal enuresis persisting into adolescence and adult life have been seen. Presumably the sufferers were ashamed of their disability and concealed it in peacetime. But wartime conscription, often entailing absence from their homes, has compelled them to reveal it. Such cases of persistent enuresis represent the most severe form of the disorder, and an analysis of the factors involved would seem to be of more value than merely to study enuretic children in general. Once these facts are ascertained, they may throw some light on the universal problem of enuresis in children.

We have therefore studied all patients suffering from enuresis, who had reached the age of puberty, seen at the Jordanburn Nerve Hospital in recent years. Cases not fully investigated or with an I.Q. below 70 per cent. were excluded, and therefore a group of 67 remains. This is an unselected, representative series of persistent enuretics. All the case-histories were taken by one of us (H. S.) personally. If the figures upon which we base our conclusions are small, they nevertheless have a peculiar validity clinically, in that they are derived from these severe, persistent cases. Unfortunately every point was not always recorded in every case, and to prevent repetition in the text of the words "no record" we have usually given the totals recorded and omitted the balance. The ages of the patients were: From $12\frac{8}{12}$ to 15, 8 cases; from $15\frac{1}{12}$ to 20, 38; from 20 to 25, 12; 25 to 30, 1; 30 to 35, 4; and 35 to 39, 4.

A long list of congenital, infective, parasitic, nephritic, diabetic and neurological disorders is usually given for the differential diagnosis of enuresis. We had few such cases to exclude, but whether that means that they were excluded by others and not referred to us, we cannot say. A lifelong history of enuresis strongly suggests the "functional" syndrome in the absence of any congenital disorder. One differential diagnosis of importance in this series was alcoholism. Excessive drinking may produce deep sleep, distension of the bladder and incontinence; if alcoholism is denied, the negative physical findings may suggest

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a true enuresis. Examination of the urine was negative in 42 cases, including microscopic examination of the centrifuge deposit; and negative in 9 other cases, including culture. In 16 we have no note of urine examination, but such an examination had usually been performed.

Nocturnal Enuresis as Part of a Local Autonomic Symptom-Complex.

Psychological explanations of nocturnal enuresis as an emotionally determined, symbolic, symptom-formation ignore the fact that it is only one of a group of symptoms of disordered autonomic function in the pelvis—symptoms which may occur by day as well as by night. Previous clinical studies have shown some of these groupings of symptoms:

Author.	Total number of cases.	Nocturnal enuresis.	Diurnal enuresis.	Frequency.	Urgency.	Encopresis.	Remarks.
Grover (1918)	200	194	76	—	—	2	Children.
Anderson (1930)	148	144	21	—	—	10	,,
Hubert (1933)	100	100	12	Very common	—	6	Children. Two other cases had diurnal enuresis only.
Addis (1936)	30	30	15	—	—	4	Children.
Stockwell and Smith (1940)	100	98	10	47	—	—	,,
Bachus and Mansell (1944)	277	277	—	229	229	—	Soldiers. Precipitancy in 88. Pain in 12.

Kanner (1935) found in a large series of enuretic children that 63 per cent. had nocturnal enuresis only, 30 per cent. had nocturnal and diurnal enuresis, and 7 per cent. diurnal enuresis only; 10 per cent. had encopresis. On the other hand, all cases of encopresis had enuresis.

Certain authors described two types of nocturnal enuresis, one with and the other without diurnal symptoms, but none of those we have referred to give figures to support their views. The existence of a type of nocturnal enuresis without other local symptoms cannot be inferred from the gaps in the above table, as obviously all the possible symptoms had not been noted by the authors.

Our findings are as follows: One patient had never suffered from nocturnal enuresis, but had always had severe diurnal symptoms. Diurnal enuresis was noted in 43 out of 63 cases. It had persisted to not later than age 5 in 4 cases; not later than age 10 in 11; age 15 in 13; age 20 in 10; age 25 in 4; and existed from age 35 to 39 in 1. The diurnal enuresis was wholly involuntary in 29. In the remaining 14 it only happened when the patient was unable to get to a lavatory. Thus certain patients had never had diurnal enuresis except in school, where they had not been allowed out. In 9 patients the diurnal enuresis was small in amount, representing an overflow. In 24 the whole bladder was voided at certain times, although some of these had dribbling enuresis as well.

Urgency and frequency of micturition by day occurred together in 38 patients, urgency only in 4 and frequency only in 4 according to the patients,

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but these symptoms may be expected to go together. Three patients had neither. Other cases were not fully recorded, but 10 were noted to have either urgency or frequency. In all but one these two symptoms were lifelong, and had shown less improvement with age than diurnal enuresis and even nocturnal enuresis had done. Occasionally the urgency and frequency were absent for a time, only to recur. The frequency varied from every 10 minutes in an acute phase down to such an estimate as 8 times a day. Where a low total figure per day was given by the patient, frequency could be demonstrated by asking him to compare his habits with those of his contemporaries or workmates, or by finding that he was unable to sit out a cinema show.

Rising at night may not be common in enuretic children, but it was common in this series. It was usually a habit developed by the patient as he grew older to prevent enuresis. It was often so frequent as to form a major part of the complaint. Out of 58 cases 17 never rose at night ; 20 rose on occasional nights ; 6 rose two or three times a week and 15 rose every night. Of the 15 who rose every night, only 3 rose but once. All the rest rose more frequently, up to 2 who rose 6 times every night. In the 21 who rose every night or two or three times a week, the benefit varied. Only 3 gained complete freedom from actual bedwetting. It was also noted that those who were " raised," or wakened by others at night, usually in childhood, seldom gained complete freedom from bedwetting thereby.

Pain on micturition was very uncommon. In 3 cases occasional mild pain was reported, with difficulty in micturition in one. Two others had pain—but only after attempts to overcome urgency. 39 had no pain. The fact that patients denied pain shows that complaints of urgency and frequency cannot be attributed to leading questions. In 23 pain was not recorded, which is really a reflection of its absence.

Of 60 patients, 8 gave a history of encopresis. In 4 it had been frequent. It had ceased altogether at ages ranging up to 11 years. Encopresis was almost always a diurnal and not a nocturnal symptom. One other patient, aged 15, still had, not encopresis, but urgency of defaecation after every meal at times when he was also suffering from nocturnal enuresis.

Only 3 patients denied having ever had any diurnal symptons—whether urgency, frequency, enuresis or encopresis.

Age of Onset.

While it is often said by patients and by their parents that enuresis began after some emotional or physical upset, careful investigation shows that most have suffered continuously since infancy. Previous writers have stated that enuresis existed from infancy in 83 per cent. (Anderson), 79 per cent. (Grover), 78 per cent. (Kanner), 76 per cent (Bachus and Mansell), 58 per cent. (Hubert), and 41 per cent. (Stockwell and Smith).

Of our cases, 54 had had enuresis regularly since infancy ; one was said to have begun at 3 years, after being dry for 2 years ; 7 gave a history of onset at anything from 5 to 13 years, associated with painful illness, wartime evacuation, etc. ; one was said to have begun at age 35, during ill-treatment and

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physical hardship as a prisoner of war in Greece, and in 3 cases symptoms recurred phasically at intervals of years.

How Often Nocturnal Enuresis Occurred.

Four patients had diurnal symptoms without nocturnal enuresis. It might be thought that they should be included in a different syndrome, sometimes called "the small irritable bladder." It was found, however, that three of them had wet the bed to ages 11 to 17; three still rose at night, and three had a family history of enuresis. We think that these cases belong to the same syndrome as the others, and a similar view is held by other writers, as shown by the table above.

Seven patients wet the bed every night and 15 nearly every night. Practically all the remainder, who had less frequent enuresis, showed marked phasic changes in its incidence. For example, enuresis might occur every night for a week and then be absent for a week. To express its frequency averages were made. 26 patients wet the bed once a week or oftener; 13 once a month or even less often.

The patients offered various explanations for the phasic nature of the enuresis. In 19 the enuresis was so frequent that there were no phasic changes. We are inclined to accept the statements of 11 patients that cold weather or a cold bed made the enuresis worse (one or two showed a summer-winter phase of incidence); and of 19 patients that disturbing emotions also made it worse. Other alleged causes for improvement or relapse were probably only coincidental. Eight patients reported that in the past new treatments had produced temporary remissions. This may be due to chance or to suggestion, but it is a warning to the therapist.

Abnormalities of the Lumbosacral Spine and Enuresis.

The literature on this subject is both confused and confusing. Some authors found that spinal abnormalities were uncommon in enuresis; others found them common, but considered that they were of no significance, while others thought they were significant. We have therefore investigated the literature on this subject carefully and brought together the scattered reports. Two main types of bony abnormality have to be considered. The first are the phylogenetic variations of sacralization of the last lumbar vertebra, or lumbarization of the first sacral vertebra. The second is an ontogenetic disdisorder—spina bifida occulta. To increase the confusion, it is by no means clear what distinguishes spina bifida occulta from normal or delayed ossification and union of the vertebral laminae. It has been suggested—and at times demonstrated by operation—that spina bifida occulta is associated with constricting fibrous bands or accumulations of fat within the spinal canal. It is also said to be associated with a condition of myelodysplasia.

The following are the principal reports of examinations of the lumbo-sacral spine in control series of adults: Wheeler (1920) quoted Adolphi, who found incomplete closure of the first sacral segment in 12·7 per cent. and of the entire

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sacrum in 3·08 per cent. of 292 skeletons; and Frets, who found incomplete closure of S.1 in 24·6 per cent. of 528 skeletons, and of the entire sacrum in 2 per cent. of 750 skeletons. Wheeler examined the radiograms of 1,000 consecutive patients suffering from irrelevant conditions. In 13·1 per cent. the dorsal closure of S.1 was considerably defective; in 4 cases S.2 was also defective; in 8 cases the sacrum was completely open. Incomplete union of the posterior laminae of the last lumbar vertebra was found in 2·3 per cent. Baetjer and Waters (1921), among a thousand "control patients," found congenital non-union of L.5 and S.1 in over 15 per cent., and also found that sacralization of L.5 and the rudimentary spina bifida of the sacrum were quite common. West (1927) found spina bifida occulta in 48 of 100 healthy soldiers. Brailsford (1929) examined the radiograms of over 3,000 patients, and found spina bifida occulta of L.5 in 6 per cent. and of S.1 and 2 in 11 per cent.; sacralization of L.5 on one side in 3·4 per cent. and on both sides in 4·7 per cent.; hemivertebrae in 0·3 per cent. and spondylolisthesis in 5 cases. Cushway and Maier (1929) made routine X-ray examinations of 931 men entering railway employment; 414 of these showed a total of 607 variations, including a number such as old fractures, not relevant to the present discussion. The relevant findings were:

Spina bifida occulta, from a mere line through the spine of S.1 to complete absence of the spine and arch of L.5 and of all the sacral segments	161
Sacralization of the transvere processes of L.5 varying from unilateral impaction to bilateral fusion	50
Incomplete union of first and second sacral segments (i.e. lumbarization)	21
Congenital deformity of sacrum	4
Spondylolisthesis	3

How many cases showed these variations does not emerge.

Köhler (1935) stated that one man in ten has some fissure formation, and regarded as normal the narrow median ossification defects affecting L.5 and S.1 or S.2, and also even a complete sacral hiatus. He accepted the views that spina bifida occulta can be found in 60 to 70 per cent. of cases of nocturnal enuresis, but that for the manifestation of the disorder a releasing stimulus is also necessary.

Laws (1937) quoted Schmore and Junghanns, who found spina bifida occulta in 15 to 20 per cent. of 10,000 spines examined radiologically.

Smith (1939) quoted Roederer and Lagrot, who found lumbosacral spina bifida occulta in one-third of 1,000 cases, and Ellis, who estimated that such a defect exists in 6 to 8 per cent. of adult working men. Langworthy, Kolb and Lewis (1940) studied 500 radiograms, and found some degree of defect of the vertebral laminae in 183, or 36·6 per cent. The defects were associated with symptoms in only 5 of the cases.

Next come the reports of examination of the lumbosacral spine in cases of enuresis in adolescents and adults. We have not considered reports of spina bifida occulta in children, as the normal time of ossification introduces an obvious error. There are very many reports of single cases or small groups of cases of enuresis associated with spinal defects, and we cannot quote all of these. Arnesen (1924) found spina bifida occulta in 15 out of 25 cases;

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West in 41 of 81 enuretic soldiers; McLellan (1939) in none of 15 cases, aged 7 to 30 years; and Bachus and Mansell in 13 of 104 enuretic soldiers. Browne and Ford-Smith (1941) found spina bifida occulta in 7 of 13 boys, aged 14 to 20, another had a congenital anomaly of S.1, and another showed flattened vertebral bodies.

We have X-ray records of 67 cases, including 17 which were not included in the total series. Radiological abnormalities were present in 34 cases and absent in 33. The positive findings were:

A. *Fusion Defects Only.*

Defect of S.1 only	20
Incomplete fusion of neural arches of upper sacrum	4
,, ,, of L.5 and upper sacrum	2
The two parts of the neural arch of S.1 unified but not completely developed	1

B. *Lumbarization and Sacralization With or Without Fusion Defects.*

S.1 shows lumbar characters (neural arch incompletely fused i)	2
Partial sacralization of L.5, with incomplete fusion of its arch and of the arches of the upper sacrum	1
Sacralization of L. 5	2
Left transverse process of L.5 sacralized and lower sacral spines bifid	1
Sacralization and fusion defect of L.5	1

Most interesting figures emerge when the X-ray findings are correlated with age:

Age.	Sacralization, etc.	Fusion defects only.	Negative.
Up to 15 years	2	7	1
,, 18 ,,	1	14	10
,, 21 ,,	1	2	9
,, 25 ,,	1	3	6
,, 30 ,,	0	0	1
,, 35 ,,	1	1	3
,, 40 ,,	1	0	3

Small though the totals are, the figures suggest that sacralization and lumbarization are equally distributed among the age-groups, as one would expect, but fusion defects are concentrated in the younger age-groups, and the proportion of negatives rises with age.

Whereas the text-books of anatomy usually say that the last vertebral laminae to unite are the sacral ones and that they do so at the 7th to the 10th year, we prefer to accept the view of Jemma (1930) that in the normal, although all the vertebral arches except S.1 have fused by the 10th year, the latter may not fuse till the 20th or even the 30th year.

Two other points should be noted before excluding vertebral causes of enuresis. Firstly, there is a type of failure of union, unilaterally or bilaterally, between the junction of the superior articulating processes and the laminae, which it is almost impossible to visualize radiologically (Wheeler, Brailsford, Willis, 1924). Willis found this condition in 4·8 per cent. of 850 spinal columns in a museum. It is therefore not very common. He believed that it might

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progress to spondylolisthesis. Secondly, according to the operative findings of Delbet and Léri (1925) a transverse fibrous cord may be found compressing the lower end of the dural canal in the absence of any spina bifida occulta.

We believe that the figures we have given from the literature and from our own cases show that many fusion defects in young persons may later unite in the normal process of ossification; that those which persist do so in normal persons as much as in enuretic persons; and that sacralization and lumbarization are also as common in the normal as in the enuretic.

True spina bifida occulta is uncommon, and should be demonstrated, not only radiologically, but also by associated lesions of three groups, which are described in the literature: (1) In the back, over the spina bifida occulta, there may be hypertrichosis, telangiectasis, pigmentation, hyperhidrosis, a dimple or scar, and benign tumours. None of our patients showed any such. We do not think that absence of a vertebral spine on palpation is proof of a true spina bifida occulta, as such absence was observed in many of our patients. (2) Motor and sensory anomalies in the "saddle" or perineal area. Again, none of our cases showed any convincing evidence of such lesions, although in three the cremasteric reflexes were doubtful. (3) Deformities and motor, sensory or trophic disturbances in the lower limbs. Only one of our patients had any such—a case of bilateral pes cavus.

Cerebral Control of Micturition and the Cystometrogram.

We do not intend to discuss the neurophysiology of micturition and the technique of cystometrography in detail in this paper. Recent accounts will be found in the books of Langworthy *et al.* and of McLellan, and in a paper by one of us (Band, 1945). Cystometrography records in continuous graphic form the bladder sensation, pressure, capacity and detrusor activity. Sphincter function is secondary to detrusor activity, and is of much less importance in itself than has been thought in the past. Cystometrography is not so much a urological as a neurological study of bladder function. It distinguishes the normal bladder and four types of neurogenic disorder: (1) The atonic, in lesions of the posterior sacral roots; (2) the autonomous, where both sides of the spinal bladder reflex are interrupted; (3) the spinal reflex bladder, where cerebral sensation and inhibition are completely cut off and the bladder behaves purely reflexly, as it does in the infant; (4) the uninhibited, where cerebral inhibition is cut off or lacking, but sensation is preserved.

Cerebral control of micturition is apparently purely inhibitory in type. The motor control of the bladder rests in the spinal centres, and the infant gradually acquires the power of cerebral inhibition based on perception of bladder sensation and effected through the motor pathways. To will micturition is to release cerebral inhibition. The cerebral control is spread diffusely in both hemispheres.

The majority of cystometrographic studies in enuresis show the uninhibited neurogenic type of bladder—just the same type as is found in subtotal organic disease of the higher cerebral centres or spinal cord pathways. Stockwell and Smith's series apparently included a good number of this type. McLellan

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found two types of cystometrogram among 15 enuretics—the normal and the uninhibited neurogenic.

Cystometrograms were made on 15 of our patients. Two were normal (see Fig. 1). Two others were doubtfully normal, showing a little evidence of uninhibited contractions and desire to void at low degrees of filling. Of these four cases, one was recovering spontaneously. The other three had the lowest I.Qs.—77, 82 and 84 per cent.—among these who had cystometrograms done. From such a small number we would not care to say whether the low I.Qs. indicate a type of failure of inhibition different from that found in persons of normal intelligence. These three patients had diurnal symptoms.

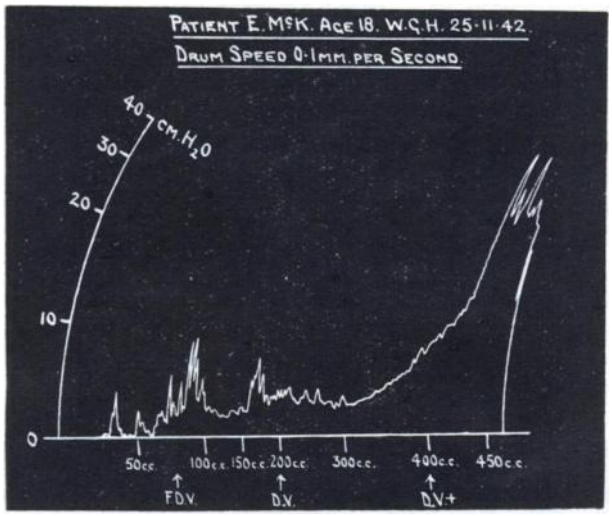


FIG. 1.—Normal cystometrogram showing early contractions of the detrusor muscle associated with the first desire to void (F.D.V.), but subsequently inhibited. Powerful contractions of the muscle occur at 400 c.c. filling associated with a strong desire to void (D.V.).

The other 11 all showed typical uninhibited neurogenic bladders (see Fig. 2). The cystometrogram of the uninhibited bladder with high pressure, low capacity, early uninhibited contractions and early desire to void, corresponds with the clinical findings of urgency, frequency and diurnal enuresis. The nocturnal enuresis or rising reflects the same bladder state. It follows that although large series of cystometrograms may reveal other types of bladder, the majority will be of the uninhibited type.

The preponderance of uninhibited neurogenic bladders further diminishes the alleged importance of spina bifida occulta in enuresis. In severer forms of spina bifida, the autonomous neurogenic bladder is usually found (McLellan). The cystometrograms suggest that the disorder of function is cerebral and not spinal in origin. We do not rule out the possibility of a local over-activity of the spinal reflex as well, but we do not see how spina bifida occulta could produce such over-activity, especially when enuresis is capable of spontaneous recovery.

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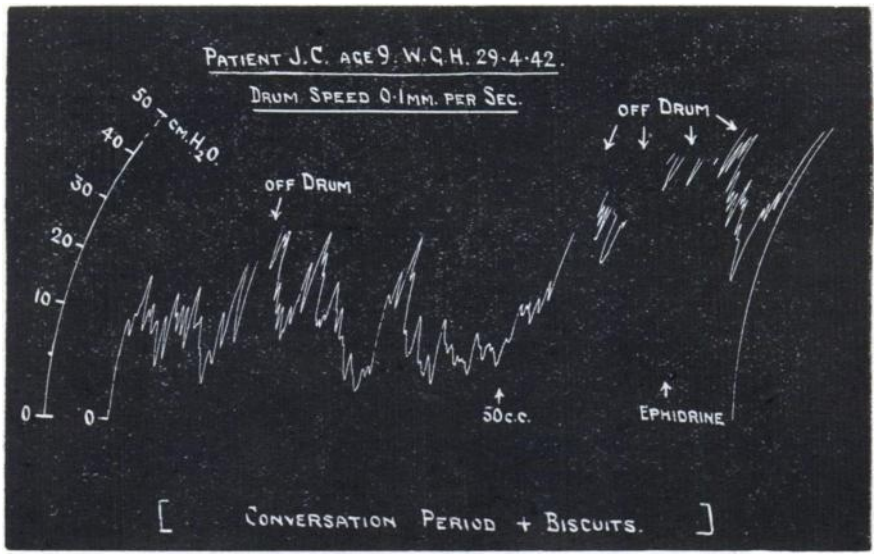


FIG. 2A.—Cystometrogram of uninhibited neurogenic bladder of enuretic type showing uninhibited contractions of the detrusor muscle at an early stage of filling. Following the injection of ephedrine the contractions are temporarily inhibited.

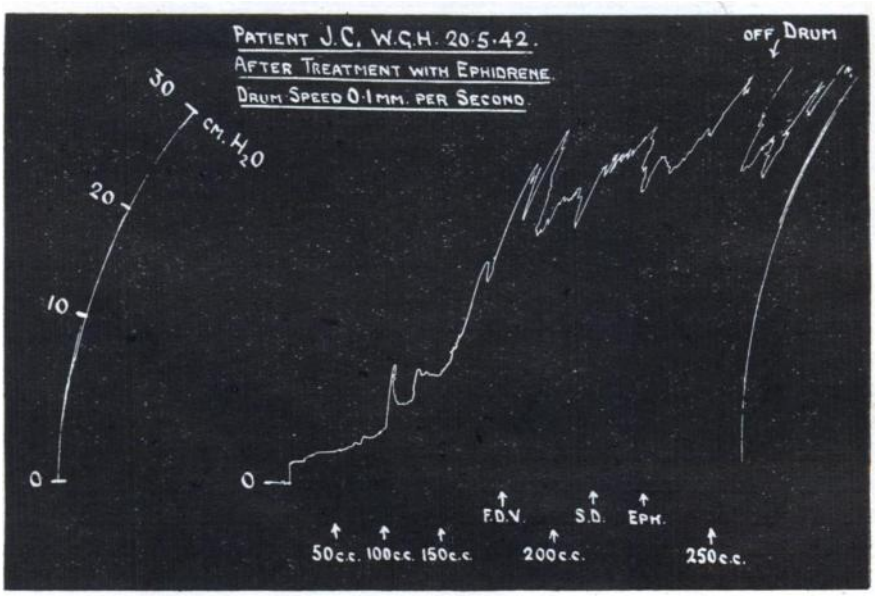


FIG. 2B.—Cystometrogram of uninhibited neurogenic bladder of enuretic type. Following a course of three weeks' treatment with ephedrine by mouth, the first desire to void (F.D.V.) does not occur till after a bladder capacity of 150 c.c. has been attained, and is followed by powerful contractions of the detrusor muscle. The bladder capacity has been increased to 250 c.c. (*Cf.* Fig. 2*a*.)

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Constitution and Enuresis.

It might be argued that the cystometrograms of uninhibited, almost reflex bladder activity only confirm the old view that enuresis is due to lack of training. The diurnal symptoms are one answer to this, and a consideration of the constitutional aspects is another.

1. *The Patients' Psychiatric States.*

The psychiatric diagnoses made were divided into three self-explanatory degrees of severity—"clinical" (this group includes 17 patients who came complaining of general psychiatric symptoms and not primarily of enuresis); "sub-clinical"; and "normal" where a definite type of personality could be recognized, but was not abnormal in degree.

Anxious personality (normal)	16
Anxiety state (sub-clinical)	17
,, ,, (clinical)	7
Mixed anxious and hysterical state (clinical)	2
Hysteria (clinical)	1
Obsessive personality (sub-clinical)	1
Psychopathic states (aggressive: alcoholic types 2, sexual type 1, epileptoid 3. Inadequate: petty delinquents 9, neurotic types 2 (all clinical)	17
Schizophreniform states (clinical)	3
Intellectual retardation. I.Qs. 76 to 78 (clinical)	3

All the diagnoses were amply justified; there was no attempt to give patients a label not fully justified by their states. To illustrate this, nine of the patients classified as psychopathic states and one classified as intellectually retarded had appeared in Court charged with offences.

If the first three groups are taken together, then a general "anxiety" group is the biggest one—40 cases. Next come the psychopathic states—17 cases.

Michaels and his collaborators (1938 to 1944) have published an important series of papers on the constitutional aspects of enuresis. They found that the incidence of enuresis was greater in the histories of delinquent and psychopathic persons than in normal children. They attached particular importance to the age to which enuresis persists, and found that enuresis was most persistent in the delinquents and psychopaths, less so in the psychotic, and still less so in the normal. They observed that the triad of psychopathy, male sex and persistent enuresis was a frequent association worthy of serious consideration. They regarded enuresis as a reflection of an ill-balanced personality, and saw the same lack of inhibitory control in the persistent enuresis and in the delinquency. Finally, they showed that a history of enuresis in children with behaviour disorders was associated in a positive manner with electroencephalographic abnormality, whereas behaviour disorders without enuresis were not positively associated with electroencephalographic abnormality. Thus the constitutional aspects of enuresis are linked with personality in its fullest neuropsychiatric or physical sense. Wexberg (1940) also noted the association

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of enuresis and delinquency. In this paper psychopathic states are diagnosed as described by Henderson (1939). Henderson (1942) has accepted Michaels' views.

2. *Sex Incidence.*

Almost all who have studied the facts report that enuresis is much commoner in the male sex. Here is a table of figures all referring to children:

Author.	Male.	Female.
Grover	124	76
Hamill (1929)	54	26
Anderson	108	40
Frary (1935)	128	90
Addis	188	126
Movitt (1936)	5	19
Brookfield	20	18
Stockwell and Smith	63	37
	690	432

Calvin (1928) said that the sex incidence was about equally distributed early, but that from six years on boys predominated. Kanner reported that 62 per cent. of enuretic children were boys. He quoted Thom as saying that enuresis was found in both sexes equally, and Thursfield as reporting predominance in girls.

Of our patients, no less than 51 were males and only 16 females—and this was not due to any recognizable chance of selection.

3. *Family History.*

(a) *Psychiatric Conditions Generally.*

Kanner found a family history of alcoholism in 25 per cent. of the fathers and 2 per cent. of the mothers; serious emotional instability or social maladjustment of one or both parents in 80 per cent.; 21 per cent. of the children had illiterate or mentally defective parents; 22 per cent. showed a family history of major psychoses; 4 per cent. of suicide; 7 per cent. of epilepsy; 10 per cent. of criminal records; 4 per cent. of the parents had been sexually delinquent. Grave though these figures are, they are paralleled by the findings in the present series. Levine (1943), among 150 naval cases, aged 17 to 27, found psychiatric abnormalities, such as somnambulism, nervousness, psychogenic fainting and "nervous breakdowns" in 70 per cent. of the families.

In the present series no information was available about two families, and in six others only partial information. A total of 153 affected relatives was found as follows (p. 335).

The affected relatives were: 56 parents, 22 siblings, 3 half-siblings, 1 offspring, 26 grandparents, 29 uncles or aunts, 1 half-uncle, 1 nephew and 1 niece, 4 cousins, 6 great-uncles or aunts, 1 cousin once removed, and 2 great-grandparents.

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Unspecified psychoses (treated in mental hospitals)	8
Manic-depressive psychoses	3
Schizophrenia	2
Senile dementia	2
Infantile convulsions (fatal in 5 cases)	6
Idiopathic epilepsy	8
Other organic psychiatric states	2
Aggressive psychopaths, alcoholic	36
,, ,, epileptoid	2
,, ,, sexual types	5
Inadequate psychopaths, petty delinquents	4
,, ,, others	8
Suicide	2
Anxiety states	18
Hysteria	2
Nervous breakdown—unspecified	2
Nervous temperament	34
Mental defect	7
Intellectual retardation	2

Only one diagnosis was entered for each relative, e.g. where a person suffered from infantile convulsions and a psychosis in later life only the psychosis was entered. "Nervous temperament" was used as an omnibus term to cover minor nervous disorders, minor hypochondriacal tendencies, emotionally unstable personalities, etc.

The number of affected relatives points to a strong constitutional tendency. The 16 patients classified as themselves being "anxious personalities of a normal degree" had family histories as bad as the average, and five, in fact, were worse than the average.

(b) *Psychosomatic Diseases.*

Addis found among 30 enuretic children that 9·7 per cent. of all their relatives showed "allergic" diseases—asthma, eczema, gout, hay-fever, recurrent headaches, or nettlerash. Gordon (1942) found among 128 enuretic children a history of allergic diseases in the child or in the family, in 85 cases (migraine, asthma, hay-fever, eczema). Of 200 normal controls 56 gave a similar history.

We found 67 cases in 61 families:

Chronic dypepsia	3
Peptic ulcer	16
Hypertension, strokes or degenerative heart disease occurring before the age of 70 years	23
Hay-fever	1
Urticaria	2
Migraine	8
Asthma	11
Hyperthyroidism	3

The affected relatives were 19 parents, 4 siblings, 2 half-siblings, 14 grandparents, 23 uncles or aunts, 3 cousins and 2 great-uncles. These included four persons who were also listed under (*a*) as suffering from psychiatric conditions.

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(c) *Nocturnal Enuresis.*

Enuresis shows a definite familial incidence.

Author.	Number of cases.	Family history of enuresis.	Remarks.
Grover	200	112	Children.
Addis	30	18	,,
Hubert	50	20	Children. Controls, 7 out of 50.
Levine	150	112	Sailors, aged 17 to 27.

Kanner, in his series of enuretic children, found a history of enuresis in one or more relatives in 52 per cent. Stockwell and Smith found, among 100 enuretic children, that 63 gave histories of parents, and 21 of siblings who had enuresis. Bachus and Mansell found a family history of enuresis in parent or sibling in 21 per cent of 277 enuretic soldiers.

Frary studied 59 clans, including 221 fraternities, in which, of a total of 787 individual members, 239 were, or had been, enuretic. Most careful and exhaustive investigations were made. Frary gives detailed statistical studies, and has made a claim that enuresis is primarily determined by a single recessive gene substitution. We are not able to confirm or deny this claim, but we have been much interested in her conclusions. Although she found a greater incidence in males, Frary did not think that enuresis was a sex-linked character.

In 7 of our cases the family history of enuresis was not recorded; in the remaining 60 cases enuresis in relatives and its approximate age of persistence were noted: Over age 3 up to age 5, 20 cases; age $5\frac{1}{2}$ to 13, 46 cases; 13 to 20, 28 cases; 20 to 30, 9 cases; 30 to 50, 2 cases; and over 50, 2. There were also 5 cases of lifelong diurnal bladder symptoms without nocturnal enuresis—total 112. Many of the affected relatives, therefore, had enuresis of long duration.

The affected relatives were 12 parents, 25 siblings, 2 half-siblings, 33 uncles or aunts, 2 grandfathers, 1 great-aunt, 26 cousins, 7 nephews or nieces and 4 offspring. Omitting 5 cousins whose sex was not recorded, the sex incidence was 56 males to 51 females. The difference is not significant in itself, although it is in line with previous observations of greater incidence in males. We interviewed mothers mostly, and they might not know about enuresis in male relatives outwith their own immediate family.

Nine of the enuretic relatives also figure under (*a*) or (*b*).

Our finding of an average of almost two other affected persons per case confirms the familial incidence. The material has not been analysed from a Mendelian point of view, but there was one other notable point. In the small number of cases who showed more than one affected relative outside the sibling group, these relatives were usually all on one side of the family.

4. *The Autonomic Nervous System.*

The earlier analysis of the symptom-complex of enuresis suggests that it is a local autonomic syndrome released by lack of cerebral inhibition. We have looked for other evidence of instability of the autonomic nervous system, as shown by a family history of psychosomatic diseases (see above), and as shown

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by the patients' own histories of such diseases. Gordon found that enuresis was present in 7 per cent. of 200 control children, in 6·9 per cent. of 73 asthmatic children, but in 31 per cent. of 58 migrainous children. Bray (1931) has seen cases of enuresis along with such "allergic" manifestations as asthma, hay-fever, eczema, urticaria and migraine. Levine found vasomotor instability of the extremities in 42 per cent.

Psychosomatic diseases were found in 13 out of 66 patients: Severe dysmenorrhoea, 8; bronchial asthma, 2; asthma and eczema, 1; migraine, 1; local allergy to an antiseptic, 1.

Autonomic symptoms, mostly of a type secondary to anxiety, were found in 33 out of 63 patients. These included dyspepsia, vomiting, diarrhoea, tachycardia, excessive sweating and a number of others.

Whether or not the incidence of psychosomatic diseases and of other autonomic symptoms is significant, the prevalence of deep sleep seems important, and it can be regarded as belonging to the same group of symptoms as an autonomic or hypothalamic manifestation. Deep sleep is an associated hypothalamic symptom and not the "releasing" cause of the enuresis, because normal persons who are deep sleepers can still control the bladder at night, and because the "releasing" mechanism exists also by day. Some writers have found deep sleep prevalent in enuresis, while others have not. Our findings were: No record, 6; not applicable (patient never had nocturnal enuresis), 1; light sleep, 8; average depth, 7; heavy sleep, 45.

Patients and their relatives usually stated without hesitation that sleep was deep. This was usually confirmed by statements that the patient never wakened at nights; that he slept through loud noises, including air raid sirens; that when raised at night he was very confused and heavy, as if still sleeping; that he was difficult to get up in the morning; that, in some cases, he could sleep 12 hours if given the chance; and that one or two patients were not wakened by an alarm set to get them up by nights, while their parents in the next room were awakened.

5. *Associated Congenital Defects.*

Among 64 patients 27 congenital defects were found in 21 cases. Many were of a minor character, such as skin melanomata, and highly arched palates; others were conditions only predisposed to by congenital influences, such as hernia; and we do not think that the presence of any of these defects has any bearing on the constitutional aspects of enuresis. The family histories of such conditions appeared quite unimportant.

Psychopathology and Enuresis.

As can be inferred from the list of psychiatric diagnoses, abnormal and complicated life histories were recorded in many cases. Nevertheless, to demonstrate psychopathological factors in enuresis it is necessary to show that such existed before the age of three years, when urinary control is normally established. Disturbances in later life may be partly reactions to the enuresis.

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In 4 cases there was no record of these years. In 12 no traumatic events were listed (but see later). The remaining 51 showed a total of 74 such events:

Posthumous child	1
One parent ill for a long time	3
Pathological (not merely difficult) labour	7
Born in the street	1
Seriously underweight at birth	1
Incomplete breast feeding (½ to 5 months)	13
No breast feeding	14
Unduly prolonged breast feeding (10 to 17 months)	3
Malnutrition needing medical attention	5
Prolonged illnesses	2
Severe burn or scald	2
Father's conduct difficult	5
Brought up (*a*) in institution, (*b*) by grandparents	2
Father working abroad	1
Mother out working	2
Resented by mother as conceived before marriage	1
Mother fatally injured in his presence	1
Paraphimosis	1
Illegitimate	9

Even this impressive list is incomplete. Disturbing family emotional influences are not covered by the one small entry of "father's conduct difficult." A fuller idea of such influences is obtained from the family history of psychiatric disorders in 56 parents. In the illegitimate cases, only that fact was entered in the table, as otherwise the many other positive findings in them would have overloaded the table and obscured the findings in the remainder. A high proportion of illegitimate children among enuretics was also noted by Wexberg.

If we assume, as is probably correct, that none of the illegitimate children were breast-fed, then abnormalities of breast-feeding occurred in 39 cases in all—a very significant finding.

Freud's original view (1930) that enuresis nocturna corresponds to a pollution is apparently disproved by the observations of Cameron (1927), Anderson, Kanner and Wexberg that masturbation and nocturnal enuresis can occur in the same child. In the present series of older persons the majority have had some sexual experience, whether as nocturnal orgasms, masturbation or intercourse.

There are, of course, other psychoanalytic explanations of enuresis. We believe that enuresis can be a source of libidinal gratification, but that this is a secondary development, to which enuresis is primary.

Other Features of the Cases.

1. *Micturition Dreams.*

These occurred in 25 out of 61 cases. Some patients had such dreams frequently, others only occasionally. In 21 these were simple, stereotyped dreams of micturating in the right place. Dreams symbolic of micturition were found in only one patient, who dreamt that she was in the bath, and awoke, requiring to micturate. In three patients vivid and complicated micturition dreams occurred, but they were still quite straightforward in their content.

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One patient dreamed frequently about a river or the sea. He saw a group of people who seemed to be pointing at him and laughing at him for wetting the bed. (He often had similar ideas of reference by day.) Sometimes he wakened up at this point, and after going to sleep again, wet the bed. Another patient dreamt he was at a choir practice and went to the w.c. The door remained open and the minister's wife said "There's water coming down your arm." He awoke and found that this was so. The history showed that in real life the minister's wife was a mother figure to him. Another had complicated dreams, in which he often stopped half way through the act of micturition and looked round to see if anyone were looking. He would think not, and continue the act. The interruption of micturition was often associated in the dream with a sensation over the lower abdomen which was in fact due to the urine passing over it.

These dreams are a help in differential diagnosis from enuresis due to epilepsy. Little is said about them in the literature—it may be that they are not so common in children.

Anderson noted these dreams in older children, and said it was uncertain whether they were the cause or the result of the enuresis. Levine found such dreams in a few cases.

We think that these dreams are the result and not the cause of enuresis, because (1) they apparently develop in older subjects, (2) a few patients learned to wake and check the enuresis when the dream began, (3) enuresis can occur by day. The dreams, however, do serve the function of "preserving sleep" postulated by Freud.

2. *Local Lesions of the Skin.*

Patients who frequently wet the bed often develop lesions of the skin of the buttocks or over the greater trochanters of the femora if they sleep on their sides. Such lesions may be useful in diagnosis from malingering, but their absence does not exclude enuresis.

In 15 cases enuresis was infrequent and there were no skin lesions. In 14 cases of frequent enuresis there were no skin lesions. In 26 cases such lesions were present, varying from erythema only (14 cases) to papules and old scars. In one patient, who always slept on his left side, the skin over the left greater trochanter was much affected—keratinized, cracked and erythematous.

3. *Circumcision.*

In 47 male patients, 13 had been circumcised and 1 had had a minor operation of stretching the prepuce. Most of the operations were done for enuresis, and in this series, of course, they were all unsuccessful.

4. *Dissociative or Hysterical Symptoms.*

In 63 cases dissociative symptoms were present in only 20. Tics and sleepwalking accounted for all but 3. The sleepwalking was sometimes a result of attempts to rise to micturate. This, and the previous observation

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of the frequency of anxious types, suggests that enuresis is not a symbolic, dissociative symptom.

5. *Diseases of the Ear, Nose and Throat.*

For those interested in focal sepsis, especially in this region, we record that 19 out of 63 patients showed active disease—usually confirmed by an ear, nose and throat surgeon. We do not think, however, that this has any connection with life-long enuresis. It is more probably a result of malnutrition and neglect.

Treatment.

One of us (H.S.) tried all the usual psychiatric methods of treatment with little success. A few patients were improved by hypnotism. It was only after these failures that he was introduced to the use of ephedrine and found that, while it was no panacea, it gave better results than other methods. Each patient continued to have a full psychiatric review of his case.

Ephedrine was first used by Parkhurst (1930), who found that ½ gr. at night for a child of 10 or 12, with limitation of fluids in the evening, was "almost specific" for the cure of enuresis. Christopherson and Broadbent (1934) found among 12 children, aged 3 to 13, that ephedrine ¼ to ½ gr. and pseudo-ephedrine (the dextro-rotatory isomer) ½ to 1 gr. were effective. Brookfield (1937) noted that in asthmatics ephedrine might produce inability to urinate for several hours. He therefore treated 38 cases of enuresis of varying ages with ephedrine alkaloid at night. The dose was increased by ½ gr. every three or four nights to as much as 5 gr. sometimes. In 10 the enuresis ceased, and in 14 it improved. The ephedrine sometimes caused restlessness or sleeplessness at night, vomiting and palpitation. A boy, aged 5, receiving 2 gr. at night complained till noon next day that he saw fishes everywhere and that they were biting him. It was adolescents and young adults who benefited most from ephedrine. Browne and Ford-Smith made controlled experiments on 12 enuretic males, aged 14 to 20. Ephedrine sulphate, 0.06 to 0·24 gm., dry extract of belladonna 0·06 to 0·24 gm., and all the other drugs tried had no effect whatever on the enuresis. Stockwell and Smith found ephedrine of no value, but atropine was of benefit. With the sleepy, slow child, benzedrine sulphate, 2·5 mgm. twice daily, had some success.

We have used ephedrine hydrochloride B.P. In adults one begins with the maximum official dose of 1½ gr. at night, increasing by ½ gr. every few nights, according to tolerance and therapeutic effect, to a maximum of 3 gr. The dosage for children is modified according to age. Smaller doses may also be given by day, especially if diurnal symptoms are severe. Fluids are restricted in the evenings.

Twelve patients did not have this treatment, as they were recovering spontaneously. These were mostly in the younger age-groups, with one or two who had been conscripted to industry or to the Forces.; 19 did not continue attendance for treatment—a characteristic reaction in enuretics; 9 are still on increasing doses, but this number probably includes some failures; 4

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showed no benefit. In the others, the improvement was measured on a rough percentage scale: 25 per cent. improved, 3; 50 per cent. improved, 6; 75 per cent., 6; and 100 per cent., 8. No serious toxic symptoms were observed, but in some patients minor symptoms prevented use of the bigger doses. The beneficial effect of ephedrine can be shown in the cystometrogram (Fig. 2*a* and *b*).

It is clear that ephedrine can help enuresis in certain cases. The pharmacology of the bladder is so complicated, and at times so variable and paradoxical, according to the description of Langworthy *et al.*, that further study of drugs which "paralyse the parasympathetic," or "stimulate the sympathetic," used in maximum doses, is needed.

Conclusions.

The literature on enuresis was reviewed and 67 cases of enuresis in adolescents and adults were studied. Such persistent cases are the most severe, but many of our conclusions can probably be applied to enuresis in children too.

Abnormalities of the lumbosacral spine, such as fusion defects and lumbarization and sacralization, are common in normal persons and have no relation to enuresis. Fusion defects disappear in the normal process of ossification. Spina bifida occulta should not be diagnosed unless other signs of it are present.

Enuresis is firstly a local autonomic symptom-complex, including several of the following: Nocturnal enuresis (which itself may not always be present), rising at night, diurnal enuresis, diurnal frequency and urgency, and encopresis. There is little evidence that this syndrome is due to local over-activity of the spinal micturition reflex, but the beneficial effect of large doses of ephedrine might suggest this.

The cerebral control of micturition consists of a release of inhibition when micturition is desired. The majority of enuretic patients have cystometrograms of the uninhibited neurogenic type, showing a lack of cerebral inhibition just the same as that found in some organic cerebral diseases.

Psychiatric abnormalities are found in the majority of enuretics, the two biggest groups being the anxious and the psychopathic, but other types occur. Disorders of autonomic function are very common in all anxiety states. The correlation between psychopathic states and enuresis is striking; the same lack of inhibitory control is seen physiologically in the enuresis and emotionally and socially in their behaviour. Electroencephalographic abnormalities are common in children with behaviour disorders and enuresis, but not in such children without enuresis (Michaels and Secunda). The electroencephalographic and cystometrographic findings link enuresis with personality in its fullest neuro-psychiatric sense.

The constitutional aspects of enuresis are further shown by its predominance in the male sex, by associated autonomic disorders, especially heavy sleep, by the serious family records of psychiatric conditions and of enuresis, and possibly by the family history of psychosomatic disorders.

Psychopathological causes should be, and were, shown to exist before the

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age of 3 years, when bladder control should be established. They were so numerous and serious as to appear almost as important as the constitutional factors. Abnormalities of breast feeding were especially frequent.

The enuresis syndrome is not purely emotional in origin, as has been widely believed, but has important physical components. It is the total personality which is involved, in its constitutional, neurophysiological and emotional aspects. Nevertheless the enuresis usually disappears, either spontaneously or as a result of treatment. We agree with a previous writer that enuresis is not just a symptom, but is a disease in itself.

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REFERENCES.

ADDIS, R. S. (1936), *Proc. R. Soc. Med.*, **29**, 1515.
ANDERSON, F. N. (1930), *Amer. J. Dis. Child.*, **40**, 591 and 818.
ARNESEN, J. A. (1924), *Norsk mag. f. laegevidensk.*, **85**, 299. Abstract in *J.A.M.A.*, **82**, 1828.
BACHUS, P. L., and MANSELL, G. S. (1944), *Brit. Med. J.*, **2**, 462.
BAETJER, F. H., and WATERS, C. A. (1921), *Injuries and Diseases of the Bones and Joints.* H. K. Lewis.
BAND, D. (1945), *Brit. J. Urol.*, **17**, 1.
BRAILSFORD, J. F. (1929), *Brit. J. Surg.*, **16**, 562.
BRAY, G. W. (1931), *Arch. Dis. Child.*, **6**, 251.
BROOKFIELD, R. W. (1937), *Lancet*, ii, 623.
BROWNE, R. C., and FORD-SMITH, A. (1941), *Brit. Med. J.*, ii, 803.
CALVIN, J. K. (1928), *J.A.M.A.*, **90**, 820.
CAMERON, H. C. (1927), *Guy's Hosp. Rep.*, **77**, 482.
CHRISTOPHERSON, J. B., and BROADBENT, M. (1934), *Brit. Med. J.*, i, 978.
CUSHWAY, B. C., and MAIER, R. J. (1929), *J.A.M.A.*, **92**, 701.
DELBET, P., and LÉRI, A. (1925), *Rev. Chir., Paris*, **63**, 483.
FRARY, L. G. (1935), *Amer. J. Dis. Child.*, **49**, 557.
FREUD, S. (1930), *Three Contributions to the Theory of Sex.* New York.
GORDON, J. (1942), *Brit. Med. J.*, i, 357.
GROVER, J. I. (1918), *J.A.M.A.*, **71**, 626.
HAMILL, R. C. (1929), *ibid.*, **93**, 254.
HENDERSON, D. K. (1939), *Psychopathic States.* London.
Idem (1942), *J. Ment. Sci.*, **88**, 485.
HUBERT, W. H. DE B. (1933), *Lancet*, i, 1281.
JEMMA, G. (1930), *Le Spine Bifide.* "La Pediatra." Naples.
KANNER, L. (1935), *Child Psychiatry.* London.
KARLIN, I. W. (1935), *Amer. J. Dis. Child.*, **49**, 125.
KÖHLER, A. (1935), *Röntgenology.* London.
LANGWORTHY, O. R., KOLB, L. C., and LEWIS, L. G. (1940), *The Physiology of Micturition.* Baltimore.
LAWS, G. M. (1937), *Amer. J. Obstet. Gynec.*, **33**, 126.
LEVINE, A. (1943), *Amer. J. Psychiat.*, **100**, 320.
MCLELLAN, F. C. (1939), *The Neurogenic Bladder.* Baltimore.
MICHAELS, J. J. (1938), *Amer. J. Orthopsychiat.*, **8**, 460.
Idem (1940), *ibid.*, **10**, 501.
Idem (1941), *ibid.*, **11**, 260.
Idem (1943), *ibid.*, **13**, 644.
Idem and GOODMAN, S. E. (1938), *Arch. of Neurol. and Psychiat.*, **40**, 699.
Idem (1939), *Amer. J. Orthopsychiat.*, **9**, 59.
MICHAELS, J. J., and SECUNDA, L. (1944), *Amer. J. Psychiat.*, **101**, 407.
MOVITT, S. I. (1936), *Urol. cutan. Rev.*, **40**, 496.
PARKHURST, L. E. (1930), *Brit. Med. J.*, ii, 1103.
SMITH, R. S. (1939), *Amer. J. Surg.*, **43**, 379.
STOCKWELL, L., and SMITH, C. K. (1940), *Amer. J. Dis. Child.*, **59**, 1013.
WEST, J. W. (1927), *Journ. R. Army Med. Cps.*, **48**, 38.
WEXBERG, E. (1940), *Amer. J. Dis. Child.*, **59**, 490.
WHEELER, T. (1920), *Carnegie Inst. Contrib. Embryol., Wash.*, **9**, 97.
WILLIS, T. A. (1924), *Surg. Gynec. Obstet.*, **38**, 658.

https://doi.org/10.1192/bjp.92.387.324 Published online by Cambridge University Press