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ENURESIS

By

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Senior Thesis

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Introduction

It has long been recognized that enuresis presents one of the most frequent problems in the management of children in the home, in the clinic and in the institution.(5) Much has been written, but relatively little is known about this condition which distresses mothers, shames children, and so frequently baffles physicians.(22) In view of the frequency of enuresis, the distress and complications resulting from it, no apology is required for a consideration of its nature, origin and treatment.(70) A study of the condition is of special interest to the pediatrician and the general practitioner, not because it endangers life, or except in rare cases, even the general welfare of the little patient, but rather because of the mental anguish and distress which it visits upon those who have reached an age to feel the mortification and discomfort of such a condition and the disadvantage it places them under in regard to their society.

There are many definitions of enuresis to be found in the literature. Davidson (22) states that enuresis should be defined as the persistence from early infancy, or the development during childhood, of unintentional and usually unconscious nocturnal or diurnal emptying of the bladder, in the absence of demonstrable organic, nervous or genito urinary lesions. Often, however, the condition is referred to solely as "bed wetting" although more than
one-half of the patients are also afflicted with inability to contain their urine during the day. Enuresis may be nocturnal, diurnal or both and frequently accompanied with urgency and frequency (pollakiuria).[33]. Bleger (9) defines enuresis as a disturbance of micturition in which the physiologic control of the brain is blocked by stronger stimuli which have to do with the nervous mechanism of the bladder. Moreover, this loss of control does not appear to be in the brain. This is conceived to be true enuresis and for this type Bleyer (9) proposes the term enuresis vera. Separating it from another condition which although true enuresis, is a mere perversion of habits in an irresponsible, usually neurotic, and often mentally defective child. Grover (31) believes that enuresis is probably never a disease entity, but simply a symptom or evidence of an underlying cause which manifests itself by loss of control of the act of micturition, and states a specific cause for the loss which will be discussed under etiology. Others simply define enuresis as an involuntary discharge of urine which may be diurnal or nocturnal in occurrence.

In the early studies of the problem of enuresis the urologist, the psychiatrist, and the pediatrician were constantly disputing as to who should handle the condition (23). The psychiatrist looked on the problem as a purely psychic disturbance and the urologist buried himself in the thought of the mechanism of the bladder and blamed the disturbed innervation of the bladder, the capacity of the bladder and a host of other local causes for the condition. The
pediatrician looked on it as a disease of unknown origin which he disliked and which he did not deal with anymore than was necessary. Apparently this latter view has been the consensus of opinion until relatively recent years and enurics were shunted from one practitioner to another until a spontaneous cure resulted or until some empirical remedy had a favorable effect.

Each author and observer of the condition has a theory of his own and tends to bear it out with compilation of statistics. Durham (23) stated that successful treatment of the patients with empirical remedies is frequently as surprising as it is inexplicable. The element of mystery thus added temporarily enhances the virtue of the cure until failures show up with its use. This brings out the fact that few remedies have ever been continuously successful, but that at times they have been of some aid. From this observation it seems probable that in most of the cases, the suggestive element in the treatment may have been the real therapeutic agent.

As the knowledge of the subject has increased the idiopathic cases have gradually diminished and Ruhrab (55) states that today "essential or idiopathic enuresis" means essential ignorance on the part of the person employing the term.

Hamil (32) from an extensive study of 80 cases of enuresis concludes that enuresis is a conduct disorder pri-
marily and that it is stopped when the child so desires. Colburn (19) states that enuresis is a pediatric problem of varied etiology, but usually occurring in children who have a neuropathic background.

From the statements of Davidson (22) who says that enuresis is a condition which so frequently baffles physicians and from Wooly (72) who says that it is a condition which practitioners dread to see come to their offices for treatment and from the wide and varied host of claimed etiological factors (to be discussed later) it can be easily seen that enuresis is as yet a much disputed problem and one worthy of further consideration.
History

It has been stated that enuresis is on the increase, but it has always been a perplexing and irritating problem to patients, parents and physicians through the ages. The old Saxon Chronicle states that, "The Magi taught the patient suffering from the disorder to drink the ashes of pigs pizzle and so to make water into a dog's kennel adding the words Lest I, like a hound should make urine in my own bed"(23). Reference is made of incontinence of urine in many of the old works of literature and the "irritable bladder" of soldiers has long been known (55).

Up to the time of Dr. S. S. Adams of Washington, D.C. there was not much importance attached to the history of this condition. With the assistance of Drs. Kolipinski and McArdle of that city, he examined all the literature on the subject from 1774 to 1814 including articles in German, French, Italian, and Spanish. In 1784 Mitchell wrote on the subject as clearly as any subsequent author and its pathology was as well understood then as it was in 1884. The tendency at that time was to let it alone with the hope that puberty would restore the function of the bladder.

Carter (17) from a review of the literature states that enuresis and bedwetting has been an irritating problem since medicine began and that during the seventeenth and eighteenth centuries when medicine was still permeated
with mysticism the therapeutic measures were as bizarre in this disorder as in others. An example of this is seen in the drinking of "pigs pizzle" as was stated in the old Saxon Chronicle. One medical writer, so late as the nineteenth century, Lallemand, recommended an aromatic bath as a cure. He steeped a handful of aromatic herbs and added to the infusion a cup of brandy. This mixture was added to the bath and the child was kept immersed for an hour daily for a period of several weeks. With this method he claimed many cures.

Throughout the early decades of the nineteenth century when a forbidding parental sternness was considered essential for successful child rearing, corporal punishment as a cure for this disorder was advised by medical authors and not it was recommended by practitioners and applied by parents with vigor. (17). Adams (1) stated in 1884 that many a child has been repeatedly and unmercifully punished for wetting his clothes or bed in the face of repeated protestations that he could not keep it. The disease and punishment go on together until the patient becomes such an object of disgust to himself and his family that they are compelled to seek professional advice. He further states that: "In too many cases the act continues untreated, and in spite of punishments and the jeers of companions, until well-marked psychical changes take place."

"The child bright and cheerful by nature soon loses its
vivacity, shrinks away from the presence of his companions, becomes morose and spiteful, pale and haggard, restless and nervous, will not look you in the face, and with chin depressed and upper lids drooping presents indeed a striking likeness to the onanist."

Two medical writers, Boerhove and Caspar, (from Carter 17) went as far as to recommend as a cure the burning of the skin with hot irons. Another advised blows on the buttocks with the palm of the hand and seriously offered a scientific explanation that the local eschemia produced the desired result. The passage of sounds and cautery has added to the discomfort of many a hopeless bedwetting child.

Foster in 1860 was among the first to vigorously attack these practices, declaring them to be unjustifiable and cruel (17). "It is the surgeons place to be the child's protector, the shame it suffers, if punishment were necessary, is punishment enough." He further called attention to the fact that fear of chastisement sometimes led to dire complications. He states the following case that a boy in fear of punishment for wetting the bed placed a tourniquet about his penis with subsequent production of gangrene of that organ. He illustrated this case with a woodcut in his admirably written book "The Surgical Diseases of Children" (17).

Henoch believed the affection to be due to a local irritability of the detrusor urinae but he could give no
explanation. He was convinced, however, that a psychical element intered into the process as was evidenced by the clinical experience of injecting into the gluteal region with drugs or even with distilled water. He naively explained that the patients were probably cured as they did not return to the clinic.

Medical thought has always turned toward local disturbances as etiological factors. Phymosis or long foreskins with smegma retention were thought to be causative and in many boy patients (2) a circumcision has been unnecessarily done and in girls the clitoris has abdomated in spite of Buckingham's assertion that bedwetting is as common a circumstance among circumcised Jewish children as it is in other children (17). Adams (1) in 1887 thought enuresis to be due to the above cause and stated positively that the condition could be cured in any case of adherent prepue by circumcision.

Among other methods of therapy in vogue was the "building up of the system idea", by the administration of such tonics as iron and arsenic. This treatment was built on the theory that the disorder was due to debility; its proponents entirely overlooking the fact that enuresis is as likely to occur in sturdy children as in the debilitated, other things being equal (17).

Adams (2) as long ago as 1884 refered to the condition to nocturnal pollution or lascivious dreams and stated that
the urinations most frequently occurred through an erected penis. This was suggested to him by the fact that enuresis ceased in many of his patients at puberty and was replaced by nocturnal pollutions. It was also his contention that many cases were due to involuntary reflex actions caused by irritating secretions about the glans which irritated the pudic nerve. Townsend (65) believed that by long persistence of the condition the bladder becomes so contracted as to be incapable of holding the normal amount of urine and in some of these cases the difficulty was treated by distending the bladder with injections of water, the patient being chloroformed.

Trevan (2) in 1884 advocated slitting the meatus which he thought too small in most children with incontinence. He states that much benefit was derived from it. Compression of the membraneous urethra by perineal pads and vaginal packs also had ardent devotees. Dittal (22) in 1872 thought that the condition was due to a lack of development of the prostate gland. It is quite true that some patients have small undeveloped prostates, but the fact that enuresis occurs nearly as frequently in girls suggests that the prostate has nothing to do with the condition.

Sir Dominic Corregan advised an ingenuous method of treatment by elevating the hips during the night in order that the urine might fall back against the fundus and not forward into the neck of the bladder. This treatment was
rational enough but he spoiled his therapeutics by recom-
mending that the prepuce and meatus in boys and the urinary
meatus in girls be sealed on retiring with collodion to be
removed in the morning.

The fact that many a child was known to have nocturnal
incontinence of urine when it was lying on its back during
sleep caused someone to recommend tying a knotted towel
on the body in such a manner that the knots come in the
middle of the back. The child is thus made uncomfortable
should he attempt to lie in the dorsal position. This form
of treatment was quite popular and it has been copied in
many text books since, (17) in spite of the fact that its
practicability is doubtful as such a contrivance usually
refuses to stay in position unless the towel is so tight-
ly applied as to interfere with respiration.

Trousseau (66) in 1870 thought enuresis to be due to
an affection of the nervous system especially manifesting
itself in an excess of excitability and tonicity in the
muscular coat of the bladder. He also believed that laziness,
fear, emotionalism, heredity and epilepsy played a
part in the etiology. Trousseau (66) was among the first
to employ belladonna in the treatment of the condition
borrowing the idea from Bretonneau in 1865. "Eustace Smith,
West, and Sacks were among the first to sense the modern
conception of the pathology of the disorder." (quote from
Carter 17). Sacks in 1896 called particular attention to
the training of the nervous system as a cure for the affection. He mentioned that he had seen cases cured with no other therapeutic measures, but he gave no explanation of how the thing occurred. Since that time numerous authors have written exhaustively on the processes of inhibition and acceleration exercised by the upper centers over the lower and of paths over which such stimuli travel and of the development of such control.
Incidence and Type

Enuresis is undoubtedly much more prevalent than is indicated by the number of patients seeking relief. There are probably many additional children in whom the condition has disappeared before the parents deem it advisable to seek medical aid. Enuresis is probably equally as common in children of the wealthy and poorer classes. During the great war, however, the enuresis that was reported among the troops, was much more prevalent among the enlisted men than among the officers. This difference may have been due to greater hardships undergone by the former. Many of the soldiers who developed enuresis were neuropathic and had suffered from the condition during childhood. This "war enuresis" was frequently associated with "colds" and was often preceded by exposure to wet and cold (17). To justify interest in the subject one need only consider briefly some of the data on its incidence. Statistics are so extremely variable according to population, clinical institutions, etc., that it would be futile to attempt any summary of figures (5). Nevertheless, a few estimates are enlightening. Pese, a German writer on the subject, found in the children's Asylum at Breslou, during the world war, 30 per cent of all small children and 10 per cent of the older children suffered with enuresis. Durham (23) said that among 800 nervous children admitted to Phipps, between the ages of 5 and 16 years, 7 per cent were bedwetters.
Cenbol (quote from 5) concluded that it is a part of the problem in from 12 to 15 per cent of all nervous children. Bray (11) in a survey of one thousand allergic children found 7 per cent of those over the age of seven years to have enuresis. Ostheimer and Livi (49) writing on the subject in 1904 state the incidence at that time to be 5 per cent of all the patients coming to their clinic.

From a study of 591 enuretic patients attended at the Harriet Lone home from 1912 to 1922, by Davidson (21), it was found that the types were nocturnal, diurnal, diurnal and nocturnal, and, any of the above accompanied by fecal incontinence. A comparison of the types with the findings of other workers is given below as regards the frequency of the various types in occurrence in their respective series of cases.

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Rochford</th>
<th>Davidson</th>
<th>Anderson</th>
<th>Zappert</th>
<th>Holt</th>
<th>Still</th>
<th>Howland</th>
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</thead>
<tbody>
<tr>
<td>Nocturnal</td>
<td>55</td>
<td>64</td>
<td>76</td>
<td>56</td>
<td>55</td>
<td>44</td>
<td>73</td>
</tr>
<tr>
<td>Nocturnal &amp; Diurnal</td>
<td>40</td>
<td>35.5</td>
<td>14</td>
<td>44</td>
<td>39.9</td>
<td>52</td>
<td>102</td>
</tr>
<tr>
<td>Diurnal With Soiling</td>
<td>5</td>
<td>1.5</td>
<td>2</td>
<td>0</td>
<td>4.9</td>
<td>4</td>
<td>9</td>
</tr>
</tbody>
</table>

(From Davidson 21)

These findings tend to emphasize that almost one-half of the patients suffering from enuresis are afflicted with diurnal as well as nocturnal incontinence while the percentage of those suffering only with the diurnal type is
relatively low.

**Sex prevalence.** As regards the incidence to the different sexes, it is found by Davidson (22) that there is a slight preponderance in boys. Bleyer (9) in a series of 252 cases found 129 of them boys and 123 girls. Among 226 cases cited by Schwartz (58) 148 patients were males. Among Grovers (31) 200 cases, 62 per cent were males. Burnett (12) expressed the belief that it is probably more frequent in boys. Firth, (quote from Anderson 6) had many more females than males in his series. Jacobs (35) stated that in one institution with which he was familiar containing 450 girls only 8 were seriously affected; in another institution of 650 boys probably 100 or more had definite enuresis. Walker (68) said that the sexes were equally affected. In general the opinion wavers between that of approximately equal incidence of the sexes and of a moderate preponderance among males.

**Mental status:** Schroder (57), in a study of enuretics reports the intelligence quotia below 70 in 7 per cent, from 70 to 80 in 25 per cent, from 80 to 90 in 30 per cent, from 90 to 100 in 36 per cent and from 110 to 120 in 2 per cent. Anderson (5) reports the enuretic to be normal or slightly above the normal in mentality, but reports the feelings of inferiority were present in about 90 per cent of his cases. Mohr and Waterhouse (48) in their series of cases found the average enuretic to be below the normal in school.
Onset. While it is known that the majority of cases with enuresis have recovered with the advance of puberty, the time of onset is less certain (3). Some cases are continued from infancy. Amberg (2) states it is most difficult to get accurate information on this point from parents. Certain observers believe that in the majority of cases the condition is acquired, that is, the enuresis has a definite onset after the child has had perfect bladder control for some time usually about 4 or 5 years (32). Davidson (22) states that in the majority of instances enuresis dates from earliest infancy. These children have never learned to control their bladders. Other patients have had cleanly habits for several years and then gradually or suddenly developed enuresis. Most normal children acquire or are taught the ability to control the act of urination by the age of 2½ years so that after this age incontinence of urine can usually be diagnosed as epuresis. Holt and Howland (33) found that in a considerable number of the patients the condition had persisted from infancy. In 60 per cent of the cases collected by Still (61) the onset of incontinence was said to have occurred between the ages of 5 and 6 years. Sundell (62) has decided that with proper care and training a child should be brought to call attention to its desire to pass water during the waking hours as early as the 18th month; it should rouse from sleep spontaneously, when micturition is emenent by the 3rd or
4th year and that bed-wetting or clothes-wetting above these ages constitutes enuresis. From the above statements it is evident that the onset of enuresis is variable; it may appear suddenly or gradually after a period of established control or it may continue directly from the infantile state. Thus enuresis may be said to be congenital or acquired according to the time of onset.

Nationality and Race. Enuresis is an exceedingly common disease - its prevalence occasioning considerable literature in Italy, France, Spain, Germany, England, and America. Especially in the European countries during and following the world war has it been investigated. The incidence in these countries appears to be about the same except possibly being somewhat higher in Germany. White children are much more commonly affected than colored. It has been suggested (22) that this racial difference is due to the fact that colored parents do not pay much attention to "bedwetting". However, among the poorer classes in Baltimore, colored children are usually better than white children so that the infrequency of enuresis among the former probably does not depend upon the failure of parents to notice the condition (22). It is likely that the relatively infrequency of neurotic and neuropathic conditions among colored children is connected with this infrequency of enuresis.
Relation of Enuresis to Sex Development. Clinically one of the most striking features of enuresis, as it is seen under ordinary circumstances, is that in the majority of cases it clears on the road to, or at about, the time of puberty (3). Relatively rarely does it persist to the end of the growth period. That certain factors associated with growth may have some connection with enuresis cannot be simply brushed aside. During growth, besides such things as changes in the position of the bladder and spinal cord, many other somatic changes occur. One of the most striking of them being the gradual development of the sexual organs. Guyon (quote from 3) emphasized the venous engorgement associated with the distention of the bladder, and dependent on it, the engorgement of the veins of the sexual organs. Further more, the vascular and nervous supply of the two systems make the relationship more than one of mere position, and so it would not be strange if the development and function of one had some influence on the other. The condition of nocturnal pollutions have long been likened to nocturnal enuresis and a change from the latter to the former with the advent of puberty has often been noted.

Heredity. Anderson (5) states that according to some authorities from 30 to 40 per cent of patients with enuresis have enuresis in the family history. Amberg (3) states that: "It is well known that some member of the immediate family, or a more distant relative, may be suffering from
the same ailment, or some ancestor may have been subject to enuresis. While enuresis as such may not be inherited it has been considered as a neuropathic hereditary stigma by Pfister who believes very minute disturbances are possible in the development of the paths between the bladder and the brain. Davidson (22) in his work with enuretics often finds two or more cases in the same family. This may be due to the fact that all of the children are neuropathic or because a younger child imitates an older enuretic brother. The parents of one of his cases reported that the child's mother, grandfather, and uncle had enuresis from 2½ years of age to puberty. Kroft (40) considers enuresis as a hereditary condition whenever the parents or any member of the family give a history of enuresis or any form of functional nervous disease. Walker (68) concludes that enuresis must be considered as a benevolent stigma of an inherited nervous temperament. While a family history of enuresis is to be found in a considerable proportion of the cases of enuresis most authors fail to stress the point and evidently do not consider the factor as of much importance.
Symptoms

Enuresis may be nocturnal, diurnal, or both (33). Cases differ greatly in severity. The incontinence may be habitual, occurring every night, often several times during the night and frequently during the day; or it may be only occasional under the influence of some special exciting cause, when it continues a few days or weeks until the cause is removed. In a considerable number of cases the condition lasts from infancy until the 6th or 7th year. It may even continue until puberty or beyond, but ceases at that period unless its cause is mechanical or depends on some organic disease of the brain or cord. In ordinary enuresis there is never dribbling of the urine, but usually a contraction of the walls of the bladder which completely empties it. In some cases the patient is not aware that he has passed urine until he finds his clothes or bed wet. In other instances the patient is aware of a desire to urinate, but the act occurs before he can make his wants known or reach a convenient place for micturition. At night the same thing may occur without awakening the child, the contraction being purely reflex (33). Dysuria is uncommon occurring in only 3 per cent of Davidson's (22) group. He says that usually some other cause can be found to account for that symptom. The passage of large amounts of water (polyuria) is but infrequently associated with
enuresis. Fecal incontinence is uncommon among enuretics except in the mentally retarded. Some patients state that the condition is worse in the winter and others that it is aggravated in the summer months. Fulton (29) quoting Grover (31) says that the great majority of the bed-wetters show more or less evidence of malnutrition of the food injury type, such as prominent abdomen with distended colon, flabby musculature, abnormal appetite, and particularly a proneness to a restless activity with a consequent exhaustion upon retiring. They are unwilling to go to bed and equally as hard to arouse in the mornings. Many patients have increased frequency and urgency of urination (pollakuria) although not all persons with pollakuria have enuresis. According to Bakwin (7) the vast majority of bed-wetters is constituted by patients with urgency and frequency. This problem will be discussed under etiology and treatment.

Physiology

In order to more clearly understand and appreciate the abnormal enuretic condition, it is deemed advisable at this time to discuss, more or less briefly, the more common and accepted theories of the normal act of micturition. Under normal conditions, the education of the bladder in the child is complete by the end of the second year. Sometimes, however, the establishment of control
is delayed until a later date. At first control is very feeble and any small accident is likely to upset it, but soon control becomes stronger and passes into the realm of habit. If, for some reason or other, this education and discipline of the bladder is arrested, incontinence is the result. Not infrequently it happens that a child who had learned control regresses and becomes incontinent at night after having enjoyed a greater or lesser period of continence.

The first difficulty which confronts us in a proper conception of enuresis lies in the fact that, the physiology of micturition is not as yet clearly understood (3). Animal experimentation yielded many interesting and important results among which was the discovery of Elliott (quote from 3) that the physiologic innervation of the bladder differs in different animals even as the anatomy differs. Hence only with great reservations can the experimental results be transferred to man. Further difficulties, particularly for clinical work arise from the observation that the effect of a stimulation of a nerve depends on the state of the organ which the nerve controls. For instance, it was noted that stimulation of the sacral nerve supply produced a relaxation of the bladder when contracted; whereas, the same stimulation caused contraction if the bladder was at rest. Similar differences have been noted in other organs, not only with electric stimulation, but with regard
to the action of drugs.

The physiology of normal urination was described by Galtz (quote from Emerson 24) in 1874 and the general principles set forth by him at that time have continued to be accepted with little modification. Stated in its simplest terms the act of micturition may be described as follows: gradual distention of the bladder induces rhythmic contraction of its walls. This contraction increases until a few drops of urine are expressed into the posterior urethra, causing a sensory stimulus, the afferent part of the reflex, which passing to its nerve center in the lumbosacral cord arouses the efferent impulses by which the bladder is made to contract vigorously and the sphincter to relax. This mechanism is, however, almost completely under the control of the will, so that micturition may be made to begin before the bladder is full, and, on the other hand, the action of the reflex may be prevented by a voluntary exercise of the will power. This urinary reflex is of such a primitive character that it persists even after section of the cord.

According to Howell (34) the bladder contains a muscular coat of plain muscle tissue, which, according to the usual description is arranged so as to make an external longitudinal coat and an internal circular or oblique coat. A thin longitudinal layer of muscle tissue lying to the in-
terior of the circular coat is also described. The separa-
tion between the longitudinal and circular layers is not so
definite as in the case of the intestine; they seem in fact
to form a continuous layer, one passing gradually into the
other by a change in the direction of the fibers. At the
opening of the bladder into the urethra, the musculature in
the submucosa is strengthened to form a ring around the or-
ifice and along the beginning of the urethra which is sup-
posed to function as a sphincter; the internal sphincter
or sphincter vesicae internae. Around the urethra in the
prostate and membranous portions is a circular layer of
striated muscle that is frequently designated as the exter-
nal sphincter or sphincter urethrae. The urine brought in-
to the bladder accumulates to a certain degree. It is pre-
vented from escaping through the urethra by a tonic contrac-
tion of the internal sphincter. When the accumulation be-
comes greater, the external sphincter may be brought into
action. Backflow of urine from the bladder into the ureters
is effectively prevented by the oblique course of the ureters
through the wall of the bladder. Owing to this circumstance
pressure within the bladder serves to close the mouths of
the ureters, and indeed the higher the pressure the more
completely. At some point in the filling of the bladder,
the pressure is sufficient to arouse a conscious sensation
of fullness and a desire to micturate. Under normal condi-
tions the act of micturition follows contraction of the
bladder with a simultaneous relaxation of the internal sphincter and of the external sphincter, also if this latter is in contraction.

The force of contraction is considerable as is evidenced by the height to which the urine may spurt from the end of the urethra. The contractions of the bladder may be and usually are assisted by contraction of the walls of the abdomen, especially toward the end of the act. It is not, however, an essential part of the act of micturition. The last portions of the urine escaping into the urethra are ejected, in the male, in spurs produced by the rhythmical contractions of the bulbocavernosus muscle.

The act of micturition as it occurs in man is pictured as follows: as the urine accumulates in the bladder, the pressure stimulation of the sensory fibers leads to a reflex stimulation of the external sphincter. Further accumulation by a pressure effect on the sensory fibers causes reflex contraction of the muscle of the bladder, and the additional sensory stimuli produced by these contractions spreading upward from the lower center occasion the conscious desire to urinate. In the adult at least the urination takes place by a voluntary act, which consists in an inhibition of the tonus center in the lumbar cord, whose reflex stimulation has up to this point maintained the tonic contraction of the internal sphincter. The effect
of this inhibition is to relax the sphincter and to allow
the bladder to empty itself by its reflex contraction,
 aided perhaps by a voluntary contraction of the abdominal
muscles. During the emptying of the bladder, the process
can be brought to a halt voluntarily by removing the inhi­
bition thus allowing the internal sphincter to contract
and shut off the flow. The above description, it will be
seen, is very much like that as was advanced by Goetz in
1874.

Gibbs (30) says that the spinal center of micturition
in the conus terminalis is brought into relationship with
the bladder by two sets of nerves: the hypogastric nerves
passing by way of the second and third lumbar nerves, and
the inferior mesenteric ganglion to the vesicle plexis and
the pelvic visceral nerves which pass through the third
and fourth sacral roots to the vesicle plexis direct. He
further states that in adults the desire to urinate arises
from stimulation of sensory nerve endings in the bladder
wall, and in children under 2 years of age this stimulation
sets up rhythmic contractions of the detrusor muscle associ­
ated with inhibition of the sphincters resulting in a re­
flex emptying of the bladder uninfluenced by the will. At
about this time the higher centers of micturition, which
Stewart locates in the corpus striatum, the optic thalamus
and the motor cortex begin to assert their hold on the
spinal center and the child gains control of micturition
during the day.
Amberg (3) concludes that the origin for the desire for urination has not been determined other than it seems to have its source in the muscular wall of the bladder, the mucous membrane having normally no sensation or very little and only that in the region of the neck of the bladder. The paths by which the desire for urination is communicated to the brain and the return paths by which the impulses sent out by the brain travel to the bladder are not known; neither is the mechanism by which the voluntary opening and closing of the bladder is brought about. Only recently has it been shown that there is no real anatomic internal sphincter in man, but that the surgical or perhaps better, functional sphincter is formed by two loops, one of which is derived from the longitudinal and the other from the circular muscle layer of the bladder wall.

An important contribution to the physiology was that of Young (74) that the opening of the sphincters of the bladder is not an act of inhibition but is brought about by the muscles of the trigone. This discovery correlates well the facts that the sphincters of the bladder which are derived from the longitudinal and circular fibers of the bladder and of the detrusor and are of smooth muscle, cannot be under control of the will and so cannot be relaxed to permit passage of urine into the posterior urethra, whereas, the muscle of the trigone which passes
through these sphincters comprises striated muscle and is, therefore, capable of voluntary contraction (9).

Thus it is the contraction of the trigone by will that overcomes the tonic contractions of the weaker muscles which are under the control of the involuntary system, which irritates the act of micturition; the convexity of the trigone at rest serving to pull the posterior wall of the orifice downward and backward as this convexity or arc disappears during contraction.

(The figure at the top shows the arc of the trigone at the orifice of the bladder. The lower figure shows the posterior wall of the orifice as it is pulled downward and backward during micturition by the contraction of the trigone. It assumes the shape of a pear. Young)

Since Young's original contribution to anatomic and embryonic studies by Wesson (69) and Young (75) appear to have confirmed the theory.
Hollibarton (quote from 70) frankly notes that while theoretically micturition is a reflex act, in practice it is a voluntary one. He believes the will causes the abdominal muscles to contract and the increased pressure on the bladder is the signal for a reflex action. To quote: "It is further possible that the mere thought of micturition may influence the sacral vesicle center and heighten its sensitiveness." In this connection he refers to the central causation of frequent micturition by fear and excitement as due to this heightened sensibility of the vesicle center.

The frequency of normal urination is very variable and depends on many factors such as the amounts of fluids taken, exercise, perspiration, and habit. The following table was compiled by Davidson after a careful survey:

Average Daily No. of Urinations in the Normal Child

<table>
<thead>
<tr>
<th>Age of Child</th>
<th>Average daily no. of urinations</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 mo.</td>
<td>13-16</td>
</tr>
<tr>
<td>2 yrs.</td>
<td>6.9</td>
</tr>
<tr>
<td>3½ yrs.</td>
<td>4.8</td>
</tr>
<tr>
<td>5½ yrs.</td>
<td>5</td>
</tr>
<tr>
<td>9 yrs.</td>
<td>4.4</td>
</tr>
<tr>
<td>11 yrs.</td>
<td>4</td>
</tr>
</tbody>
</table>

It is here evident that with the growths and development of the individual he is better able to control and contain his urine.
Classification

From a review of the literature it is found that almost every writer on the subject of enuresis has classified it according to his own conception. It is impossible in this limited paper to consider all of them. A few of the older classifications are here presented and several of the more recent ones listed to give a comparison.

Adams (2) in 1884 divided incontinence of urine into three classes:

I. A constant dribbling of urine day and night;
II. Intermittant but occurring during the day as well as at night and;
III. Those who were incontinent only at night.

Collin (21) gives the following classes:

I. The prolonged infantile type, in which nocturnal enuresis has persisted after infancy;
II. Digestive form in which the digestive system is at fault, and;
III. The emotional form occurring in children of excitable temperament.

Fulton (29) simply classifies enuresis as:

I. Organic and,
II. Functional

Ruhrah (55) gives the following classification according to etiology:

I. General - as diabetes, ricketts, thyroid insuffi-
ciency, enlarged tonsils, and adenoids.

II. Physiological - too much fluid.

III. Alimentary - faulty metabolism, too much salt, due to drugs.

IV. Urine - hyperacidity, alkalinity, bacteria.

V. Genito-urinary tract - inflammations, malformations.

VI. Central Nervous System - hypertonia, weakness, malformation of cord, general irritability, and reflexive due to colonitis, vaginitis, anal fissure, rectal polypi and parasites.

Saxl and Kurzweil (56) in a study of 250 cases gives the following classification:

I. Due to local irritation - penworms, masturbation, vulvo-gaginitis, cystitis, fissure en ano, rectal polypi, phymosis bolonitis, tonsils and adenoids, renal calculi, vesical calculi, adherent clitoris and malformations (epispadius, hypospadius, and no urethra).

II. Due to general ailments - neurasthenias and neuroses, anemia, malnutrition, and neurologic disease (chorea, epilepsy, hysteria, neuralgia, and mental deficiency).

III. Due to endocrine - actual disturbance, i.e. cretinism, and indefinite or slight disturbance.

IV. Due to Urine - highly acid concentrated urine, diabetes insipidus, diabetes mellitus, and nephritis.

V. Idiopathic - of undetermined origin.
Wile and Argel (70) from a study of a large series over a considerable length of time have compiled the following classification which to my mind seems fairly complete. Their classification also is founded on etiological factors.

I. Peripheral
A. Malformations
   1. epispadius, ectropia vesicae, hypospadium, patent urachus, vesico-rectal fistula, phymosis (small meatus)
B. Trauma, Inflammations, new growths.
   1. Balanitis, adherent prepuce, cystitis, adherent clitoris, calculus, stenosis, tumor of bladder, incontinence of retention.
C. Metabolic.
   1. Acid urine, constipation, diabetes mellitus, endocrine disturbance.
D. Reflex.
   1. Pin worms, vulvo-vaginitis, anal fissure, rectal polypi, masturbation, and pertussis.

II. Spinal
A. Malformation
   1. spina bifida occulta
B. Inflammation - trauma.
   1. Pott's disease, myelitis lumbar cord.
C. Reflex.
   1. Hyper-irritability of spinal center.

III. Cerebral
A. Organic.
   1. Malformation and retarded development.
      a. Mongolianism, infantilism, iodicy, cretinism.
   2. Diseased states, trauma, new growths.
      a. Tumore, chronic meningitis, diabetes insipidus, epilepsy, chorea, hydrocephalus.
B. Functional.
   1. Metabolic.
      a. General debility, malnutrition, rickets, intoxications, pathological sleep.
   2. Psychic.
      a. Neurasthenia, dreams, hysteria, neurosis, psychosis, weak attention, weak will, worry and anxiety, fear and malice.

A comparison of the above classifications shows that a great deal of progress has been made in this field.
Etiology and Treatment

A. Physical Basis.

1. Phimosis. This condition has long been considered as an etiological factor in enuresis. Adams (1) thought enuresis to be due to long prepuce and that in any case cures could be obtained by circumcision. Bleyer (9) found in his series of 129 cases of boys with enuresis, 33 had been circumcised before entering the hospital which shows that enuresis occurs among the circumcised as well as among the uncircumcised. Indeed 14 of the boys had the operation for the relief of enuresis with only transitory effect. In 2 cases the parents believed the operation had caused the disease. Retraction of the prepuce among the uncircumcised boys was without benefit. It was thus, in his series of cases, not possible to show any relationship between the male prepuce and enuresis. Buckingham (17) asserts that bedwetting is as common among circumcised Jewish children as it is in other children.

2. Tonsils and adenoids. The connection of tonsils and adenoids with enuresis has long been frequently emphasized (21). Carter (17) states that foci of infection such as infected tonsils and teeth should be removed as does Cameron (15). Wile and Orgel (70) include tonsils and adenoids in their etiological classification, as do Saxl and Kurzweil (56). Bleyer (9) found in his series of 252 cases of enuresis, 116 of the children showed suf-
ficient trouble with the tonsils or adenoids to justify their classification as abnormal. In 49 of these the tonsils or adenoids were removed for the purpose of curing the enuresis. This it seemed to do in one case. In one other case the enuresis became considerably worse after the operation and in the remaining 47 cases it did not seem to have any effect.

3. Eye strain. It has been stated that because of the proximity of the optic centers to the higher centers of micturition that reflexive irritation from the eyes is a cause of enuresis. Gibbs (30) states that eyes should be refracted and properly fitted with glasses in the treatment of enuresis. Bleyer (9) refracted 38 cases of his enuretic children who suffered with defective vision or eye strain with no effect from the correction being noticed on the course of the enuresis.

4. Small meatus. Lievan (2) in 1884 considered that the meatus was too small in children with enuresis and advocated slitting it. By this procedure he claimed many cures. Bleyer (9) studied the factor in 18 children where the condition was judged to exist. Two of the group were subjected to meatotony and 16 to dilatation without any effect.

5. Pollakiuria. It is stated that many patients have increased frequency of urination (21). Trousseau (66) long ago made note of the fact that this syndrome was the
most frequent symptom of enuresis and recommended the use of Belladonna for its correction. Bakwin (7) thinks it sufficiently important to rate a special consideration in the etiology of enuresis and says that it is a predisposing factor in enuresis. Patients with pollakiuria constitute the largest number of bedwetters. Pollakiuria is said to be hereditary and persists through adult life (7). Both Trousseau (66) and Bakwin (7) state that enuretics who also have pollakiuria can be cured by the administration of belladonna. To illustrate a typical case history is given as follows: H.C. a boy of 3½ years was brought to the dispensary because of bedwetting which had persisted since infancy at that time, the mother remarked the child was always wet. At times he seemed to urinate every few minutes and the mother's attempts to train him during the second year of life by setting him on the toilet at hourly intervals was futile.

The urinary urgency and frequency continued up to the time treatment was started and the child was still wetting himself three or four times a day. The fluid intake was not excessive. The mother had also wet the bed until she was 12 years of age. From that time until her marriage at the age of 19 she had nocturia and at present has urgency and frequency.

Physical examination was essentially negative. He had been circumcised shortly after birth. The urine was
faintly acid, specific gravity 1.010 and there was neither albumin nor reducing substances present.

Belladonna was given this patient over a period of five weeks, during which his enuresis disappeared and then discontinued with no recurrence of the enuresis.

6. Abnormal urine. Hyperacidity and alkalinity of the urine have been discussed as etiological in the problem of enuresis (22). However, many patients have been cured while taking large doses of sodium bicarbonate or potassium citrate so it is improbable that the presence of alkaline urine is a predisposing factor (22). Practically all authorities agree that a markedly hyperacid urine should be neutralized. Occasionally the pollakiuria and polyuria of diabetes may give rise to enuretic symptoms so the urine should always be examined for sugar. Bacilliuria is sometimes found but only in a very small percentage of the cases and so cannot be considered entirely responsible for enuresis (25). Freidell (28) reports a reversal of the normal day and night concentration in the urine of 5 of his 27 cases in whom the enuresis continued unabated in spite of all treatment.

7. Posture. Lippman (41) has devoted considerable time to faulty posture as a cause of enuresis and claims a considerable number of cures by postural education. However, Bleyer (9) was unable to substantiate these contentions in his series of cases.
8. Inflammations. Vaginitis, balanitis and cystitis have all been considered as etiological in enuresis and are to be found in almost all classifications. Bleyer (9) could establish no relationship existing between these and the enuretic symptoms, in some cases he cleared up the infection with no effect on the enuresis and in others the enuresis with no attention or effect on the infection.

9. Allergy. Bray (11) states definitely that some cases of enuresis are allergic in origin and says that this is not surprising if one compares the innervation of the bladder with that of the lungs. He divides such enuretics into three groups: (1) cases in which enuresis occurs along with such allergic conditions as asthma, hay-fever, eczema, urticaria and migraine; (2) cases in which enuresis is present along with conditions which have been proved to be allergic in origin; and (3) cases in which enuresis occurs as the sole manifestation of allergy.

To illustrate, he gives the following case histories:

(1) Cases associated with allergic conditions: (a) W.S., a boy aged 5 had always wet the bed. For 3 months he had had asthmatic attacks each weekend which were always preceded by intense stomach ache and accompanied by more frequent lapses. In spite of fluid limitations and waking at specific intervals, the administrations of belladonna, the habit continued unabated. Skin tests revealed a hypersensitivity to wheat. Since the restrictions of wheat in
foods eighteen months ago neither the asthma nor the enuresis have reappeared.

(b) B. C. a boy of 11 years had suffered from enuresis always and asthma every 3 weeks for the past 4 years. He gave huge skin reactions to feathers and rabbit hair which comprised his bedding and their removal led to a cessation of both complaints.

(c) P. L. a boy aged 3 years suffered from facial eczema, asthma and enuresis. The boy gave positive skin reactions to feathers, horsehair, egg, pork, potatoes, and rice, the removal of which relieved all the symptoms.

(2). In some cases enuresis accompanies other conditions which have proved allergic in origin. C. C. a girl of 3½ years had wet the bed since birth and for the past 18 months had several severe crops of lichen urticarius. Positive skin reactions were obtained to pork. By elimination of all pork, bacon and lard from the diet 4 months ago, the child has not wet the bed once nor have any more spots appeared.

(3) Cases in which enuresis is the only manifestation of allergy:

(a) R. P. a girl of 10½ years had suffered from diurnal and nocturnal enuresis since birth without intermission. All the boys in the father's family had suffered from enuresis. She had been under constant medical care for years without any response to the usual therapy. She was found
sensitive to rice, oatmeal, potatoes, and feathers and since the elimination of these factors a year ago there has not been a single wet bed.

The cases chosen illustrate the point that some cases of persistent enuresis are allergic in origin. In cases of this complaint which fail to respond to the usual therapy the protein skin tests may indicate a causal factor and its elimination to a prompt cessation of the condition.

10. Bladder atony. From a study of 75 cases Blau (8) concludes that basically vesical atony is responsible for enuresis and is supported in this view by many authors, (Davidson, Pisok, Townsend, Adams, Thompson). Bokay (10) states that it is due to atony of the sphincters added to spasmotic contraction of the bladder wall. This seems to be more likely as parents who have watched the children during their sleep report that the urine is expelled with considerable force and dribbling is seldom seen in the enuretic (20). Van Gienhoren (21) believed enuresis due to the escape of a drop of urine through the relaxed sphincter into the prostatic urethra with the consequent excitation of urination. He is supported in this view by Carrigan (17) and even today it is apart of the routine treatment to raise the foot of the bed to hold the urine against the fundus of the bladder.

11. Neurologic causes. Still (61) suggests that enuresis may sometimes be due to disorders of the afferent
nervous paths. Fuchs (21) believed that enuresis was due to lack of development of the spinal cord. He believed that many enuretics have spina bifida occulta. This was found in only 4 of Davidson's series of 541 cases and Carran (18) states that radiography failed to reveal any anomaly in 49 of 68 children. Durham (23) suggests that enuresis is due to a bladder tic and should be treated by reduction with substitution of another movement to replace the tic. Foote (26) also supports this theory. Hyperexcitability of the sphincters and detrusor muscles has been advanced as a cause (22). Minute cord defects which interfere with the inhibitory impulses coming from the higher centers are also described (22). Wilson (71) states that if due to a cortical lesion enuresis will always be accompanied by some neighborhood paralysis. Hyperirritability of the spinal centers of micturition, epilepsy, trauma, inflammations, diseased states, tumors, etc. of the cord are described by Wile and Orgel (70) as etiological in enuresis.

12. Diet. Because enuresis was more frequent in Germany during the world war it has been suggested that faulty diet may be the cause of the disease (22). Davidson found the diet of enuretic children to be essentially the same as that of normal children. Bleyer (9) found no nutritional inferiority in his group of enuretics as compared with normal children. Andesosn (6) states that digestive dis-
turbances should be cleared up and Collin (21) definitely describes a digestive type of enuresis which is cleared up by careful regulation of the diet. Both Fulton (29) and Grover (31) blame enuresis on a neuro-muscular fatigue which is due to malnutrition of the food energy type.

13. The association of the sexual centers and sexual development has been discussed above.

14. Endocrine dyscrasia. That enuresis is due to an endocrine abnormality has lately been creeping into the literature and is supported ardently by such men as Lippman (41), Blau (8), Anderson (5), Cameron (15), Gibbs (30), and Mello-Leitio (45). This will be discussed more fully under treatment.

15. Macciotta (42) reports a spasmophillic type of enuresis and in a series of 28 cases found 19 with increased galvanic excitability.

Obviously the above listed theories is not a complete compilation of all the physical causes said to be etiological factors in enuresis, but does serve to show that a wide variety of exciting factors have been determined to be causative in varying cases.
Treatment

The types of therapy that have been recommended for enuresis are legion. Some of the various methods that have been used are as follows:

1. Surgical Procedures. (a) Circumcision has been a time-honored procedure in the treatment of enuresis. Many of the older writers as Adams (1) (2) and Klingensmith (38) claim many cures from this practice alone. Bleyer (9), however, could find no benefit whatever from its applications. Removal of the tonsils and adenoids frequently arrests, though usually but temporarily, the course of enuresis (22 and 9). Operations for the correction of spina bifida have sometimes proved successful (53). In studying the literature one can find authors claiming cures from operations on the prepuce, clitoris, bladder and spinal cord which others contend that such cures do not occur.

(b) Epidural injections. This method consists of injection, by a needle about 6 cm. in length, of 10 cc. or more of physiologic solution through the membrane covering the sacral hiatus. In this manner the fluid gains entrance to the epidural space. Good results have been reported from this procedure by Gonzalez (31) who claims many cures, and Emerson (24) who does also. However, the latter claims that this procedure should be done after other measures have failed. Just how the saline solution acts on the re-
flexes is not known. Freeman (27) states that the epidural pressure effect, and the possible direct pressure acts on the filaments of the cauda equina and has a reflex tonic effect on the lumbar center. Freidel (28) reports that he cured 29 of 39 patients with a series of 1 cc. injections of sterile water. This would seem to discount the value of the physiologic solution.

2. Mechanical treatment. Corrigan's method of applying collodion to the urinary meatus has been discussed above as have the application of knotted towels, pressure appliances to the urethra, in the history. The passage of sounds and bougies has been used but is now discarded (24). Lifting the foot of the bed has been discussed in the etiology. Plato (51) cured 13 children by simply having them wear urinals in their sleep and at play. Many ingenious contrivances have been made, but have proved futile. Dilation of the meatus was found to be useless by Bleyer (9).

3. Distention of the bladder. Thompson (63) trains the bladder muscle by passing a moderate sized catheter and funneling under a pressure of 15 to 150 cc. into the bladder in increasing quantities and having the patient void, stopping and starting several times. Others have simplified the method by having the child sit in a chair and hold the urine after having the desire to void (30). Contly states that gradual distention of the bladder is not necessary and Bleyer (9) found this treatment to be ineffectual.
4. Massage of the bladder. Abst recommends bimanual massage of the bladder with one finger and the other hand over the symphysis. Bleyer (9) states that this combined with the use of atropine is the only effectual treatment of enuresis and claims many cures from it. He further states that the duration of the enuresis does not materially influence the effectiveness of the treatment. Davidson (22) also uses this form of therapy but makes no specific claims as to its benefit.

5. Electric treatment. Reference to the electrical treatment of enuresis is found throughout the literature. Electricity is employed in many ways making use of the galvanic, faradic or high frequency current. The negative electrode may be placed against the perineum, in the rectum or by means of an insulated sound with an olive-shaped metal end directly against the membraneous urethra. The indifferent electrode is place against the lower part of the abdomen. The faradic current in perceptible, but not painful intensity, about 10 milliamperes applied for 3 to 10 minutes and repeated every 3 to 4 days is most frequently used and should show good results within one month (30). Johnson (37) claims many cures by this method as does Gonzalez (31).

6. Use of cold spinal douches. Prendergast (52) reports numerous cures in older boys by giving them cold spinal douches followed by a brisk rubdown immediately
before going to bed.

7. Restriction of fluids and Wakening. The restriction of all fluids after 4 p.m. seems to be an entegral part of all routine therapy for enuresis. No coffee, tea, cocoa or spiritous liquor are permitted (56). If the child has been accustomed to milk or soup with his evening meal these are transferred to the noon meal (22). The patient is sent to the toilet before retiring and kept there until urination occurs. He is then sent to bed and awakened at 11 or 12 p.m. and again taken to the toilet. At this time he must be thoroughly roused and kept there until he urinates. An additional awakening at 2 or 3 a.m. may be necessary. Regular times of urination during the day should be insisted upon. This treatment should give good results in 2 or 3 weeks.

Drug therapy. A list of over thirty drugs has been compiled which have been used in the treatment of enuresis and which give equally good results (21). Camphor, arsenic, iron, adrenalin, luminol, silver nitrate and many others have ardent advocates. The drug which is used most commonly, however, is tincture of belladonna or atropine. The tinct. of belladonna or a .1% solution of atropine sulphate in doses of 5 g# T.I.D. for child of 6 years is frequently prescribed. This dosage is then increased daily by 1 drop until the physiologic reaction of flushing of the face is obtained. The amount is then reduced 25 to 30% and adminis-
tration continued for several days. These drugs must always be used cautiously for some children are sensitive to them. Adams (2) says that drugs physiologically and chemically incompatible have been combined, administered, and success claimed for them. The bromides have a place in the treatment of highly nervous children (13).

Thyroid extract has been used with good success especially in the deficient and mentally dull children (5). Excellent results have been reported with the use of pituitary extracts some clinicians reporting cure or improvement in 75 per cent of cases (8). Cameron (15) reports good results also with thyroid extract and Gibbs (30) suggests its use in his therapy. Lippman (41) reports a large percentage of cures with the use of pituitary extract.

Testicular extract has been used and good results obtained where the enuretic also suffered from unilateral or bilateral cryptorchidism (5). Ergotoxin, valerian, antipyrine, rhus aromatica, tuberculin, take-diastase, glycerine, strychnine and many other drugs have been used in the treatment of enuresis with varying degrees of success (5).

While not all of the various treatments for enuresis, said to be due to a physical basis, have been given, enough have been listed to show that cures are obtained and that results are good in many instances regardless of the mode of treatment or its physiologic or pharmacologic action.
B. Functional Theories.

Etiology. Since orthodox medical methods have never been proved highly efficacious, it has been increasingly felt by many workers that psychic and emotional factors play a part (5).

1. Dream theory. This theory of Adams (2) and Janet (31) has been discussed under history. However, suffice it to say here that the theory has passed into disrepute.

2. Deep sleep theory. It is frequently noted that enuretic patients sleep very soundly. Many, therefore, believe that the slumber is so deep as to be below the threshold for the normal rousing reflex for evacuation of the bladder (22). The connection of sleep has been explained in various ways; including the above idea and also that it was not deep enough so that the central nervous system acted properly in response to urinary sensations particularly if these were exaggerated (3).

3. Over sensitive central nervous system. In the high-tensional, active, restless, nervous child the nervous system probably tends to respond too quickly to impulses sent to and from the bladder. Over stimulation of this sensitive nervous system by overwork in school, extra music, too much play, exciting movies and radio programs, dancing lessons, quarreling in the home, etc., especially when these extra stimulations occur late in the afternoon or evening certainly contributes as a cause of enuresis (13).
4. Fear. This factor certainly plays a part in the psychic etiology of enuresis. To illustrate Amberg (3) cites a case. A boy who slept on the second floor was a sufferer of enuresis which immediately stopped when he was moved to the first floor. The enuresis immediately recurred on his removal back to the second floor to sleep. Close questioning revealed the fact that there were mice on the second floor of which the boy was frightened.

5. Fear concerning the ability to control the bladder brought about by punishment, shaming and segregating because of wet mishaps which concentrate the child's mind on the difficulties of the bladder control is also a factor. Fear and anxiety of committing the act, the suggestion acting on the child's mind that he has failed to control a nasty situation is a prominent cause and may become an abscession (13). A child who is anxious to please and at the same time afraid he cannot do it is apt to be lead into this sort of an abscession (77).

6. Antagonism. This may be due to the spirit of training, arguing, rowing, undue and unreasonable discipline and domination, impatience and inconsistency in methods, in short making the toilet a battle ground for discipline. Children then often wet merely to annoy and to get their own way (13) (72).

7. Emotional scenes. Emotional scenes on the part of the mother or nurse concerning the use of the toilet, such
as: showing great concern over accidents, weeping, excessive petting and coaxing, etc. Children love emotional scenes which make them the center of attraction (72) and so wetting may keep them in the limelight. The child may keep it up just for the satisfaction of being the center of the stage and the object of so much emotional solicitude (72).

8. Excessive "Babying". Undue emotional dependance on the mother often results in enuresis. A vague desire to continue the period of infancy and enjoy the kind of maternal care given to infants may be the determining cause (13) (72).

9. Masturbation may be associated with enuresis as both conditions are frequently met in the emotionally unstable child. Occasionally the suppression of masturbation may cause enuresis to develop as a substitution habit, or suppressing one may cure both (13) (70).

10. Emphasizing organic ailments. The emphasis of organic ailments to the children, or in their presence, without sufficient findings, as, "weak kidneys" or "weakness of the bladder" etc. may be etiological. The child may feel justified in persisting in the habit because he is sure that he has "weak kidneys" which he will outgrow when he is a "big boy" (13).

11. Lack of faith. Loss of confidence by the child that he can be cured, as usually the child and mother have given up hope after many attempts at unsuccessful treat-
ment can be said to be etiological as the original exciting factor may have long since disappeared and the habit continued. This is born out by the fact that after placebo treatment when given in great confidence that it will keep results in a cure (13).

12. Lack of training. The most common failures in developing correct habits about the use of the toilet have to do with the age at which training is undertaken (72). Easy indulgence of parents and lack of sustained systematic efforts at training often lead to enuresis, the child dominating the parents (71). This may also lead to an indifference on the part of the child and lead to its not being the least shamed by the enuresis nor discomforted by the wet bed (7). Davidson (22) states that the lack of early intensive training in regular habits of urination is certainly responsible for some cases in much the same way that faulty home training leads to formation of slovenly table manner which are later difficult to eradicate.

13. Hysteria. Konrad (39) states that a proof of the hysterical element is the fact that the affection sometimes breaks out in epidemic forms in schools and institutions and claims good results from use of the same treatment as is used for hysteria.
Treatment

(1) Since it has been shown that lack of training is an important etiological factor of enuresis, the primary approach of treatment should consist of proper training at the proper time. By the time the child is 18 months of age it should have control of its bladder in the daytime and should rouse spontaneously during sleep when micturition is eminent by the time it is 3 years of age. As a general rule commencing at the age of 6 months, or as soon as the child is able to sit up well, the placing of the child on a chamber or modified toilet immediately before each nursing, will within a few months, obtain regular habits of urination and defication. These habits may be made regular by providing the child with regular opportunities for the emptying of the bladder and rectum (22). Having a little hot water in the chamber seems to stimulate the act of micturition by the effect of the steam on the genitals. Mishaps should be treated casually and the child's clothes or bedding changed, as soon as discovered. Firm, yet considerate reasonable handling of the child is important.

(2) Active Treatment. The active treatment of an established case can be easily and successfully carried out within a few weeks time, but the utmost cooperation of the parents is essential (13). Wooly (72) says that fear must be eliminated, a faith instilled in the child
that success can be attained, and that a sense of responsibility developed in the child for his own behavior. In short, the cure must be carried out by persons who have good control of the child, have confidence in their ability to cure the child and can communicate this confidence to the child (13).

Any physical defects should of course be corrected or eliminated if possible. As many of these children are under par and anemic, general improvement of the physical condition by proper diet, hygiene, rest and tonics is indicated.

The following printed directions should be given to the mothers (13) (72):

Direction to Mothers:

1. Stop all punishments or any action that will arouse fear in connection with the habit.

2. Stop shaming.

3. Stop all arguing and rowing and unreasonable domination. The question of the use of the toilet should not be a battle ground for discipline.

4. Stop all displays of emotional concern and adopt an attitude of indifference.

5. Treat mishaps in a casual and kindly way so as not to concentrate the child's mind on the failures and difficulties.

7. Keep a "gold star" calendar for dry nights only.
8. Stop "babying" the child by overaffection, etc.
9. Never mention to the child that he has "weak kidneys", etc., or that after years he will outgrow the habit.

The following directions are given to mothers of enuretic children at the University of Nebraska Dispensary on a printed form.

1. Do not be discouraged--the condition can be helped.
2. Do not scold or spank the child--he cannot help it.
3. Reward any improvement.
4. Follow directions.
5. Training is the most important part of the treatment.
6. Raise the foot of the bed--this may help.
7. Everytime the child goes to the toilet to pass water, teach him to stop a second then go on, then stop again doing this five times each time he goes to the toilet in the daytime.
8. Do not give any liquids after P.M.______.
9. Do not give tea or coffee.
10. Be sure the child passes water before supper, at bedtime and at 10 o'clock at night.
11. Bring him to the dispensary as often as the doctor wants to see him.


(1) Restrict fluids (milk, water, soup, etc.) after 4 p.m. The evening meal should be light and dry, that is,
cereal or custard, or junket, bread, jello, fruit, etc. Coffee, tea, salt pepper and other condiments are to be avoided at all meals. Especially avoid salt and sweets after 4 p.m. as these increase thirst.

(2) Have the child empty the bladder at bedtime and again at 10 or 11 p.m. Be certain that the child urinated freely at these times.

(3). Rest, an afternoon nap if possible will prove very beneficial. No excitement or high tension after 5 p.m. such as exercise, competitive games, loud laughter, movies, exciting radio programs, etc. The child should sit down and play quietly after 5 p.m. The child should not be fatigued before retiring and should retire early. Elevating the foot of the bed 6 inches is advisable.

The psychic therapy consists of elimination of the physiologic causes of bedwetting listed above and adjustment of psychological maladjustments in the home (13). This is largely done by the "instructions to mothers" just listed. The child must be talked to by the physician something in this wise: That the habit is not so desperately tragic and that the trouble always gets well and that it continues now because he is worried and keeps thinking about it, etc.

After eliminating fear, anxiety, emotional scenes, etc., confidence must be restored in the child as usually the child and mother have give up. Build faith that suc-
cess can be obtained (77). Encourage each child. This is accomplished largely by suggestion and usually some outside source of stimulation is necessary. The physician rather than the parent can usually build up this faith in the child. The physician must insist to the child that he can cure him, but drive this home in the child's mind it is necessary to perform some striking yet harmless procedure, i.e., a hypodermic injection of sterile water at the weekly visits to the physician with the absolute assurance to the patient that this will result in a cure.

A visible record of success is a very good method to cultivate an atmosphere of optimism and confidence. Have the mother mark the successful day on a calendar with gold stars and give high praise, thus emphasizing the success with commendation and reward. Leave the other days blank and never mention or indicate these failures. These calendars should be brought to the office with the patient at weekly intervals.

The problem should never be discussed between the physician and the parent in the presence of the child. In general avoid centering the enuretics attention on his problem and short comings. Avoid stressing sex in the treatment if necessary (13).

Drug Therapy

Belladonna or atropine have proved most effective in the treatment of those cases in which no physical defect
has been found but which are also affected with pollakiuria (7) and has been discussed under that heading. Endocrine extracts have also proved successful in many cases and many cures are claimed by Lippman (41) and others. One of the fundamental underlying causes of most enuresis is the nervous high tension in children (13). Consequently sedatives such as pheno-barbital in the maximum dose possible without producing lethargy are of value. If the enuresis is purely nocturnal it is administered at bedtime; (gr. 1 to a child of 4 to 5 years) if diurnal it is given in divided doses T.I.D. The results have been remarkable, the enuresis stopping in many cases at once (13). The luminal must be continued at least three weeks until the habit is thoroughly broken and then the dose gradually reduced and discontinued unless there is a relapse in which case the course of the treatment is repeated. The pheno-barbital apparently raises the threshold of the nervous system response, so that the anxiety and fear complex and other subconscious psychic factors do not suggest or intrude on the deep-sleeping brain, and the high tensioned over-responsive nerves are quieted. This treatment is especially successful in the nervous child, but is of value in the treatment of all cases (13). If the other principles of treatment are carried out the chances of recurrence are slight.
Finally the easiest method of treatment and cure of this type of enuresis (i.e. that associated with no physical pathology) is to change the whole environment of the child to another home or to a hospital, boarding school or nursing school (13). These bedwetters almost invariably control the habit soon after being placed there, but must remain in the new surroundings for at least three weeks to effect a permanent cure. Here the motive is that they try to do as other children do and want to stand well with their fellows. The attendants should, however, take an indifferent attitude toward bedwetting.
Conclusion

In consideration of the factors of the problem of enuresis as indicated above, I would conclude:

1. That, as yet, no specific etiological factor has been found for enuresis;

2. That it seems to be a type reaction to a legion of exciting stimuli which may be physical or psychic in character;

3. That cures can be and have been obtained from almost any therapy but that suggestion appears to play a leading role;

4. That each enuretic child may present a different picture and each case should be carefully studied as to etiology before routine treatment is instituted.
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