The physiology of micturition and the physiologic basis of its disorders are subjects about which there is much confusion, especially at the supraspinal level. Micturition is fundamentally a spinobulbospinal reflex facilitated and inhibited by higher brain centers such as the [pontine micturition center](https://en.wikipedia.org/wiki/Pontine_micturition_center%22%20%5Co%20%22Pontine%20micturition%20center) and, like [defecation](https://en.wikipedia.org/wiki/Defecation), subject to voluntary facilitation and inhibition.[[6]](https://en.wikipedia.org/wiki/Urination#cite_note-yoshimura-6)

In healthy individuals, the lower urinary tract has two discrete phases of activity: the storage (or guarding) phase, when urine is stored in the bladder; and the voiding phase, when urine is released through the urethra. The state of the reflex system is dependent on both a conscious signal from the brain and the firing rate of sensory fibers from the bladder and urethra.[[6]](https://en.wikipedia.org/wiki/Urination#cite_note-yoshimura-6) At low bladder volumes, afferent firing is low, resulting in excitation of the outlet (the sphincter and urethra), and relaxation of the bladder.[[7]](https://en.wikipedia.org/wiki/Urination#cite_note-7) At high bladder volumes, afferent firing increases, causing a conscious sensation of urinary urge. When the individual is ready to urinate, he or she consciously initiates voiding, causing the bladder to contract and the outlet to relax. Voiding continues until the bladder empties completely, at which point the bladder relaxes and the outlet contracts to re-initiate storage.[[6]](https://en.wikipedia.org/wiki/Urination#cite_note-yoshimura-6) The muscles controlling micturition are controlled by the [autonomic](https://en.wikipedia.org/wiki/Autonomic_nervous_system) and somatic nervous systems. During the storage phase the internal urethral sphincter remains tense and the detrusor muscle relaxed by [sympathetic](https://en.wikipedia.org/wiki/Sympathetic_nervous_system) stimulation. During micturition, [parasympathetic](https://en.wikipedia.org/wiki/Parasympathetic_nervous_system) stimulation causes the detrusor muscle to contract and the internal urethral sphincter to relax. The external urethral sphincter (sphincter urethrae) is under somatic control and is consciously relaxed during micturition.

In infants, voiding occurs involuntarily (as a reflex). The ability to voluntarily inhibit micturition develops by the age of 2–3 years, as control at higher levels of the central nervous system develops. In the adult, the volume of urine in the bladder that normally initiates a reflex contraction is about 300–400 millilitres (11–14 imp fl oz; 10–14 US fl oz).

**Storage phase**

During storage, bladder pressure stays low, because of the bladder's highly compliant nature. A plot of bladder (intravesical) pressure against the depressant of fluid in the bladder (called a [cystometrogram](https://en.wikipedia.org/wiki/Cystometrogram%22%20%5Co%20%22Cystometrogram)), will show a very slight rise as the bladder is filled. This phenomenon is a manifestation of the [law of Laplace](https://en.wikipedia.org/wiki/Young%E2%80%93Laplace_equation), which states that the pressure in a spherical viscus is equal to twice the wall tension divided by the radius. In the case of the bladder, the tension increases as the organ fills, but so does the radius. Therefore, the pressure increase is slight until the organ is relatively full. The bladder's smooth muscle has some inherent contractile activity; however, when its nerve supply is intact, stretch receptors in the bladder wall initiate a reflex contraction that has a lower threshold than the inherent contractile response of the muscle.

Action potentials carried by sensory neurons from stretch receptors in the urinary bladder wall travel to the sacral segments of the spinal cord through the pelvic nerves.[[6]](https://en.wikipedia.org/wiki/Urination#cite_note-yoshimura-6) Since bladder wall stretch is low during the storage phase, these afferent neurons fire at low frequencies. Low-frequency afferent signals cause relaxation of the bladder by inhibiting sacral parasympathetic preganglionic neurons and exciting lumbar sympathetic preganglionic neurons. Conversely, afferent input causes contraction of the sphincter through excitation of Onuf's nucleus, and contraction of the bladder neck and urethra through excitation of the sympathetic preganglionic neurons.

[Diuresis](https://en.wikipedia.org/wiki/Diuresis) (production of urine by the kidney) occurs constantly, and as the bladder becomes full, afferent firing increases, yet the micturition reflex can be voluntarily inhibited until it is appropriate to begin voiding.

**Voiding phase**

Voiding begins when a voluntary signal is sent from the brain to begin urination, and continues until the bladder is empty.

Bladder afferent signals ascend the spinal cord to the [periaqueductal gray](https://en.wikipedia.org/wiki/Periaqueductal_gray%22%20%5Co%20%22Periaqueductal%20gray), where they project both to the [pontine micturition center](https://en.wikipedia.org/wiki/Pontine_micturition_center%22%20%5Co%20%22Pontine%20micturition%20center) and to the cerebrum.[[8]](https://en.wikipedia.org/wiki/Urination#cite_note-8) At a certain level of afferent activity, the conscious urge to void becomes difficult to ignore. Once the voluntary signal to begin voiding has been issued, neurons in pontine micturition center fire maximally, causing excitation of sacral preganglionic neurons. The firing of these neurons causes the wall of the bladder to contract; as a result, a sudden, sharp rise in intravesical pressure occurs. The pontine micturition center also causes inhibition of Onuf's nucleus, resulting in relaxation of the external urinary sphincter.[[9]](https://en.wikipedia.org/wiki/Urination#cite_note-9) When the external urinary sphincter is relaxed urine is released from the urinary bladder when the pressure there is great enough to force urine to flow out of the urethra. The micturition reflex normally produces a series of contractions of the urinary bladder.

The flow of urine through the urethra has an overall excitatory role in micturition, which helps sustain voiding until the bladder is empty.[[10]](https://en.wikipedia.org/wiki/Urination#cite_note-10)

After urination, the [female urethra](https://en.wikipedia.org/wiki/Female_urethra) empties partially by gravity, with assistance from muscles.[[*clarification needed*](https://en.wikipedia.org/wiki/Wikipedia%3APlease_clarify)] Urine remaining in the [male urethra](https://en.wikipedia.org/wiki/Male_urethra) is expelled by several contractions of the [bulbospongiosus muscle](https://en.wikipedia.org/wiki/Bulbospongiosus_muscle%22%20%5Co%20%22Bulbospongiosus%20muscle), and, by some men, manual squeezing along the length of the penis to expel the rest of the urine.

For land mammals over 1 kilogram, the duration of urination does not vary with body mass, being dispersed around an average of 21 seconds (standard deviation 13 seconds), despite a 4 order of magnitude (1000×) difference in bladder volume.[[11]](https://en.wikipedia.org/wiki/Urination#cite_note-law-11)[[12]](https://en.wikipedia.org/wiki/Urination#cite_note-ng-12) This is due to increased urethra length of large animals, which amplifies gravitational force (hence flow rate), and increased urethra width, which increases flow rate. For smaller mammals a different phenomenon occurs, where urine is discharged as droplets, and urination in smaller mammals, such as mice and rats, can occur in less than a second.[[12]](https://en.wikipedia.org/wiki/Urination#cite_note-ng-12) The posited benefits of faster voiding are decreased risk of predation (while voiding) and decreased risk of urinary tract infection.

**Voluntary control**

The mechanism by which voluntary urination is initiated remains unsettled.[[13]](https://en.wikipedia.org/wiki/Urination#cite_note-13) One possibility is that the voluntary relaxation of the muscles of the pelvic floor causes a sufficient downward tug on the [detrusor muscle](https://en.wikipedia.org/wiki/Detrusor_muscle%22%20%5Co%20%22Detrusor%20muscle) to initiate its contraction.[[14]](https://en.wikipedia.org/wiki/Urination#cite_note-14) Another possibility is the excitation or disinhibition of neurons in the pontine micturition center, which causes concurrent contraction of the bladder and relaxation of the sphincter.[[6]](https://en.wikipedia.org/wiki/Urination#cite_note-yoshimura-6)

There is an inhibitory area for micturition in the midbrain. After transection of the brain stem just above the pons, the threshold is lowered and less bladder filling is required to trigger it, whereas after transection at the top of the midbrain, the threshold for the reflex is essentially normal. There is another facilitatory area in the posterior hypothalamus. In humans with lesions in the superior frontal gyrus, the desire to urinate is reduced and there is also difficulty in stopping micturition once it has commenced. However, stimulation experiments in animals indicate that other cortical areas also affect the process.

The bladder can be made to contract by voluntary facilitation of the spinal voiding reflex when it contains only a few milliliters of urine. Voluntary contraction of the [abdominal muscles](https://en.wikipedia.org/wiki/Abdominal_muscles) aids the expulsion of urine by increasing the pressure applied to the urinary bladder wall, but voiding can be initiated without straining even when the bladder is nearly empty.

Voiding can also be consciously interrupted once it has begun, through a contraction of the perineal muscles. The external sphincter can be contracted voluntarily, which will prevent urine from passing down the urethra.