Oxytocin

The structures of the neurohypophyseal hormones oxytocin and argininevasopressin (also called antidiuretic hormone, or ADH) and the physiology and pharmacology of vasopressin are presented in Chapter 29. The following discussion emphasizes the physiology of oxytocin and its use in pregnancy.

Biosynthesis of Oxytocin

Oxytocin is a cyclic nonapeptide that differs from vasopressin by only two amino acids. It is synthesized as a larger precursor molecule in cell bodies of the paraventricular nucleus, and to a lesser extent, the supraoptic nucleus in the hypothalamus. The precursor is rapidly converted by proteolysis to the active hormone and its neurophysin, packaged into secretory granules as an oxytocin-neurophysin complex, and secreted from nerve endings that terminate primarily in the posterior pituitary gland (neurohypophysis). In addition, oxytocinergic neurons that regulate the autonomic nervous system project to regions of the hypothalamus, brainstem, and spinal cord. Other sites of oxytocin synthesis include the luteal cells of the ovary, the endometrium, and the placenta.

Stimuli for oxytocin secretion include sensory stimuli arising from dilation of the cervix and vagina and from suckling at the breast. Increases in circulating oxytocin in women in labor are difficult to detect, partly because of the pulsatile nature of oxytocin secretion and partly because of the activity of circulating oxytocinase. Nevertheless, increased oxytocin in maternal circulation is detected in the second stage of labor, likely triggered by sustained distension of the uterine cervix and vagina. Estradiol stimulates oxytocin secretion, whereas the ovarian polypeptide relaxin inhibits release. The inhibitory effect of relaxin appears to be the net result of a direct stimulatory effect on oxytocin-producing cells and an inhibitory action mediated indirectly by endogenous opioids. Other factors that primarily affect vasopressin secretion also have some impact on oxytocin release (*e.g.*, ethanol inhibits release, while pain, dehydration, hemorrhage, and hypovolemia stimulate release). Although peripheral actions of oxytocin appear to play no significant role in the response to dehydration, hemorrhage, or hypovolemia, oxytocin may participate in the central regulation of blood pressure. As described below, pharmacological doses of oxytocin can inhibit free water clearance by the kidney through activity similar to that of

arginine vasopressin at vasopressin V_2 receptors, occasionally causing water intoxication if administered with large volumes of hypotonic fluid.