penicillin. Only 12 years later the pure substance was isolated and characterized and its chemical structure determined (Fig. 1). The success of penicillin and its derivatives triggered a search for additional antibiotics produced by other fungi and led, for example, to the discovery of cephalosporins (Fig. 1) which have the same mechanism of action but are less prone to hydrolysis by bacterial β-lactamases.

1.4 Steroid Hormones

The first steroid hormone was isolated from the urine of pregnant women by Adolf Butenandt in 1929 (estrone; see Fig. 1) (Butenandt 1931). To guide the isolation, he used a specific test system to detect the activity of the hormone. In the following years, he and others isolated and structurally characterized other female (estradiol, estriol) and male (testosterone, androsterone) sex hormones, progestogens (progesterone), and corticosteroids (e.g., cortisol). Their chemical optimization toward oral bioavailability and the search for more potent analogs led to a number of important drugs in the field of cancer (antiestrogens, antiandrogens; see Fig. 1) and immune diseases (e.g., dexamethasone). In addition, the idea to combine an estrogen and progestogen by Carl Djerassi and Gregory Pincus in the 1950s gave rise to the first oral contraceptive pill and revolutionized family planning in the industrialized world.

Until modern molecular biology techniques were established in the mid-1980s, the molecular basis of the pharmacology of most drugs was not known. Pharmacological receptors, a concept proposed by Langley (1905), were only a model inferred from dose-response curves derived from measuring the effect of pharmacological agents applied to whole animals or isolated tissues, such as the muscle, gut, and heart in organ bath apparatuses (Fig. 2). This was still the case in 1975 (Goodman and Gilman 1975). It was assumed already in 1880 by Langley (1880)

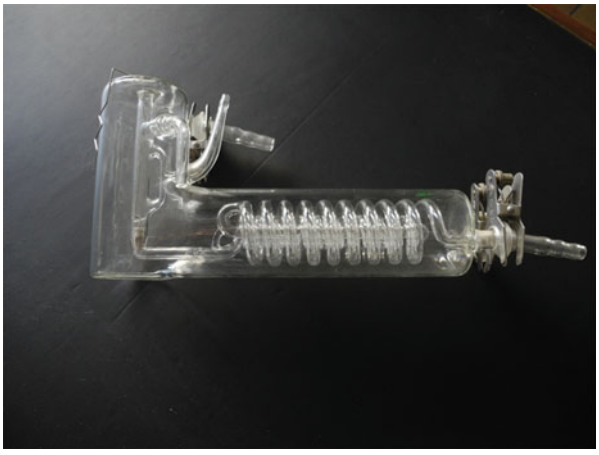

Fig. 2 Organ bath used in the author's laboratory (PH) in the 1980s