



Figure 9.21 The coupling of chemical work to ATP hydrolysis. (A) The process of concentrating molecules, such as nutrients, inside the cell is an example of chemical work. (B) The work done is coupled to the hydrolysis of ATP by transporter proteins, such as the one illustrated in Figure 9.22. The free-energy change upon ATP hydrolysis, ΔG_{ATP} , limits the extent to which molecules can be moved against a concentration gradient.