5. (10 pts.) A biochemist in the Antarctic is cut off from his normal food supplies and is forced to subsist on a diet that consists almost entirely of animal fats. He decides to measure his own levels of urinary ketone bodies, beginning on the day he starts the high-fat diet. What changes in urinary ketone levels will he find?
4. (15 pts.) During a “fight or flight” situation, the release of epinephrine promotes glycogen breakdown in the liver, heart, and skeletal muscle. The end product of glycogen breakdown in the liver is glucose. In contrast, the end product in skeletal muscle is pyruvate. (a) Why are different products of the glycogen breakdown observed in the two tissues? (b) What is the advantage to the organism during a “fight or flight” condition of having these specific glycogen breakdown routes?
3. In the 1950s, Earl Sutherland and his colleagues carried out pioneering experiments to elucidate the mechanism of action of epinephrine and glucagon. In the light of our current understanding of hormone action, interpret the two experiments described below:

(a) (10 pts.) The addition of epinephrine to a normal liver homogenate (a preparation of broken liver cells) resulted in an increase in the activity of glycogen phosphorylase. However, if the homogenate was first centrifuged at high speed and epinephrine or glucagon was added to the clear supernatent fraction containing phosphorylase, no increase in phosphorylase activity was observed.

(b) (10 pts.) When the particulate fraction sedimented from a liver homogenate by centrifugation was separated and treated with epinephrine, a new substance was produced. The substance was isolated and purified. Unlike epinephrine, this substance activated glycogen phosphorylase when added to the clear supernatent fraction of the homogenate.
2. (10 points) In skeletal muscle, a short term energy storage molecule, phosphocreatine, is synthesized from creatine and ATP by the enzyme *creatine kinase*:

\[
\text{creatine + ATP } \rightarrow \text{phosphocreatine + ADP}
\]

During times of exertion, the above reaction is carried out in the reverse direction to replenish the muscle ATP supply. ATP is needed to catalyze the process leading to muscle relaxation. During exertion, the phosphocreatine concentration rapidly drops in the muscle cell, while the ATP concentration remains relatively constant.

If the muscle is treated with 1-fluoro-2,4-dinitrobenzene, the concentration of ATP in the muscle declines rapidly, while the concentration of phosphocreatine remains unchanged during a series of contractions. Suggest a reason for this observation.
1. (15 points) Chronic alcohol consumption leads to fatty acid deposits in the liver, and lactic acidosis due to accumulation of lactate in the blood. Explain how excess alcohol consumption will lead to the accumulation of fatty acids and lactate. (HINT: ethanol cannot be metabolically converted to lactate).