What is Acetyl Coenzyme A ?

Acetyl coenzyme A is a *thioester* derivative of acetic acid **1** (Figure 1). Acetic acid **1** is a typical example of a *carboxylic acid* and methyl acetate **2** is a typical example of an *ester* derivative of acetic acid **1**. Thioesters are simply the sulphur analogues of esters and compound **3** is a thioester analogue of compound **2**. Acetyl coenzyme A is also a thioester and for the moment we will represent it by the abbreviated thioester structure **4** which is the usual way of drawing this molecule.

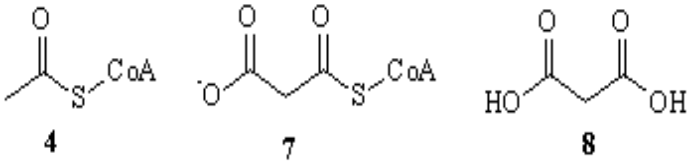

Figure 5. Acetyl Coenzyme A, Malonyl Coenzyme A and Malonic Acid

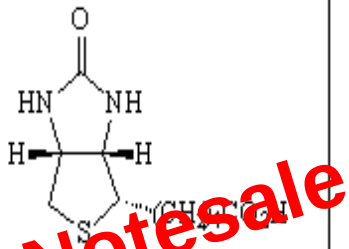

Figure 6. Biotin

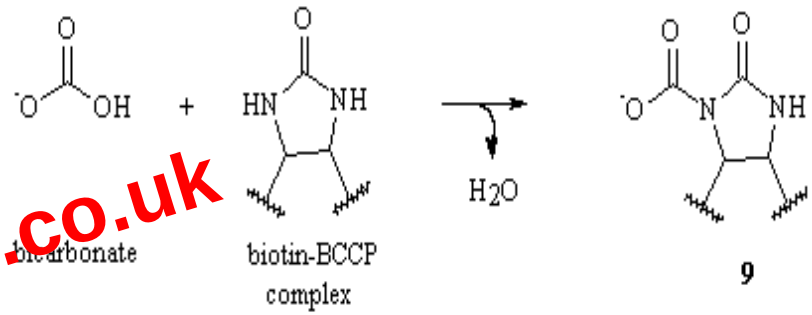

Figure 7. Carboxylation of Biotin-BCCP Complex

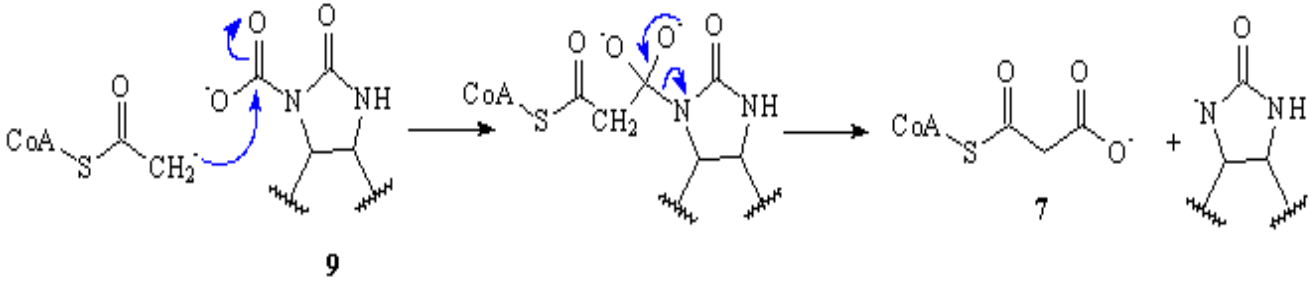

Figure 8. Formation of Malonyl Coenzyme A

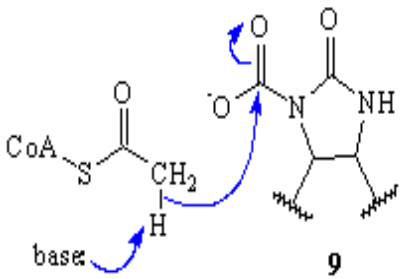

Figure 9. Synchronous Deprotonation-Nucleophilic Attack

Malonyl Coenzyme A; a Partnership with Acetyl Coenzyme A

Biotin is attached through its carboxyl group to an associated enzyme, biotin carboxyl carrier protein (BCCP) during the carboxylation reaction of acetyl coenzyme A **4**. The mechanism of the carboxylation reaction of acetyl coenzyme A **4** is shown in Figures 7 and 8. The initial reaction involves the carboxylation of the biotin-BCCP complex with bicarbonate giving molecule **9** as shown in Figure 7.

How is Acetyl Coenzyme A used in Biosynthesis ?

- In Figure 11, the reaction mechanism has been shown as a stepwise reaction involving the formation of a discrete carbanion intermediate. In reality, a synchronous reaction occurs; as carbon dioxide is lost carbon-carbon bond formation takes place as shown in Figure 12.
- Intermediates **11** are used widely as precursors to a diverse range of natural products. We shall see later how fatty acids and polyketides are biosynthesized from intermediate **11**.