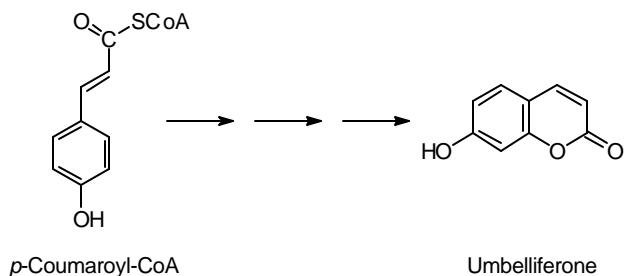


Biology 407b Plant Secondary Metabolism

Assignment No. 2 Biosynthesis of Secondary Metabolites

Due Monday February 02, 2004

1. In the mevalonate pathway for the biosynthesis of isopentenyl pyrophosphate, 3 units of acetyl-CoA are combined to make the 6-carbon intermediate 3-hydroxy-3-methylglutaryl-CoA (HMG-CoA). (Refer to Figure 24-4, Buchanan et al, 2000, Biochemistry and Molecular Biology of Plants). Knowing that this sequence of reactions involves both aldol and Claisen reactions, draw a complete set of reactions illustrating the biosynthesis of HMG-CoA. Be sure to include double-barbed arrows to indicate e^- movement. (Hint: Don't worry about how all the Coenzyme A groups are removed, except the one lost during the Claisen reaction involved in the sequence.)
2. For the natural product umbelliferone (a coumarin), suggest a plausible biosynthetic route, starting with *p*-coumaroyl-CoA. You should only need 3 steps. (Hint: *trans* to *cis* isomerization can occur non-enzymatically.) For each step, describe what kind of reaction is taking place, what kind of enzyme is involved and what coenzymes or cofactors are required. (You may need to look beyond your class notes to do this...)



[Bonus: Predict the e^- flow (using double-barbed arrows) for the cyclization reaction that must take place, and label the reactive components (e.g., electrophile, neutrophile, etc).]

3. Briefly explain how enzymes are able to catalyze complex chemical reactions under mild conditions (e.g., ambient temperature, neutral pH, dilute substrate concentrations, etc.).