The Role of Methylmalonate Semialdehyde Dehydrogenase in Valine and Propionyl-CoA Metabolism in *Arabidopsis thaliana*.

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Abstract: Methylmalonate Semialdehyde Dehydrogenase (MMSD) is an enzyme involved in valine degradation in *A. thaliana*. Although it is not part of the metabolic pathway for propionate, MMSD knockout mutants suffer dramatic growth defects when treated with the metabolite. This study seeks to characterize the enzyme's role in valine and propionate metabolism.

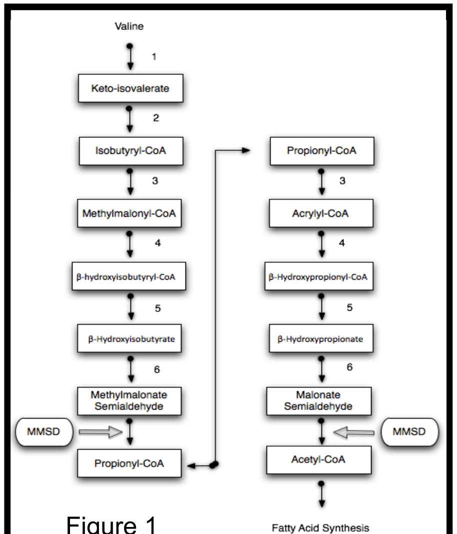

Figure 1

Figure 1.
Mitochondrial valine and propionyl-CoA degradation in *A. thaliana*.

Figure 2.
Peroxisomal propionate degradation, resulting in β-hydroxypropionate.

Note
Enzymes 3,4, and 5 are present in both organelles.

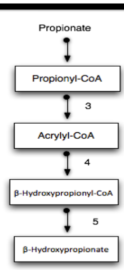

Figure 2

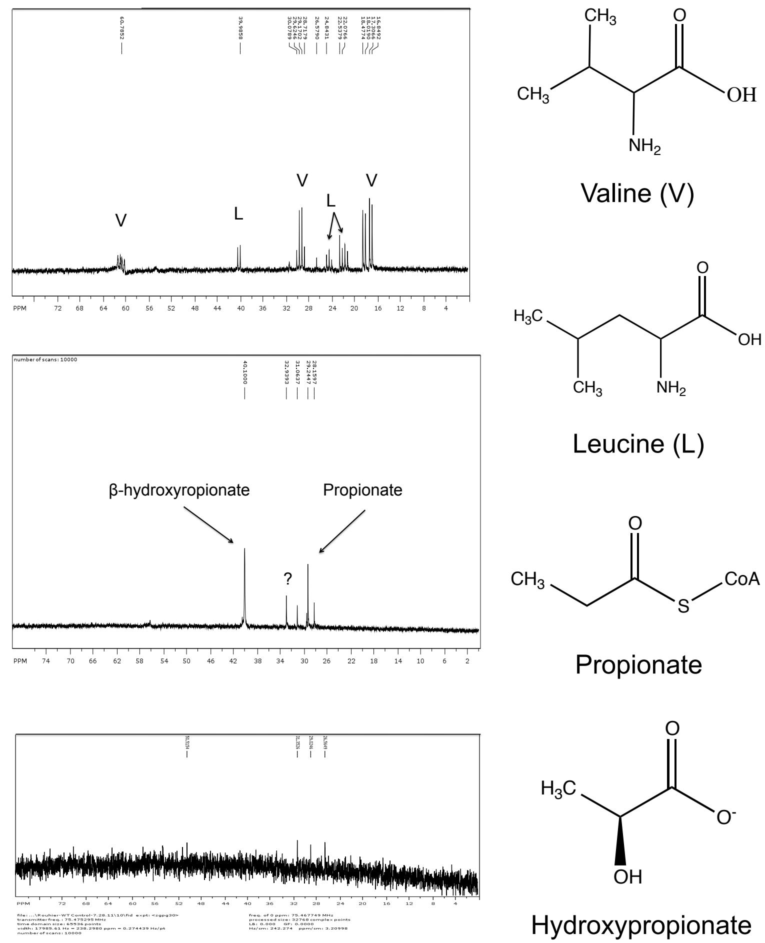

Figure 3. Nuclear magnetic resonance spectrum of 4 day old wild type seedlings incubated for 24 hours with: top, [U-^{13}C] valine resulting in valine and leucine; middle, [2-^{13}C] propionate resulting in propionate and β-hydroxypropionate; bottom, untreated control seedlings.

Results:

- The addition of labeled valine to wild type seedlings did not induce the valine-propionyl-CoA pathway, but rather was converted to leucine.
- The addition of labeled propionate to wild type seedlings resulted in an accumulation of β-hydroxypropionate.

Discussion:

- The failure of the addition of labeled valine to result in the valine-propionyl-CoA pathway was a result of inadequate conditions for the seedlings to induce the pathway. This could be mended with either a change in seedlings growth preparation or a prolonged exposure to darkness during germination.
- A lack of homozygote MMSD knockout seeds prevented extensive study of the MMSD knockout pathway.

Future Work:

- Future work will include experimenting with the conditions necessary to induce the proper valine-propionyl-CoA pathway, and applying those conditions to MMSD knockout seeds.

References:

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