Science of Synthesis
Guided Examples

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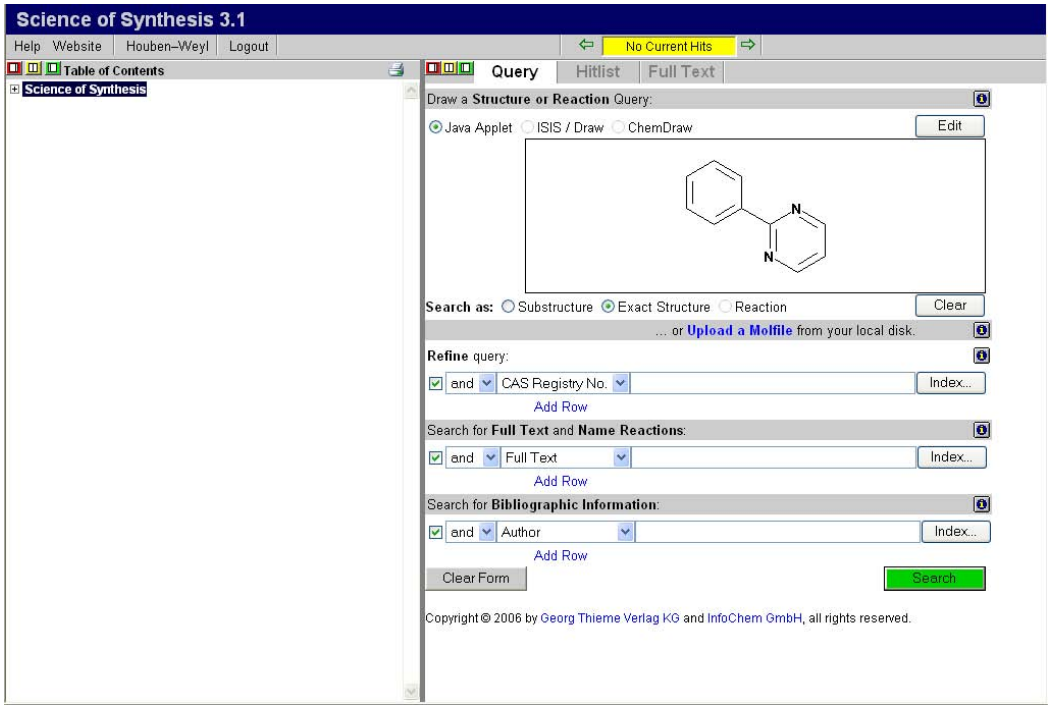
1 Exact Structure Search



Draw 2-Phenyl-Pyrimidine (depicted above) using one of the three supported drawing tools, then select “Exact Structure” from the “Search As” options.

Click Search.

Note: Performing this search in SciFinder (CAS) will generate 15,565 hits 15% of which relate to the synthesis of 2-Phenyl-Pyrimidine. This amounts to approximately 2,300 links to original papers.

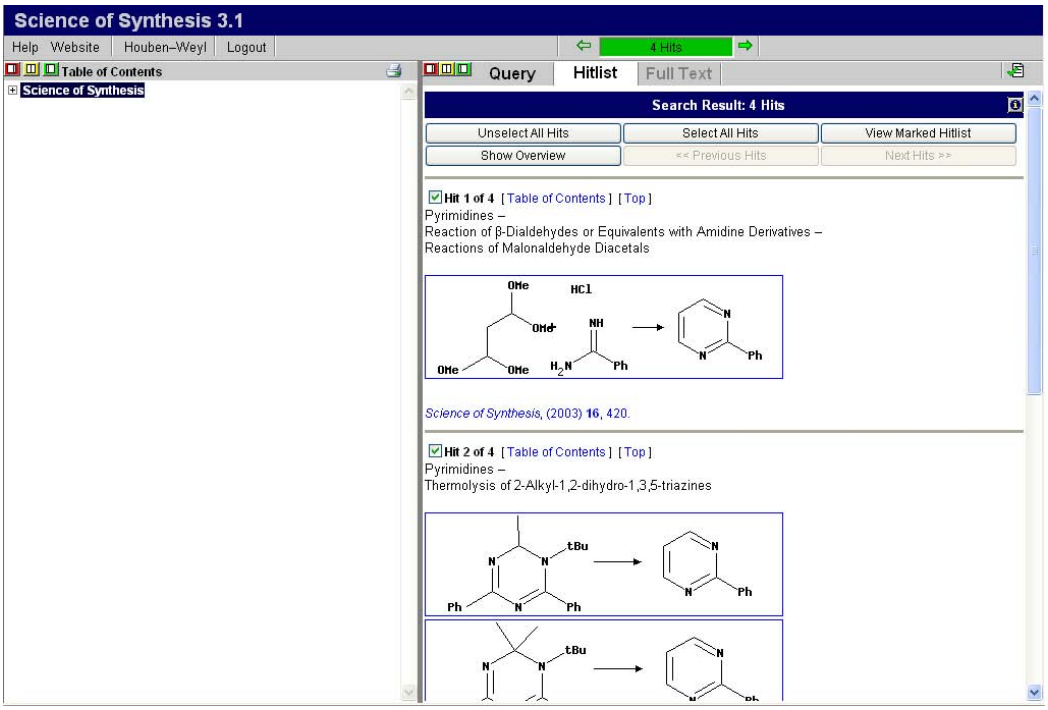
Extracting the information you need from this list may be difficult: assuming you have access to all the journals, how do you process all these hits to isolate the useful information? And how can you be sure that the methods you settle on will work?

Performing the search in Crossfire (Beilstein) will give only 1 hit since Crossfire is a substance database. Clicking on “Synthesize this” will lead to a couple of hit sets, which mainly link to patents or very old literature.

Performing the above search in Science of Synthesis will generate a concise hitlist of transformations that have been proven to work reliably on a number of different substrates. To decide which method to use for any given transformation, Science of Synthesis is the ideal tool.

Note: You would not use Science of Synthesis if you are searching for a specific compound. The focus of Science of Synthesis is specific functional group *transformations*, rather than the various products that may result.

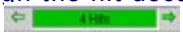
Nor would you use Science of Synthesis for an exhaustive overview over all possible synthetic routes for a given transformation: Science of Synthesis only presents the most useful and reliable methods selected by its expert authors.



In Science of Synthesis the hit list is displayed in the right-hand frame. Each hit shows the substance class (in this case: “Pyrimidines”), the type of transformation (e.g. hit 2: “Thermolysis of 2-Alkyl-1,2-dihydro-1,3,5-triazoles”) and the single step reaction(s) found in the hit document.

Clicking on a reaction scheme will lead you directly to the full-text document, as will clicking on the link below the schemes (e.g. Science of Synthesis, (2003) 16, 420 connects you to Science of Synthesis volume 16, page 420).

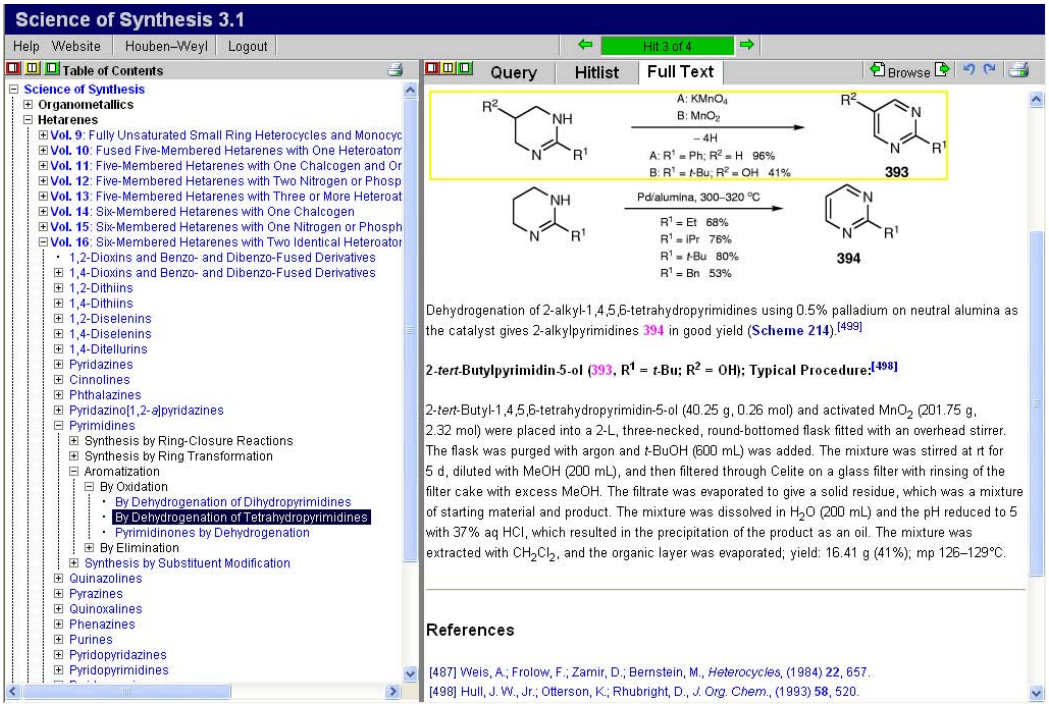
In the header, you can see that your exact structure search for 2-Phenyl-Pyrimidine results in 4 hits: 

Note: You can browse through the hit documents by clicking the green arrows left and right of the status field: 

Science of Synthesis is not merely a database but a reference work for organic transformations: all 4 hits deliver reliable methods to synthesize 2-Phenyl-Pyrimidine:

- Hit 1: By Reactions of Malonaldehyde Diacetals
- Hit 2: By Thermolysis of 2-Alkyl-1,2-dihydro-1,3,5-triazines
- Hit 3: By Dehydrogenation of Tetrahydropyrimidines
- Hit 4: Reaction of (Trialkylstannyl)pyrimidines with Acid Chlorides and Aryl Halides

Click on the structure in the third hit to bring up the corresponding document:



The transformation containing your search structure is highlighted in a yellow box and a generally applicable preparative method is given towards the end of the document. This method can be used in the laboratory immediately, without having to consult the primary literature. You may copy and paste, or print, any part of the document as necessary.

Note: You may print the document you are currently viewing by clicking on the print icon in the top right-hand corner of the screen. (The document will display in low resolution, but print in high resolution).

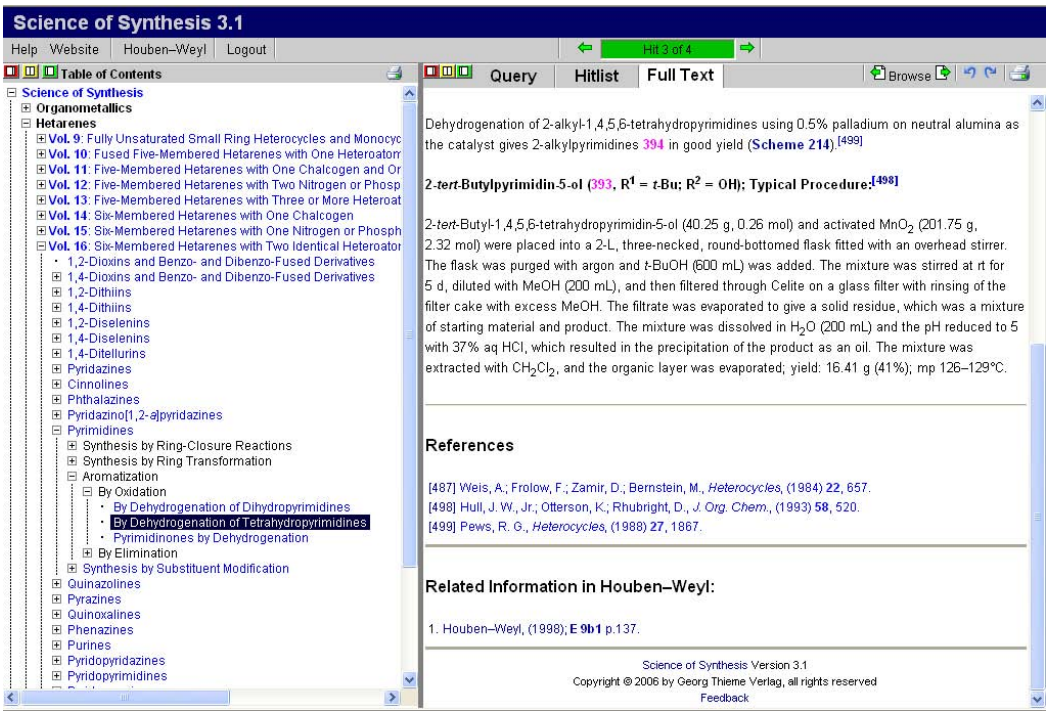
In the interactive table of contents in the left-hand frame the title of the document currently displayed is highlighted: By Dehydrogenation of Tetrahydropyrimidines.

Note: The table of contents gives rapid access to related methods that might not be part of your hit list. These methods use similar chemistry and may offer valuable alternatives to solve your synthesis problem. To print out all related methods, click on the chapter heading (in this case, "By Oxidation") and use the print icon in the top-right hand corner of the left-hand frame.

Preparative methods given in Science of Synthesis are "General Procedures" or "Typical Procedures". You can be assured that they have been applied on a range of substrates, under a variety of conditions, in numerous laboratories. Science of Synthesis aims to present a compilation of the best methods for synthesizing any given class of compounds.

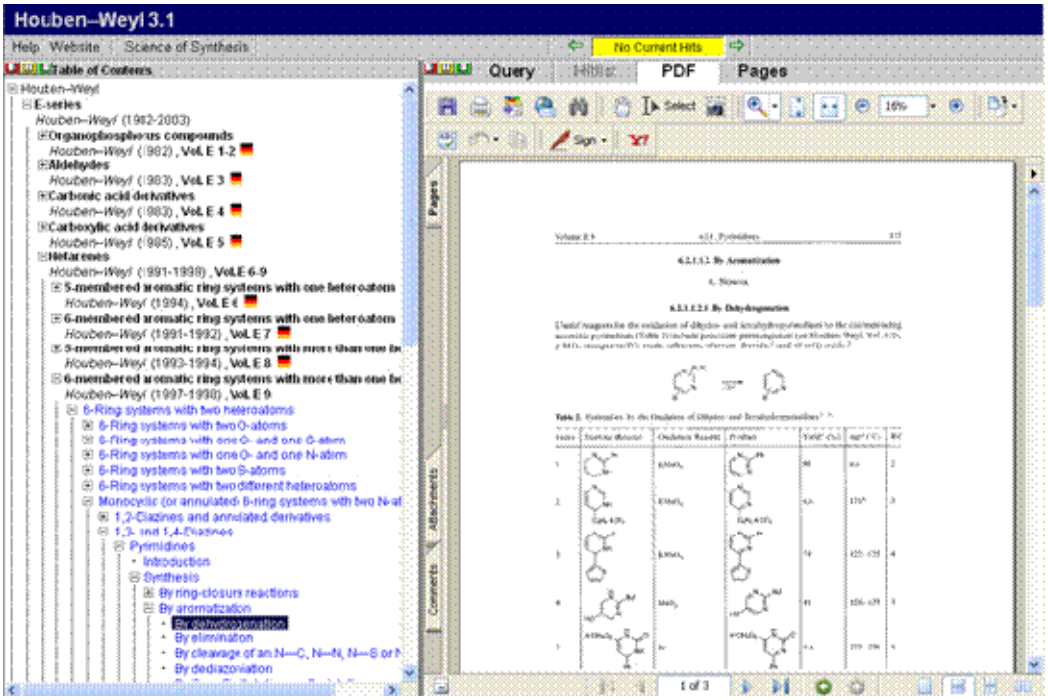
2 Houben-Weyl

At the foot of each document in Science of Synthesis, you will find links to the relevant primary literature, as well as, where applicable, links to related sections of the electronic back file (Houben-Weyl):



Houben-Weyl is particularly useful if you are looking for a robust method, which does not so much require expensive, state-of-the-art equipment or the use of precious catalysts.

Houben-Weyl has good coverage of methods from the 1960s and 70s which have passed out of copyright. These methods are excellent candidates for scale-up. Houben-Weyl often will list more/supplementary examples than (intentionally!)



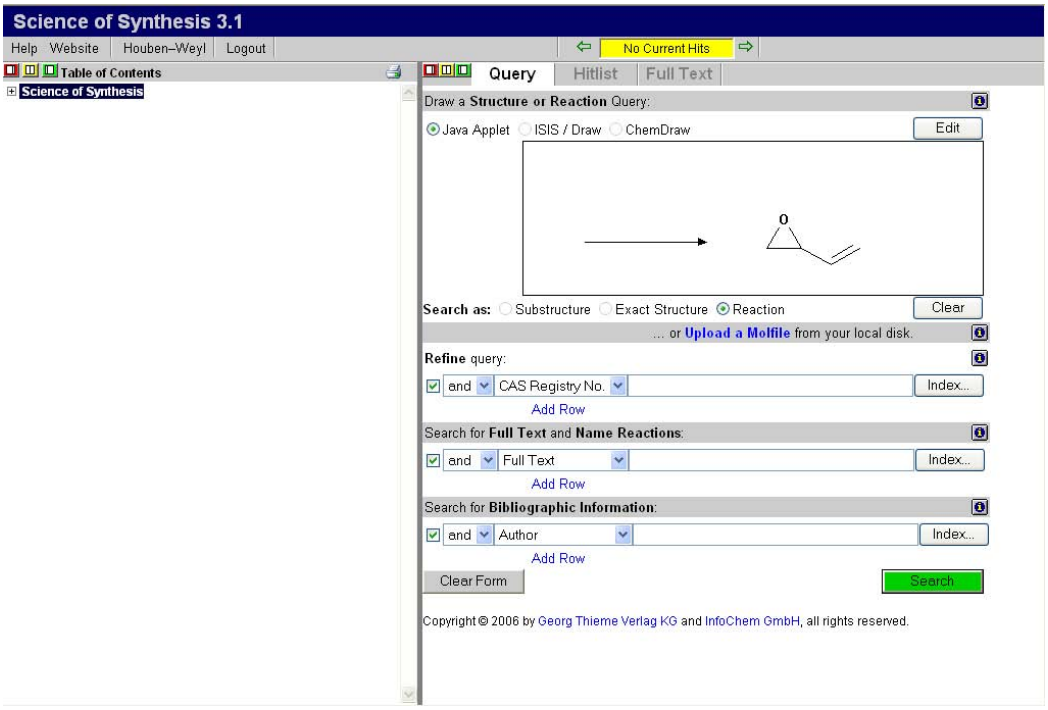
3 Reaction Search

Science of Synthesis automatically switches to reaction search mode if an arrow is drawn next to the structure in the drawing tool.

Note: Placing an arrow to the left of your target structure gives hits where the structure is the (or part of the) product; placing the arrow to the right gives hits where your target molecule is a (or part of a) reactant.

Reaction searches seek both exact and substructure matches with the target molecule – ie. the results may include exact hits as well as reactions where the target structure is part of a larger molecule.

In the example below Science of Synthesis finds methods for synthesizing 2-Vinyl-Oxiranes:



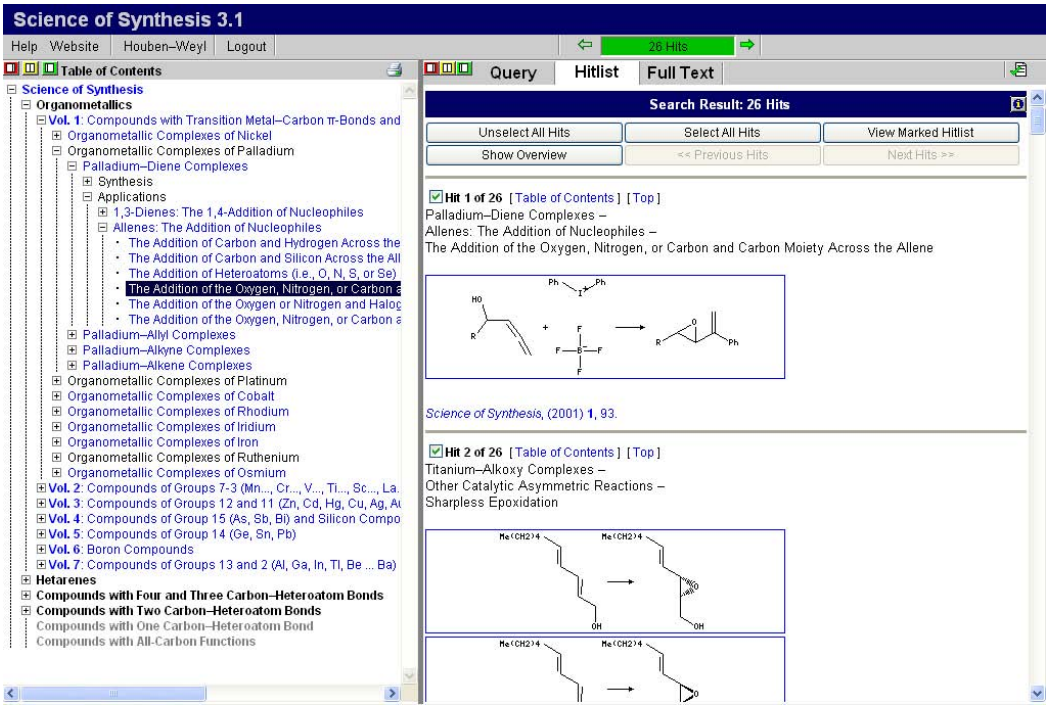
Note: Performing this reaction search in SciFinder (CAS) will give 7,880 hits – only 30% of which are related to the synthesis of 2-Vinyl-Oxirane (and its derivatives). Since this is a highly reactive species, most of the hits refer to papers where the 2-Vinyl-Oxirane is a reactant, not a product.

Performing this search in Crossfire (Beilstein) will give 511 hits. As with SciFinder, in the majority of these the target structure is part of the reactant, not the product.

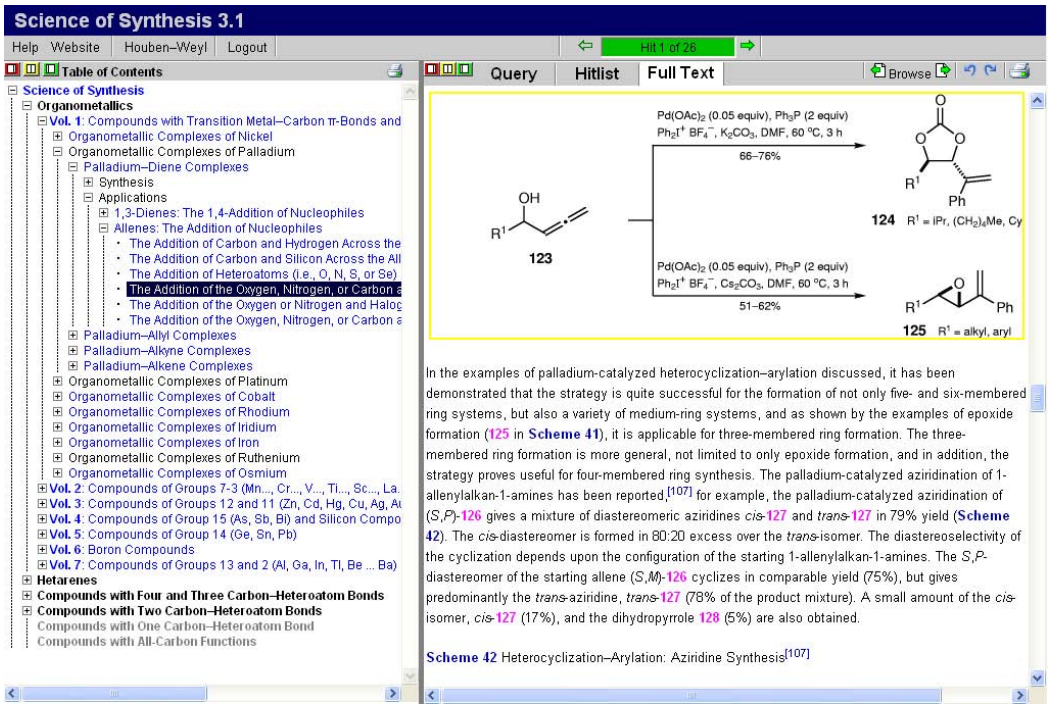
Science of Synthesis is an authoritative reference work: leading chemists are hand-picked to write each chapter. Science of Synthesis differs from other databases because it presents a selection of preparative methods carefully chosen by these experts. Your Science of Synthesis hitlist will contain only documents relevant to the synthesis of a given molecular entity.

Science of Synthesis authors filter the literature to provide procedures that work reliably with a variety of substrates. The authors provide reaction schemes to illustrate generally applicable methods.

The reaction search for 2-Vinyl-Oxiranes in Science of Synthesis gives 26 hits. Twenty-one of these give access to evaluated preparative procedures you can immediately use to synthesize the 2-Vinyl-Oxirane moiety:



Click on the single-step reaction featuring classes of starting material and end-products matching your needs (e.g. hit 1) to jump directly to the Full Text article detailing the synthesis:



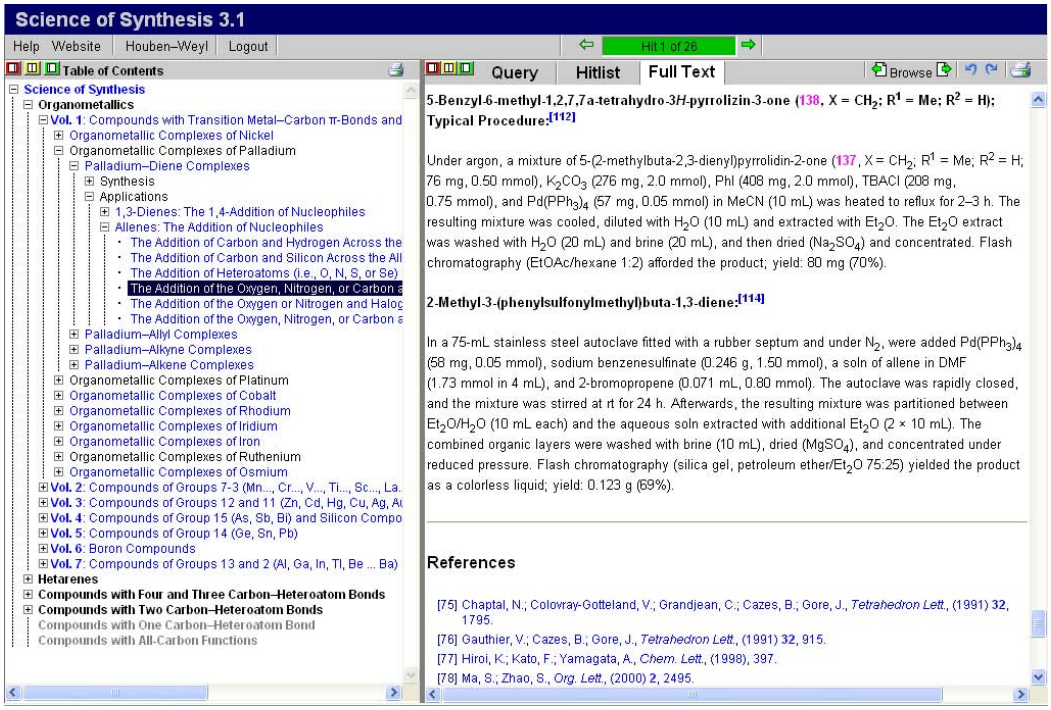
The Table of Contents in the left-hand frame provides “chemical context” for the transformation you are viewing in the Full Text window – in this case the addition of

nucleophiles to allenes. Adjacent listings in the Table of Contents are logically/chemically related by the functional group or system to be synthesized.

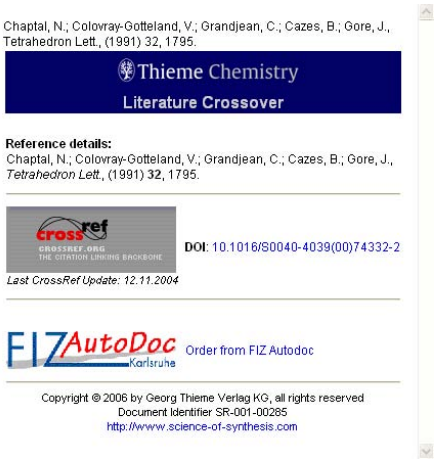
This simple, unparalleled feature provides you with immediate access to analogous methods that could provide a novel solution to your synthesis problem. A network of related information is laid out right in front of you. No more tunnel vision!

4 Outbound Linking

At the foot of each Full Text article in Science of Synthesis you will find links to the primary literature references within the document.



Clicking on a reference link opens a window which gives you the choice to connect to an abstract (and from there the full-text article, if you have an online subscription) or to purchase the article by document delivery:



Note: Since the full experimental procedures are detailed in Science of Synthesis you have the information you need to decide whether a particular method will solve your synthesis problem. From this point you may focus on the relevant references provided, saving you the time and effort involved in filtering through the primary literature.