

## The Molecule Project: Linking Concepts in a One-semester GOB Course

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## Background: Reforming the GOB Course at Georgia Southern

### One-Semester Integrated GOB Curriculum

- Cover organic functional groups early (after T1)
- Cover organic chemistry topics in the context of biochemistry
- De-emphasize stoichiometry,  $e^-$  configuration, and quantum numbers
- Cover measurement and unit conversion in lab (2 pds.)

### Other

- Recitation Sessions at beginning of lab session
- **Molecule Project**

■ Adapted from Tracy, H. *J. Chem. Educ.*, November 1998, 75(11): 1442-1444.



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## The Molecule Project

Students receive the name of a biologically active molecule during the first week of class. By the end of the semester they must generate a report that includes the following:

- The molecule's Lewis structure
- The molecule's organic functional group(s) and chiral centers
- A color, three dimensional perspective ball-and-stick model of the molecule computer generated
- A statement predicting of the molecule's solubility in water
- A summary of the molecule's biological function including at least one chemical reaction in which the molecule is involved
- References to any materials used to compile the report



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## Goals of the Molecule Project

- Apply knowledge covered during the course to their individual molecule
- Think about more complex topics earlier in course
  - Enhanced learning of topics
  - Linking topics together in a meaningful way
- Understand the relevancy of chemistry to life
  - Appreciation of chemistry



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## Student Feedback-Instrument

- Did they think they learned anything from the molecule project?
- Could they make connections between topics?
- Was there an enhanced appreciation for chemistry as a result of the molecule project?
- Student Assessment of Learning Gains (SALG) survey
  - Five point Lickert scale: 1-5 where 1 is not much, 5 very much

(<http://www.wcer.wisc.edu/salgains/instructor/>)



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## Student Feedback - Parameters

- Surveys given during F'05 and Sp'06
- 3 different professors (all did Molecule Project)
- 4 sections
- ~140 students
- ~80% of students / section responded to survey



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### Did students think the molecule project enhanced their learning?

"How much did (the molecule project) help your learning?"

3.58 ±1.14  
N=141

**Conclusion: Students felt that the molecule project was moderately helpful to their learning.**



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### Did students remember what they learned?

"How much of (your molecule) do you think you will remember and carry with you into other classes or aspects of your life?"

3.73 ±1.1  
N=140

**Conclusion: Students felt that they will remember a lot about the molecule project as they advance.**



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### Could students link the class concepts in a meaningful way?

"To what extent did you make gains in (being able to tie multiple concepts together to understand several aspects of a single molecule) as a result of what you did in this class?"

3.77 ±1.02  
N=139

**Conclusion: Students felt that they made a lot of gains in tying together concepts to understand a single molecule.**



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### Could students link the class concepts in a meaningful way?

“The molecule project was useful for making connections between material throughout the course.”

Scale: 1-5 where 1 is strongly agree, 5 is strongly disagree

**2.02 ±0.97**  
**N=142**

**Conclusion: Students agreed that the molecule project was useful for making connections between material presented in the course.**



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### Does Instructor Matter?

For statements presented, the responses were subjected to Chi Square test.

**No!**

**The distribution of responses was independent of instructor**



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### Student Comments on the Molecule Project - Analysis

■ **Number of Responses**

$N_{TOTAL} = 142$

$N_{NO RESPONSE} = 88$

$N_{RESPONSE} = 54$

■ **Tone of Comment (N=54)**

Positive Responses = 32 (59%)

Negative Responses = 9 (17%)

Neutral Response = 13 (24%)



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## Student Comments – Linking Concepts

■ *“It was interesting to see how our understanding of our molecule increased as we learned more of the course material.”*

■ *“The project tied in information that was learned in the very beginning of class until the end. Doing the project helped a lot in refreshing my memory and hopefully will stick with me during the exam.”*

■ *“Strangely enough, I actually enjoyed the molecule project because I was able to tie all the material together for one major project I was solely responsible for. It was neat to see how certain topics we discussed in class related to my specific molecule.”*



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## Student Comments – Appreciation of Chemistry

■ *“I felt the molecule project provided me with insight to how my drug, ibuprofen, worked in my body. This information will be useful to me as a nurse and a mother someday.”*

■ *“It helped me understand a lot about how the Human body works in general because of all the research I had to do for my molecule”*

■ *“It allowed me to know more about something that was very common to me and that I use often.”*



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## Considerations for Implementation

### ■ Molecule Selection

### ■ Grading of Projects

- For large classes, grading papers can get time consuming!
- Some previous knowledge of molecules greatly reduces grading time.



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## Conclusions

- The molecule project is helpful for enhanced student learning
- The molecule project is helpful for linking class concepts together in a meaningful way
- The molecule project is a memorable experience; some students even implied it enhanced their appreciation for chemistry.
- Student response to the molecule project was independent of instructor.



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## Acknowledgements

**Todd Deal, Dept. of Chemistry, GSU**

**Karen Welch, Dept. of Chemistry, GSU**

**Faculty Development Committee, GSU**

**Department of Chemistry, GSU**



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## References

Frost, Laura DeLong; Deal, S. Todd; Humphrey, Patricia B. "Making the Most of a One-Semester General, Organic, Biochemistry Course: A Novel Integrated Curriculum" *J. Chem. Educ.* June 2006, *83(6)*: 893.

Tracy, Henry J., "A One-Semester General, Organic, and Biochemistry Course Format Linked by a Molecular Model Project", *J. Chem. Educ.*, November 1998, *75(11)*: 1442.



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