

Enhancing Student Participation in a Biology Class by Flipping Instruction

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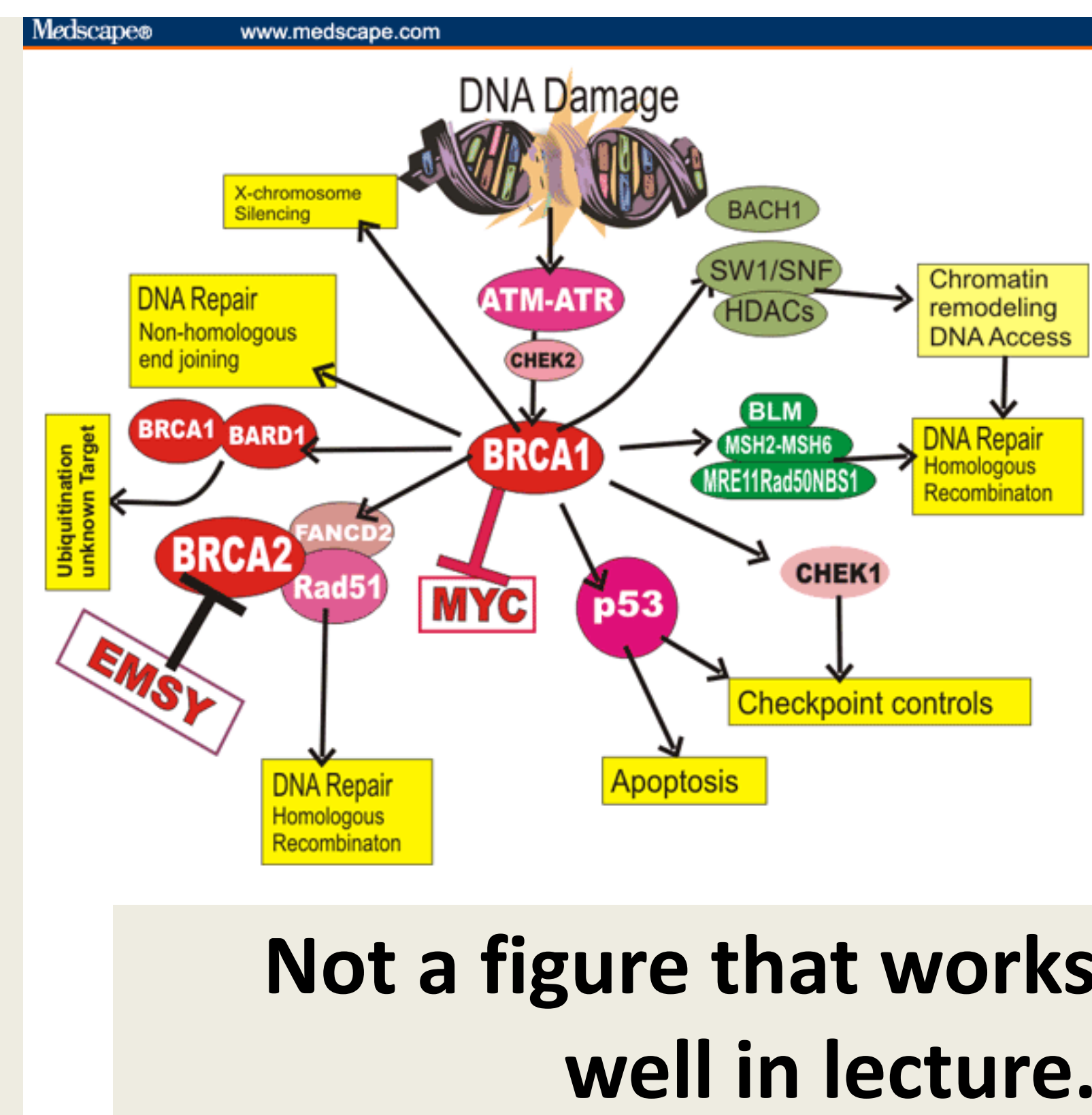
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Introduction:

BSC 329, Human Molecular Genetics, is a three credit senior level elective course emphasizing current research. Although demanding, it is one of our most popular senior undergraduate courses, with 30 students enrolled in Fall 2013. I have taught my advanced genetics course in a blended format for three years. Twenty online content modules are substituted for one class session each week.

Problems with the traditional format:

- Diverse levels of prior student knowledge.
- Too much lecture needed to provide content.
- Complex course content unsuited for quick coverage.
- Too much instructor- and not enough student-directed learning.



RNA Interference

Module 11

How can we use RNA interference in medicine?

Almost immediately after the discovery of the RNA interference process, major hype began describing RNAi as the answer to everything in both lab and clinic. While RNAi has proven to be a significant tool in gene expression research, its direct application to human health has been less immediate.

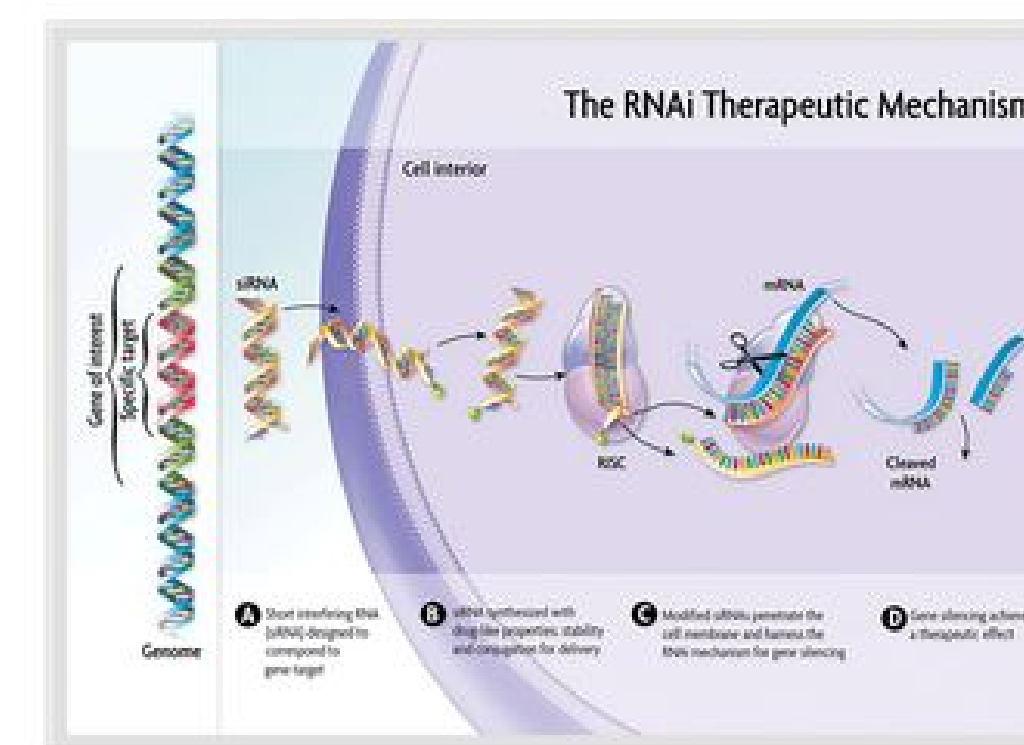


Figure 1. The basic idea of RNAi therapy is the insertion into cells of siRNA molecules designed to block the production of harmful proteins.

The article in the Hand Outs sidebar does a good job of describing the basics of RNAi and its potential applications to human disease (it looks long because there are several pages of references). For comparison, look at this [short article on the NOVA web site](#) that provides another overview of some of the more promising areas of research applying RNAi strategies to fight human diseases such as Huntington disease. As you will notice, the NOVA article was written in 2005, and our optimism is more cautious now than then. However, these are all topics with ongoing research. This would be a good time to go back to the [video clip cited on page 3](#), starting at ~8:30 minutes for the discussion of applications of RNAi to human disease. For a detailed look at current clinical research in siRNA therapeutics, see the Learn More sidebar.

What's in the Modules?

- All basic content and review materials, illustrated with figures, videos, links and articles.
- Self-tests and discussion questions.

In place of traditional exams, students create blogs.

At the end of each course unit, students write a blog entry describing what they felt that they had learned and their thoughts about the material.

Positives for instructor:

- High class attendance and participation in class activities.
- Significantly fewer student complaints about 'homework' and lack of group time.
- Easy to identify problem areas before class.

Positives for students:

- Self-paced learning and review material only as needed.
- Discussion questions introduced before class.
- Time for 1:1 interaction with instructor.
- No Friday afternoon class required (open lab with online module instead).

Conclusions

The flipped course format allows the instructor to incorporate the best features of face-to-face and online strategies to provide students with opportunities for self-paced learning and a deeper content understanding compared to classroom-only instruction. Blog entries indicate that most students gained a significantly better understanding of several difficult topics than previous students demonstrated on in-class exams.

Acknowledgments: I want to thank Mayuko Nakamura and Charles Bristow at the Center for Teaching, Learning and Technology for their Reggienet support and patience.

What do we do in class?

- Discussions of papers and questions introduced in modules.
- Modeling activities.
- Group work on major projects such as wikis.
- Occasional 10-15 lectures focused on applications.

New Topic

3. In-class activities

1. Presentation of case study

2. Self-paced content module

