

FDA DRUG DEVELOPMENT

Part III: Lab Activity

FDA Drug Development Process: From Idea to Rollout

Name _____

Pre-Lab

1. The Federal Drug Administration is charged with overseeing and approving new drugs. How does the FDA fit into our federal government's structure?
2. The "breakthrough" made by Jim Allison involved the use of immunotherapy. What is immunotherapy?
3. The FDA is part of the United States government. Are there other agencies in other countries that have similar functions?
4. What other functions does the U.S. FDA have?
5. A very important part of the drug development process is the use of models to test the effectiveness of a new drug or therapy. What is a model in science? List different kinds of models that might be used in scientific research.
6. What information do you need before you take a medicine? List what you need to know before you actually use a medicine



Lab Procedure



Background: As you learned in the film, Dr. Allison and Max Krummel as well as Jeff Bluestone and Dr. Allison's grad students discovered that CTLA-4 actually acts as a metabolic brake in the T-cell's immune response on cancer cells. Jim Allison theorized that tumors have evolved to trick the immune system. They engage CTLA-4, turning on the T cell's break. This stops T cells from attacking the tumors. Dr. Allison hypothesized that if he inserted an antibody to block the connection between the tumor and CTLA-4, the T cell will be free to attack the tumor. Once Jim Allison's research team developed the proper antibody and was able to show that cancerous tumors in mice disappeared. From then on, for the next decade, they had one goal: to get that antibody therapy made into a drug for cancer patients. A simple mission? How does that happen? The winding path from a "breakthrough" discovery to a functioning medication, drug or therapy is not only winding, it is long and costly. Help Dr. Allison's research team treat cancer throughout the world. Map the route that is needed to be followed to make a drug!

1. Since Dr. Allison's research team is working in the United States he is obligated to work with the U.S. agencies responsible for regulating medicines and drugs in America. What agency is involved in the regulation and development of drugs in the U.S.?
2. Explore the [U.S. agency responsible for drug research and development](https://www.fda.gov/about-fda/virtual-exhibits-fda-history/brief-history-center-drug-evaluation-and-research) web site to find out about drug development in the U.S. (<https://www.fda.gov/about-fda/virtual-exhibits-fda-history/brief-history-center-drug-evaluation-and-research>)

What agencies are involved in drug research and development in other countries? Explore the [Global Drug Regulation](https://www.pharmatutor.org/articles/pharmaceutical-regulatory-agencies-and-organizations-around-world-scope-challenges-in-drug-development) website. (<https://www.pharmatutor.org/articles/pharmaceutical-regulatory-agencies-and-organizations-around-world-scope-challenges-in-drug-development>)

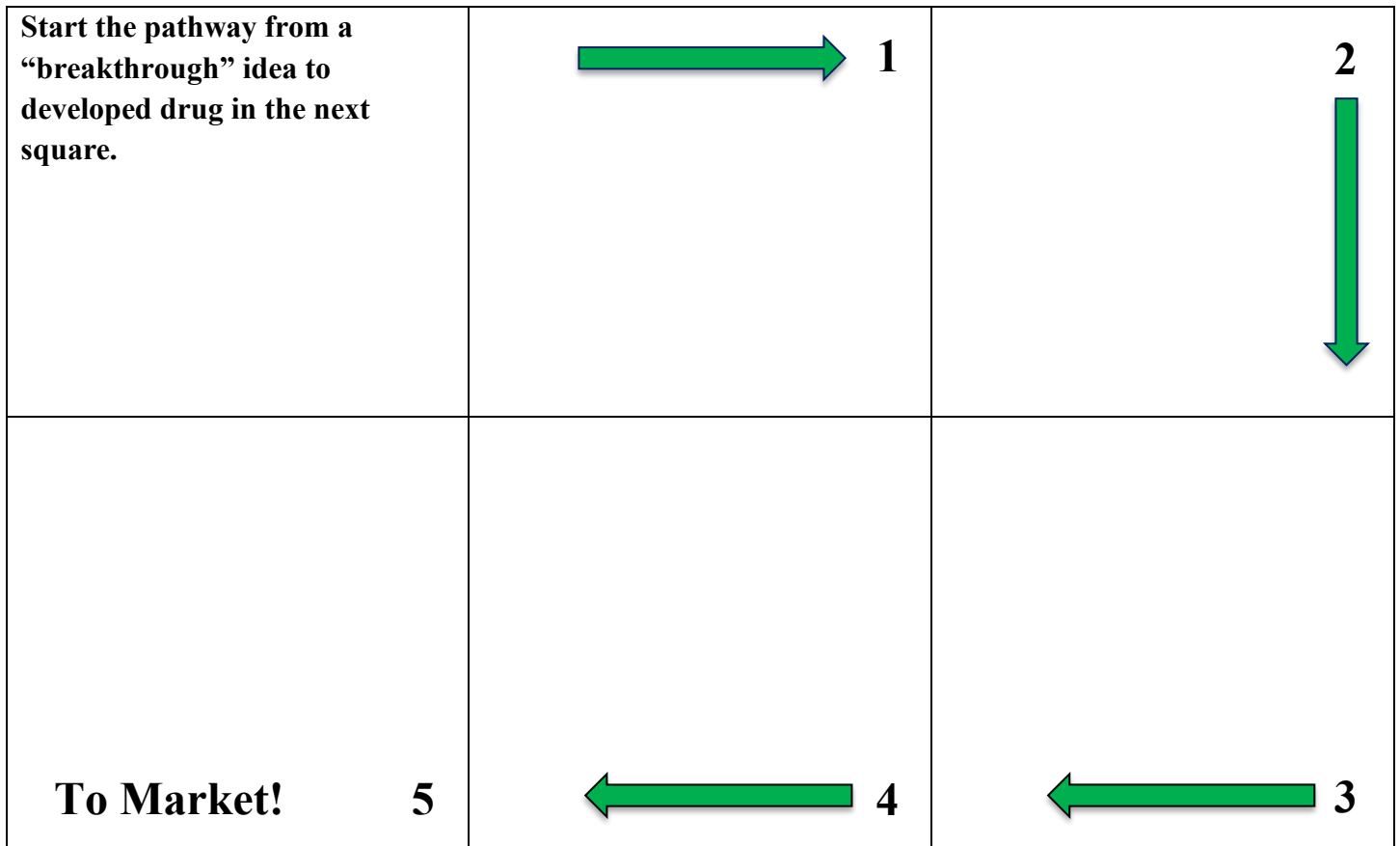
3. The winding path from a "breakthrough" discovery to a functioning medication, drug or therapy is long, costly and often strewn with roadblocks. What is the process? What are the steps? What are the roadblocks? In the boxes below, help Dr. Allison and his researchers find their way down the drug development pathway. There are a number of resources given below that will help orient you to the route that a research team must travel down to see their "breakthrough" actually becomes a usable drug or therapy.

In each square write the name of the step in the development process and describe what happens at each step.

[Drug Development YouTube Video](https://youtu.be/U96He401wj4) (<https://youtu.be/U96He401wj4>)

[Drug Development Pathway](https://www.fda.gov/patients/learn-about-drug-and-device-approvals/drug-development-process) → (<https://www.fda.gov/patients/learn-about-drug-and-device-approvals/drug-development-process>)





4. One of the steps is called--*Clinical Research*. This step is actually divided into a number of separate steps or phases. In the space below describe what happens in each phase or step of *Clinical Research*. The following link might be helpful: [Drug Development Pathway](https://www.fda.gov/patients/learn-about-drug-and-device-approvals/drug-development-process) →
 (<https://www.fda.gov/patients/learn-about-drug-and-device-approvals/drug-development-process>)



5. During the long and winding road that the Allison research team went down to get that antibody therapy made into a drug for cancer patients they ran into a number of problems or roadblocks. Some steps went smoothly, some did not. What were some of the roadblocks they encountered?

Name of Drug Development Step	What Jim Allison's Team Did	Possible Roadblocks They Had



6. Sometimes the journey to develop a medicine or a drug or a therapy finds a diamond and the explorer is rewarded for his or her efforts. The development of ipilimumab for immunotherapy of melanoma earned Dr. Jim Allison acclaim. What was his “pot of gold” at the end of his research rainbow?



Post-Lab Extension: Develop a Research Proposal Outline

As this lab demonstrates, the pathway to a developed, successful drug or therapy is very complex and can be filled with a number of roadblocks. One of the major roadblocks is the cost of developing the drug. As Dr. Allison discovered, the interactions with the big pharmaceutical companies is a major obstacle to the development process. In addition to the costs of drug development there is the cost of research itself. A very familiar process for science researchers is the procurement of monies for the research itself. Researchers in every field of science must learn how to fund their work. They must learn who to get funds from and how to ask for funds. As an extension of this lab activity you will become a researcher. You have an idea, a “breakthrough” in your lab has shown that there may be a way to manipulate T-cells to become cancer fighting cells. (of course, this is just what Jim Allison did.) You and Allison discovered that CTLA-4 actually acts as a metabolic brake in the T-cell’s immune response on cancer cells. It was theorized that tumors have evolved to trick the immune system. They engage CTLA-4, turning on the T cell’s break. This stops T cells from attacking the tumors. The Dr. Allison team hypothesized that if they inserted an antibody to block the connection between the tumor and CTLA-4, the T cell will be free to attack the tumor. Now you need to fund further research. You need to write a proposal to fund the next steps in your research. Who do you submit it to? How will your research be organized? In the extension to this lab activity refer to the film “Breakthrough”, and various web resources to develop a proposal outline for the next step of your research.

Your proposal outline should include the following:

- **TITLE.** Your title should give a clear indication of your proposed research approach or key question.
- **BACKGROUND AND RATIONALE.** You should include: some background and of your proposed research, a short literature review, a summary of key debates and developments in the field, etc.
- **RESEARCH QUESTION(S).** Formulate these clearly, giving an explanation as to what problems and issues are to be explored and why they are worth exploring.
- **RESEARCH METHODOLOGY.** Describe the research approach (theoretical framework), the research methods appropriate for the proposed research, a discussion of advantages as well as limits of particular approaches and methods.
- **PLAN OF WORK & TIME SCHEDULE.** You should include the various stages and hypothetical time lines for developing and implementing the research.
- **BIBLIOGRAPHY.** A selection of sources appropriate to the proposed research

*Remember this is only an outline of the actual research proposal.

