The Folded-List Study Tool with Minute Sketches

A summary. Traditional styles of memorizing and applying concepts and terms can be slow, dull, and uninteresting. Material learned using the methods of most students tends to be easy to forget. The 'Folded-List' method requires training and practice, but ultimately is faster and gives better recall and application of what you learn. The method trains your brain to visualize any concept as a model and connect it to key words. It requires action in two ways: first to start with any concept, event, process, or structure and simplify it to essentials in a sketch, and second to engage hands and motor-learning brain areas in repeated sketching and writing.

It takes work and practice to learn and use. Most of my students have needed months to get it working well for them, though a few lucky or deeply motivated students have seen improvements in only weeks. Once learned, it can greatly improve learning while reducing study time and making study time more interesting.

What's in here:

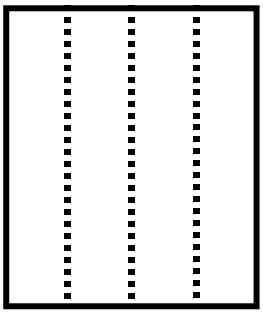
(I) Why you might want to try this method.
(II) The Folded-List technique (which I sometimes call the 'Sketch-link' technique)
(III) Some comments on modes of learning and what makes this technique work (and which should help you use the technique intelligently)
(IV) It's a scary change, so why is it worth trying?

(I) Why do you need a new/different study technique? You might not.

If you're satisfied with your grades, and you know that you're not wasting any time with inefficient study methods, then a new technique isn't necessary. However, almost anyone will benefit by a rational consideration of what methods help them learn a particular kind of material or skill the best or the fastest.

For many students, the single biggest advantage of the sketch-link technique is that it's **FAST**. Once you learn how to use it and get some practice (and it does take some practice, sometimes a lot), this is among the very fastest and most efficient ways to learn in many areas of science (and some other fields). **Once my students have learned how to use it**, I've had many students conclude that they learned more, got better grades, and saved time with this technique. Of course, that takes practice and experience--most students need to try it a number of times before they understand how to use it well. This isn't some magic wand to raise grades in just a few weeks. Just as in sports, when an athlete wants to learn a new move or shot or serve, they need practice and dedication to nail it, and sometimes an athlete is worse (briefly) as they begin to apply a new method that they haven't yet mastered. This method is not something to try in order to learn better in a few weeks; it is something to try in order to be a much better learner and user of knowledge over months and years. (I don't think that any new study method works well without practice & intelligent adjustment.)

The method is simple: Start with a blank piece of paper, fold it lengthwise into 4 sections:

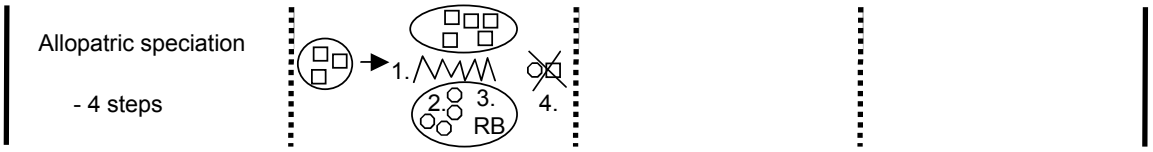


Pull out your lecture notes (or, sometimes, a text book), and start identifying the topics that are most important. In the left column, write the term for the first concept (here, we'll do "Allopatric Speciation", the process in which geographic splitting of a population results in accumulated genetic change that then prevents interbreeding, thus leading to the formation of two species from one. It has four steps: a geographic barrier that splits the populations, accumulation of genetic changes over time, resulting eventually in enough changes that reproduction between groups becomes impossible, and, if the geographic barrier ever disappears, no possibility of mating"). Underneath it, you might write something that may help you recall it ("4 steps"). Then, in the next column, make the simplest sketch *(also described elsewhere in my explanation of 'Minute Sketches')*, with the simplest labels you can, that represents the concept. Do not use any words in your sketches.

THIS IS IMPORTANT—one column is for words, and the other is for images. IF you must, you are allowed to use common short abbreviations, such as 'RB' for reproductive barrier, or DNA, but symbols are always better. You should put key words or phrases in the word column, but never a complete definition anywhere. Your sketch is supposed to show you the definition; if it doesn't, then you need a better sketch. THIS MATTERS--your goal at this stage is to identify any important idea or concept or term, and to convert it to a very simple sketch that will capture the essence of the concept AND be easy to remember & fast to draw/write. What you have created is a 'chunk', the basic units in which experts think. Your chunk is in the form of a 'Minute Sketch', something you can draw in 30 to 60 seconds that reminds you of EVERY important part of a concept or structure or set of events. The ability to create chunks and minute sketches is a valuable skill.

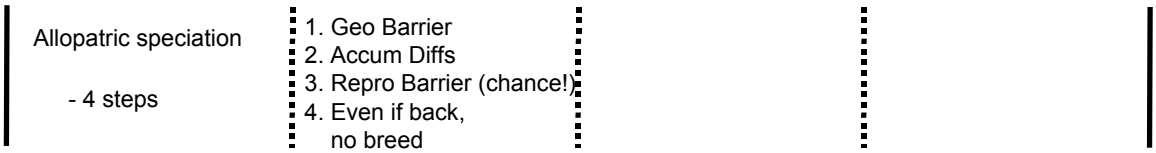
You should have for each concept:

(A) ONLY WORDS ONLY SKETCHES



Especially when you first use the technique, you may find that you really want (and think that you need) more text. For example, an alternative would be:

(B)

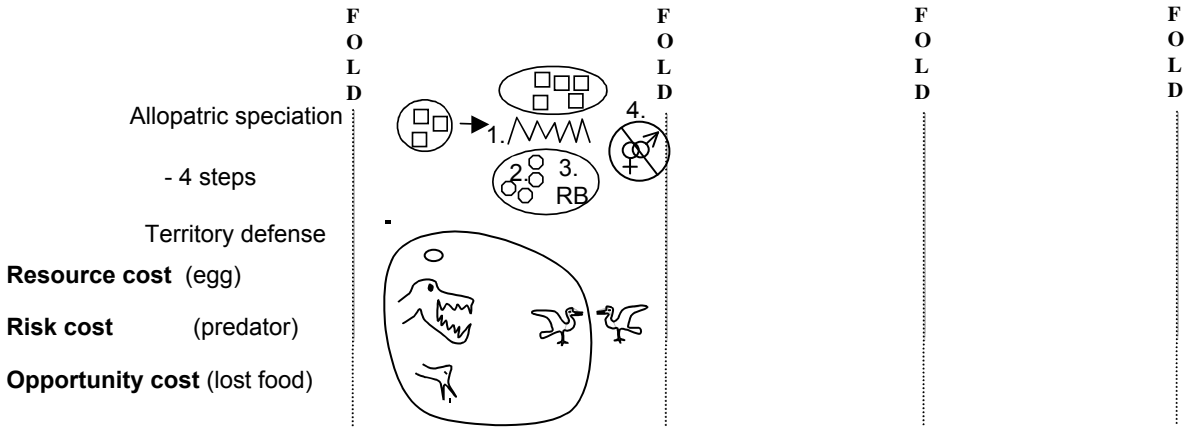


This second alternative, (B), might be easier to invent, but **don't** do it. Use numbered sketches and arrows and diagrams as in (A) instead. Using the figures is faster than the words (try timing yourself or competing with someone else to see which is faster, reading through the words (in your head) or thinking through the logic of the sketch (in your head). When I do time trials with students, the image almost always wins. Try drawing the image above for yourself twice, and then close your eyes & try to imagine the image. Then close your eyes and try to remember the words--usually much harder.

Keep in mind that your goal is partly to remember the concept, but **also** to have your memory of it represent the concept. If you use only words, & study only words, & memorize only words, then you'll remember only words. Remembering only words is fine if you need simply to regurgitate a definition or a term on an exam, but if you actually need to use the concept to solve a problem, you'll need a deeper and non-textual understanding! (If you're trying to learn about basketball for a class, and you know the test will be a written multiple choice test in which you match terms with descriptions, then you should read about basketball and memorize words. But if you know that the examination will be to play a basketball game, then your studying should be practice with the ball and playing basketball! What you know you'll face on an exam (or in life) should, IN ALL COURSES AND AT ALL TIMES, make you adjust how you prepare for it. Practice/study the things you know you'll need to do on the exam. The same goes for learning tasks you face in the rest of your life.

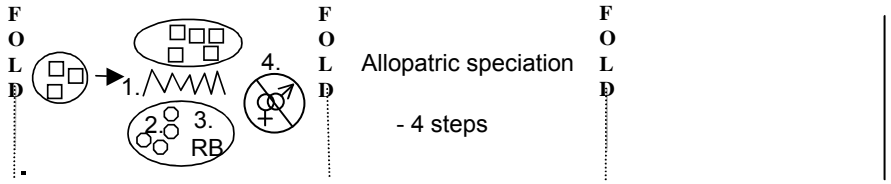
The sketch in (A) actually captures what happens in allopatric speciation, and that sketch illustrates most of the events in a way that is easy to remember, easy to scribble down on the margin of an exam (or even use as part of an essay answer), and helpful if you need to decide whether a particular new example is allopatric speciation. Version B will help you memorize words, and if you think through the idea while writing the words, that might be enough. But if you need to use concepts to do problem solving on an exam, memorized words alone won't help at all. I might be able to memorize a French novel and '**know**' it perfectly, but that wouldn't help me answer any questions about the plot (since I don't understand French…). One can 'know' biology in intricate detail, and still fail an exam that asks you to solve problems.

So, back to our list. Keep adding words in one column, & sketches in the next, until you've filled the page. (I've added another concept: costs of territory defense.)

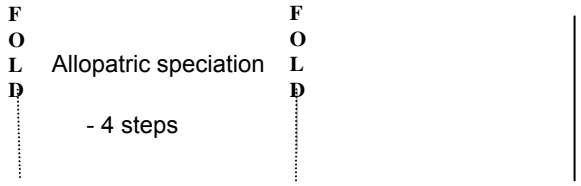


Once you have a full page, you can, whenever you wish, start learning them. Start by folding the first column <u>behind</u> the paper so that you can see only the second column (and the empty third and fourth column). THIS PART IS FAST!

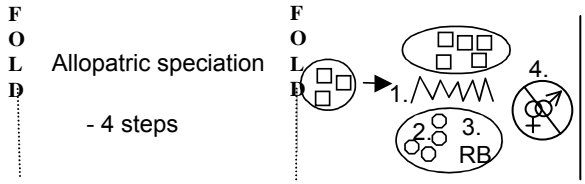
Now, in the third column, go down the page and write the term (and any quick reminder you're using to help) next to each sketch:



Now fold the next column behind:



And draw in your sketch:



Fold the final column behind, and now start a <u>new</u> piece of folded paper, writing the terms, and so on … continue copying and recopying from memory, checking back when you need to, until you have the material memorized (and understood), eventually very well.

Think about the concept (or the term) while you're writing. Go through the cycle a couple of times on one day, then do it again a day or two later, and by a third day you should find that you're starting to understand and remember those concepts very well. If you're doing this correctly, you should see improvement **<u>every</u> <u>day</u>**, even with only three minutes per concept (going through each concept twice, using four columns). (Well, unless you're badly sleep deprived; severe sleep deprivation blocks memory consolidation.) Some concepts will be easier

than others, and sometimes you'll find you MUST to go back to your book or your notes to think through a concept better or to get a better sketch or to get a better explanation.

DON'T give in to the temptation to pack too much into your lists or sketches. Absolutely not! That defeats the purpose--you're trying to reduce a concept to the essentials, and to make those essentials be enough to enable you to think through the full idea. You shouldn't be trying to get a complete description on paper; rather, you just want enough to jog your memory for a complete understanding. ALSO, don't think you can get away without repeating the writing and the sketching parts by hand! Actually recopying and thinking about it as you do is how you're getting your attention fully on the material, and **VERY IMPORTANTLY**, how you're engaging your motor memory (somatosensory cortex, motor cortex, and their link to memory) as well as your visual cortex on this material. That gives you three times as many brain areas with which to recall the information later. IT MATTERS!

When you find that you don't need to keep writing/sketching any more, then you can start doing quick reviews of an entire page at a time (one column only). Let your eyes scan down the column, and for each item you might then close your eyes and try to visualize your sketch (or the terms), and perhaps even explain it aloud (or in your head) in words. If you can't remember everything, flip the paper over for a quick check. One great advantage of this technique is that it is very easy to carry a few sheets of sketch-links with you, and most people can take advantage of even a few minutes in a noisy classroom before a class begins to go through a few items or even an entire page. (And very few people can concentrate enough to do much of this with a textbook or written notes)

In most classes, you should be able to get all of the essential material for an entire lecture on the top 1/2 of one sheet. Truly. Force yourself to keep to a limit like that, because that will force you to identify the most important material as your first step. You can always go back and add more material & sketches, or reread more of the text and notes once you feel that you've mastered the essentials. In most classes, of course, you'll need to combine several study methods. Folded lists are great for the most essential material.

(II) This method does a bunch of good things for you:

1. It makes you go through the large amount of material and select out the things that are important. (The more you do this, the better you'll get at assessing how important particular elements of any topic are for your understanding of an entire topic.)
2. It makes you think through long (often long-winded) explanations or diagrams and pull out only the essentials. That's important. It reduces extremely large, complex tasks down to a manageable level. It ensures that you focus on the important stuff first, and that you don't waste time memorizing details for bigger concepts that you don't yet know or understand, and that you don't waste time memorizing details that aren't important or necessary.
3. It makes you learn things as sequential events. While this may not be good for **all** areas of knowledge, it is almost always good in biology and chemistry--chemical and biological things happen in a sequence over time, so it's good to learn them that way. When you make a sketch or write out a list, that can only happen as a sequence (you can't write or draw two things at once, you have to do them in sequence). If your sketch or lists follow the same sequence as the real

event, then not only do you learn it that way, but as you redraw your sketch, you're also thinking through the procedure in order.

4. It sets up any learning task (such as preparing for an exam) with a set of specific simple tasks that you can go through on a schedule, and for which you know how much you've accomplished at any given time. (In contrast, if you're just reading and rereading your notes and the book, it is very hard to **know** how much you've learned and how much you still need to learn.) With this method, you can schedule a day by which you want to have lists made, another by which you will have redrawn them all by memory twice, and so on. Also, you can set a goal for yourself for each study session: for example, tell yourself, "When I can accurately do 90% of the items on three full pages, then I know I've learned as much as I need today, and so I can quit and go do something fun." You may find that you are less likely to put off studying when there's a clear objective and a reward at the end of the task. (It works for me, and I'm a serious procrastinator….)

5. It engages your mind more actively than most other methods. Reading and rereading the same material over and over is **extremely boring** to most people. That makes it hard to focus on and think through (even when you're wide awake). Consider the number of times you've read through a page, reached the end, and then thought to yourself, "I have no idea what I just read!" When that happens, your time is wasted (you would have been better off taking a nap). With a sketch-link, because your mind and hands are more engaged, this happens much less often.

6. It allows you to review material surprisingly **fast**, even in distracting conditions. Some of you may think that this method isn't very different from using flashcards, but it truly is. Flash cards, once you've made them, are just another read & reread tool. Also, flash cards are actually slower than this method (I know this: I've held races in which students competed against their own times for the same material with flash cards and their folded sketch links). Once you get to the stage of knowing much of the material and just needing to review, flash cards still require that you move physically through a stack of cards. With a sketch-link at the same stage, your eye just scans easily and quickly down a page, lingering at an item only when you know you need to review it. (I've timed this myself and with multiple students, and found that the sketch-link can be more than ***four*** times faster than flash cards at this stage of studying; also less boring.)

7. You can extend it to use in other study methods. For example,

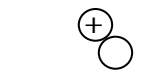
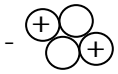
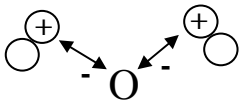
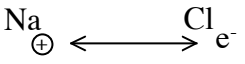
(a) when you know a concept well, try and make up your own example, explain it to yourself, and then think what you could change to make it become incorrect. (That's one way I and other teachers write exam questions, so you would be practicing a skill we want you to have, and something we're testing you over.) Go down your list, making up examples & thinking about them for each one.

(b) You can use your sketches or words as part of 'concept mapping' (a useful method developed over 20 years ago, and described many places on the web; I also have an explanation on my web site). Concept maps helps you connect ideas. How is that useful? I'll give you an example. On one exam, I had a question that described how regulatory genes might control the growth of antlers. Some of the possible multiple choice answers had to do with the control of genes for regulatory proteins. However, one choice stated that this protein could act by causing an allometric effect (and it was a true answer). For this, you needed to be able to connect your knowledge of genetics with another concept, allometry (differences in proportion of body parts caused by different rates of growth of cells), that we covered in a different context (as a concept connected with macroevolution) and in a different week of the class. A concept map could have

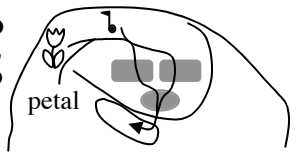
easily shown you that connection. Without a concept map you had to make that connection <u>for the first time</u> during the exam.

(V) <u>A Final Comment</u>, this method can be a little scary when you first try it. It is new, and you have to learn new things that take time and are frustrating at first because you don't yet know what you're doing. In contrast, the same old method of reading the book (or your notes) over and over is very reassuring, because you know that won't miss anything. However, learning only by reading and rereading the ever-larger amounts of material we teachers (and ultimately your bosses) give you just won't keep working. The learning tasks you face keep getting harder and harder, and the problem solving keeps getting more and more complex. A potentially better and faster method should be important to you. It helps to start with focus on a manageable few important concepts, and then build them together to create more and more complete and complex interconnected ideas. This is what experts do in any field in the process of 'chunking' their knowledge. With time and practice you should get better and better at applying the method, and also better at knowing when you truly need it. It's scary to try something new, especially since new things do not work perfectly the first time. As with anything in learning, practice makes you better, and much practice makes you an expert.

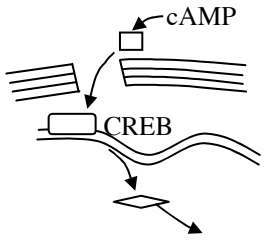
********** More sample folded lists:

Text Column	**Minute Sketch Column**
Element proton neutron electron	
Ion (+1)	
Sharing electrons covalent bond H_2O	
Not sharing electrons ionic bond	

(a) Declarative memory
Visual / Audit. cortex
Perirhinal &
Parahippocampal cort.
Entorhinal cortex
Hippocampus



(b) Molecules of Memory
cyclic AMP
Nuclear membrane
CREB Protein
DNA regulation
New protein
Stronger synapse
New/Stronger Memory



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