

Teacher Guide: Mapping Gene Therapy Concepts

ACTIVITY OVERVIEW

Abstract:

These activities present ways to use concept maps to assist students in organizing their knowledge about gene therapy.

- Activity 1: Teaching Concept Mapping
This activity provides an introduction to concept mapping, engaging students in thinking about and implementing the process.
- Activity 2: Concept Maps on Gene Therapy
This activity can be used at the beginning and end of the *Gene Therapy: Molecular Bandage?* module to assess students' understanding of the topic. Word lists are provided for beginning, intermediate and advanced levels.

Module:
Gene Therapy: Molecular Bandage?

Key Concepts:
Concept mapping

Prior Knowledge Needed:

General knowledge of organizational methods

Materials:

Copies of student pages, pencils and/or pens; Optional – Inspiration® software and computers.

Appropriate For:

Ages: 12 - 20
USA grades: 7 - 14

Prep Time:

30 minutes

Class Time:

45 minutes

Activity Overview Web Address:

<http://gslc.genetics.utah.edu/teachers/tindex/overview.cfm?id=gtconceptmapping>

Other activities in the ***Gene Therapy: Molecular Bandage?*** module can be found at:

<http://gslc.genetics.utah.edu/teachers/tindex/>

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I. PEDAGOGY

A. Learning Objectives

- Students will be able to organize information using a concept map.

B. Teaching Strategies

1. Timeline

- Beginning of school year:
 - Optional: Order Inspiration® software and install it on computers.

Activity 1: Teaching Concept Mapping

- 4-8 weeks before activity:
 - Optional: Reserve a laptop computer and projector if you plan to use them to show the PowerPoint presentation for Activity 1.
 - Optional: Reserve a computer lab if students will create their concept maps using Inspiration® software.
- 1 day before activity:
 - If you are not showing the PowerPoint presentation on a computer, make overhead transparencies of the slides.
 - Optional: Make photocopies of the PowerPoint presentation for students.
 - Photocopy Student Pages S-1 and S-2.
 - Make an overhead transparency of Student Pages S-1 and S-2.
- Day of activity:
 - Discuss concept mapping and provide examples.
 - Have students create their own concept map in class or as homework.

Activity 2: Concept Maps on Gene Therapy

- 4-8 weeks before activity:
 - Optional: Reserve a computer lab if students will create their concept maps using Inspiration® software.
- 1 day before activity:
 - Make photocopies of the appropriate word lists (choose from S-3 through S-5).
 - Optional: Make overhead transparencies of the Word List you plan to use.

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- Day of activity:
 - Distribute the Student Pages and have students create a concept map on paper or using Inspiration® software.

2. Classroom Implementation

Activity 1: Teaching Concept Mapping

- As a class, discuss why it would be useful to organize facts, thoughts, ideas, etc.
- Show the PowerPoint presentation, discussing each slide.
 - Advanced students can take notes.
 - Younger students may just follow along on the printouts.
- Option 1: Give students the example concept map (page S-1) and go through it as a class.
 - Have students answer the questions on their own or with a partner.
 - Lead a class discussion of the questions.
 - Discuss why items are placed in one location and not another.
 - Remind students that sometimes things can be placed in multiple places.
- Option 2: Have students create the sample concept map using Inspiration® software.
 - Students can label the Main Idea, Large Topics and Subtopics using the program and then print out the concept map.
 - Proceed with a class discussion as in Option 1, above.
- Have students create a concept map on their own using the concept map template (page S-2) to check for comprehension.
 - This can be an in-class activity or assigned as homework.

Activity 2: Concept Maps on Gene Therapy

Use concept maps as pre- and post-tests for the *Gene Therapy: Molecular Bandage?* module to assess students' understanding of the topic. The pre-test can assist you in planning where to begin the learning activities for this module as well as assist students in identifying topics for investigation. Comparing the pre- and post-tests enables you and the students to identify how much they have learned.

- Pre-test
 - Distribute the Beginning Word List (page S-3) and instruct students to organize the words on the list into a concept map.
 - Optional: Have students create their concept map using Inspiration® software.
 - Allow students time to complete their maps without rushing them.
 - Collect the maps and file them for reference at the end of the module.

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- **Post-test**

Three word lists, Beginning, Intermediate and Advanced, are provided.

- Beginning: Covers basic concepts from the module (page S-3).
- Intermediate: Requires that students go into more detail (page S-4).
- Advanced: Requires even more details (pages S-5).

Use the word list that is appropriate for the material you have covered and/or the level of the students.

- Distribute the appropriate word list to students and ask students to organize the words on the list into a concept map.
- Optional: Have students create their concept map using Inspiration[®] software.
- Allow students time to complete their maps without rushing them.
- Return both the pre- and post-test to students.
- Have students compare the two maps, identifying what items they have learned or still need to learn.

3. Adaptations

- Have students cut apart the words/phrases in the Word Lists so they can move them around into possible groupings. Once they have decided on an organization, the slips of paper can be glued or taped to form a concept map.
- Have students generate their own word lists (either individually or as a class) instead of using the ones in the Student Pages. This can be particularly helpful at the beginning of the module as you assess students' prior knowledge about gene therapy.
- Instead of keeping the pre-test concept map until the end of the module, have students add to and reorganize it as they explore the topic of gene therapy. If they are working on paper, students might make each set of additions in a different color. If they are using Inspiration[®] software, they can print out a copy of each map they create. This progressive set of concept maps can provide you and the students with a record of changes in their understanding of gene therapy.

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II. ADDITIONAL RESOURCES

A. Activity Resources - linked from the online Activity Overview:

<http://gslc.genetics.utah.edu/teachers/tindex/overview.cfm?id=gtconceptmapping>

- Powerpoint: Building a Concept Map – Presentation to use with Activity 1.
- Website: Inspiration® software – Ordering information, a free trial copy, and other information.

III. MATERIALS

A. Detailed Materials List

Activity 1: Teaching Concept Mapping

- *Building a Concept Map* PowerPoint presentation
- *Building a Concept Map* student pages (S-1 and S-2)
- Option 1: Pens/pencils
- Option 2: Computers with Inspiration® software

Activity 2: Concept Maps on Gene Therapy

- Beginning, Intermediate or Advanced Word Lists and Concept Map Templates (S-3 through S-5)
- Option 1: Pens/pencils
- Option 2: Computers with Inspiration® software

IV. STANDARDS

A. AAAS Benchmarks for Science Literacy

Grades 6-8:

- Habits of Mind: Communication Skills - organize information in simple tables and graphs and identify relationships they reveal.

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B. Utah Core Curriculum

Intended Learning Outcomes for Seventh and Eighth Integrated Science:

Students will:

1. Use Science Process and Thinking Skills
 - c. Develop and use categories to classify subjects studied.
6. Communicate Effectively Using Science Language and Reasoning
 - f. Construct models to describe concepts and principles.

Intended Learning Outcomes for Biology (9-12):

Students will:

1. Use Science Process and Thinking Skills
 - c. Evaluate, sort, and sequence data according to given criteria

V. CREDITS

Activity created by:

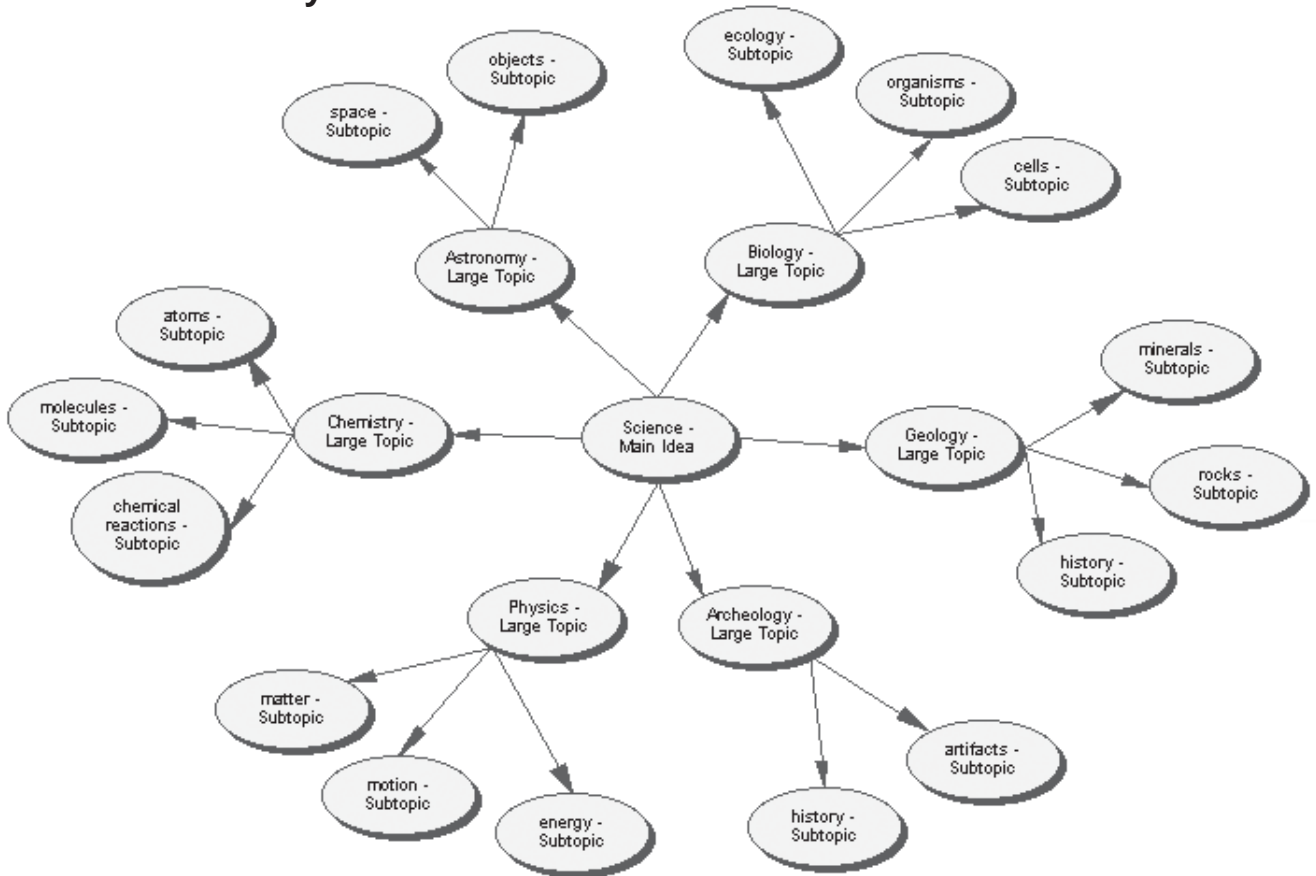
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Project funded by:

Funding for this module was provided by a Science Education Partnership Award (No. 1 R25 RR16291) from the national Center for Research Resources, a component of the National Institutes of Health.

Teacher Reference: Activity 1: Building a Concept Map

A. Answer Key



- 1. Why is Science in the center circle?** *It is the Main Idea.*
- 2. Why is history in more than one place?** *It is an important Subtopic to both Large Topics. Therefore it must be included with both.*
- 3. Do all Large Topics need to have the same number of Subtopics? Why or why not?** *No. If there is a lot of information about a Large Topic, it will need many Subtopics. If there is little information, the Large Topic will have fewer Subtopics.*
- 4. What is the minimum number of Subtopics a Large Topic should have?** *Two*
- 5. Label the following on the sample concept map above: Main Idea, Large Topics, Subtopics** *See above graphic*
- 6. Now, design a web of your own using the template on the next page.** *(S-2)*

Teacher Reference: Activity 1: Building a Concept Map

B. Answer Key-Template



- You may add more stars where you need them.
- Make sure you have at least four Large Topics.
- Make sure you have at least two Subtopics for each of these.

Accept answers for logical thinking. Score based on the following rubric:

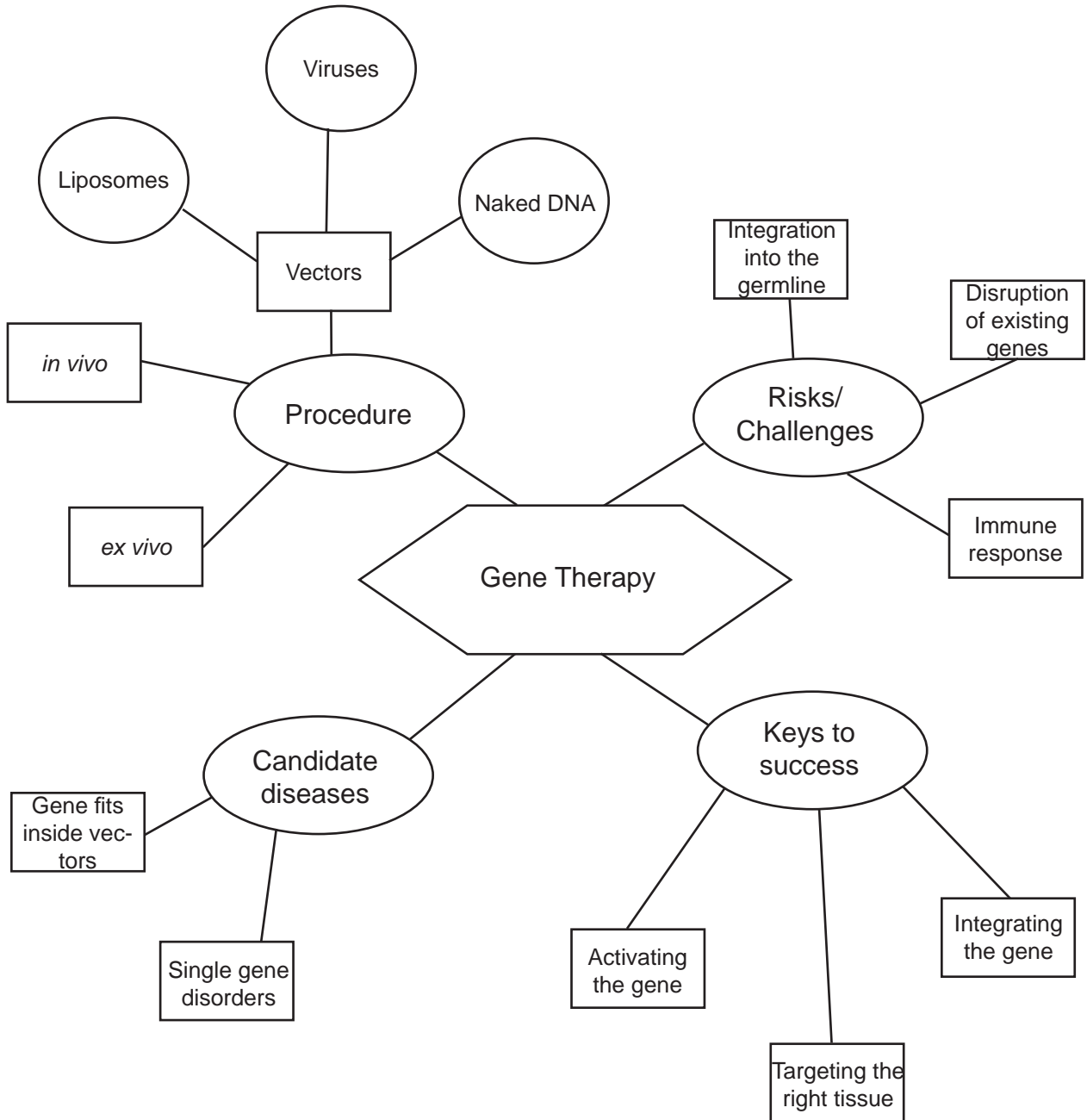
Organization-

- **Did the student place the Main Idea in the center of the Map?** 0 5
- **Did the student include at least 4 Large Topics?** 0 1 2 3 4
- 1 point for each Large Topic given
- **Did the student include at least two Subtopics for each Large Topic?**
- 1 point for each Subtopic

Total Points awarded _____/29

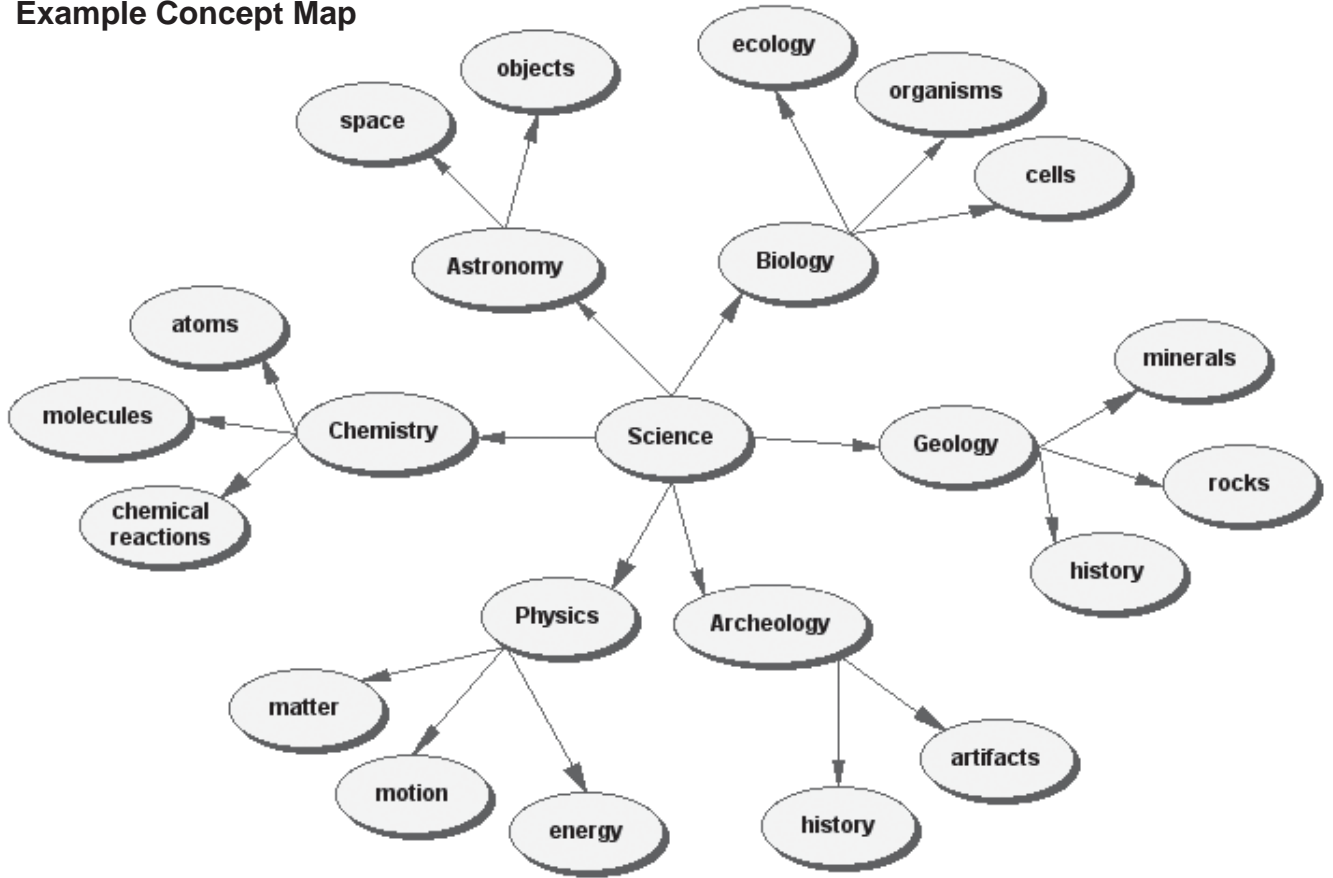
Teacher Reference: Activity 2: Mapping Gene Therapy Concepts

C. Example Concept Map- Beginning Word List



Building a Concept Map

Example Concept Map



1. Why is Science in the center circle? _____

2. Why is history in more than one place? _____

3. Do all Large Topics need to have the same number of Subtopics? Why or why not?

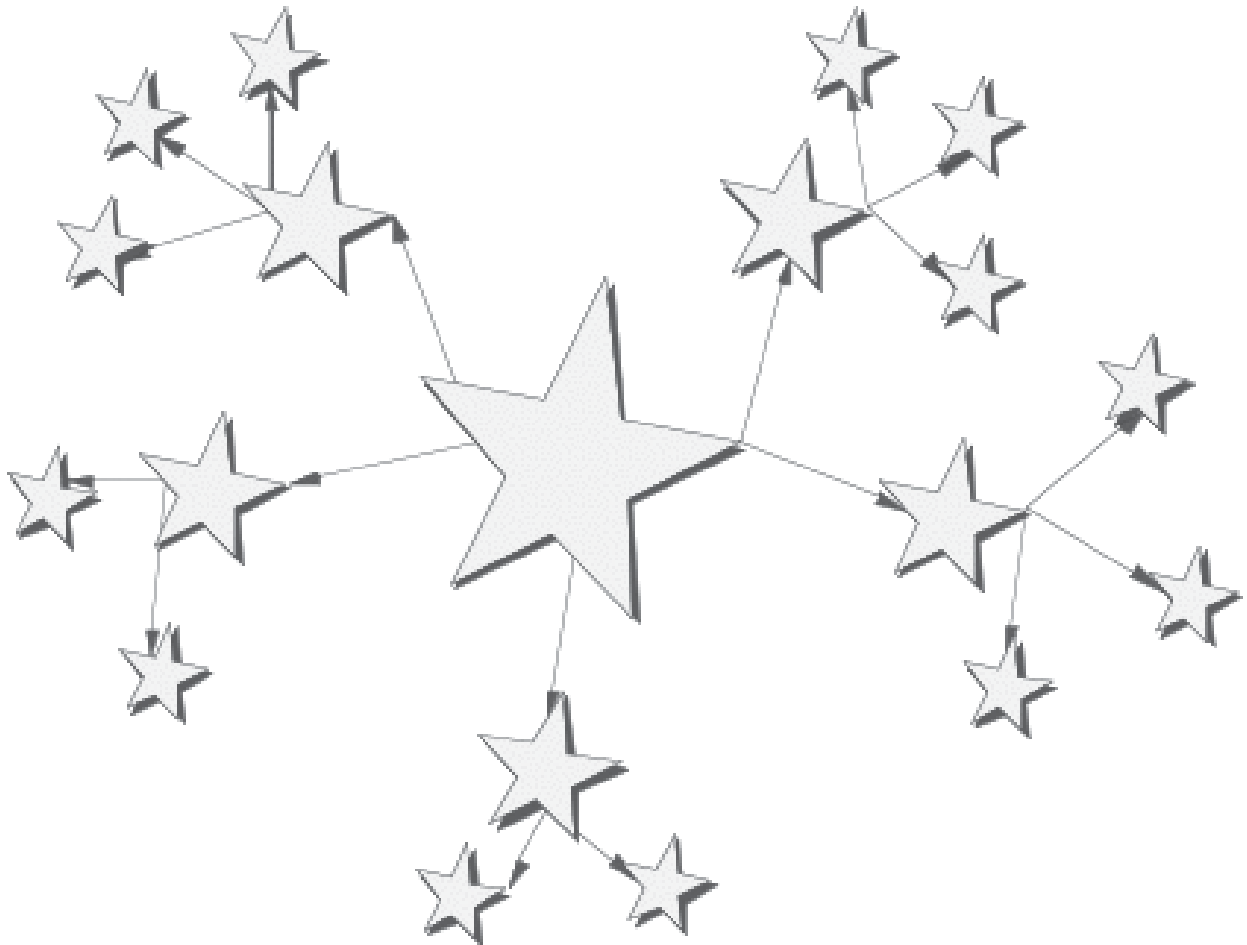
4. What is the minimum number of Subtopics a Large Topic should have? _____

5. Label the following on the sample concept map above: Main Idea, Large Topics, and Subtopics.

6. Now, design a concept map of your own using the template on the next page (S-2).

Building a Concept Map

Concept Map Template



- You may add more stars where you need them.
- Make sure you have at least four Large Topics.
- Make sure you have at least two Subtopics for each of these.

Mapping Gene Therapy Concepts

Beginning Concept Map Word List

Targeting the right tissue

Immune response

Vectors

Single gene disorders

Naked DNA

Activating the gene

Disruption of existing genes

in vivo

Integrating the gene

Fit inside vectors

Keys to success

Viruses

Candidate diseases

Liposomes

Procedure

Integration into the germline

Risks/Challenges

ex vivo

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Intermediate Concept Map Word List

Targeting the right tissue	Enhancement
Immune response	Viral ligands must match cell receptors
Vectors	Gene integrates into the middle of a functioning gene
Single gene disorders	Herpes Simplex Virus
Naked DNA	Vector injected into the body
Activating the gene	No dominant-negative mutations
Disruption of existing genes	Preventative medicine
<i>in vivo</i>	Transcription and translation must take place
Integrating the gene	The introduced gene is passed on to offspring
Fit inside vectors	Retroviruses
Keys to success	Cosmetic Purposes
Viruses	Adeno-associated viruses
Candidate diseases	Vector injected into cells removed from the body; these cells are then returned to the body
Liposomes	Adenovirus
Procedure	
Integration into the germline	
Risks/Challenges	
<i>ex vivo</i>	

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Advanced Concept Map Word List

Targeting the right tissue	Vector injected into cells removed from the body; these cells are then returned to the body
Immune response	
Vectors	Adenovirus
Single gene disorders	Gene integrates into the middle of a functioning gene
Naked DNA	Herpes Simplex Virus
Activating the gene	Vector injected into the body
Disruption of existing genes	No dominant-negative mutations
<i>in vivo</i>	Preventative medicine
Integrating the gene	Transcription and translation must take place
Fit inside vectors	
Keys to success	The introduced gene is passed on to offspring
Viruses	Retroviruses
Candidate diseases	Triple-helix forming oligonucleotides
Liposomes	Repairing mutated proteins
Procedure	New approaches
Integration into the germline	Antisense
Risks/Challenges	SMaRT
<i>ex vivo</i>	Preventing the production of mutated proteins
Enhancement	
Viral ligands must match cell receptors	Ribozymes
Cosmetic Purposes	
Adeno-associated viruses	