Life Sciences: Homeostasis
High School 9th Grade

Project READI Curriculum Module
Technical Report CM #28

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Please send us comments, questions, etc.: info.projectreadi@gmail.com

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Project READI operated as a multi-institution collaboration among the Learning Sciences Research Institute, University of Illinois at Chicago; Northern Illinois University; Northwestern University; WestEd's Strategic Literacy Initiative; and Inquirium, LLC. Project READI developed and researched interventions in collaboration with classroom teachers that were designed to improve reading comprehension through argumentation from multiple sources in literature, history, and the sciences appropriate for adolescent learners. Curriculum materials such as those in this module were developed based on enacted instruction and are intended as case examples of the READI approach to deep and meaningful disciplinary literacy and learning.

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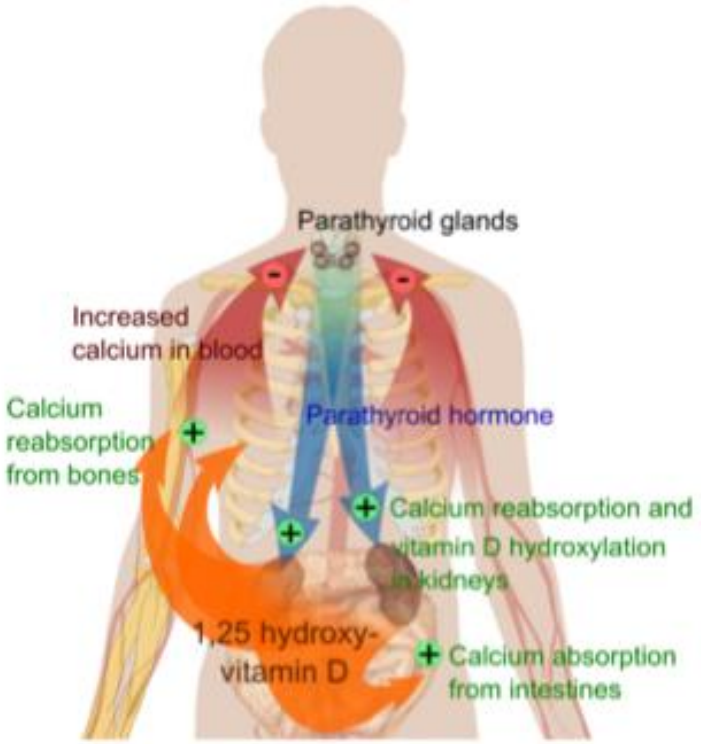
Name _____ Date _____

Teacher _____

Homeostasis Investigation, Part I



How does your body work to maintain balance?
What happens when this balance is disrupted?

The intended use of these materials is in tandem with ongoing professional development focused on supporting reading as scientific practice. This work is funded by the Reading for Understanding Initiative of the Institute for Education Sciences, U.S. Department of Education, through Grant R305F100007 to University of Illinois at Chicago. The opinions expressed are those of the authors and do not represent views of the Institute or the U.S. Department of Education.

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Hypernatremia Due to Dehydration in Dementia

Individual think-write: preview

- Take out your science reading and talking stems, then turn to the text "Hypernatremia Due to Dehydration in Dementia," page R1 in your Reader.
- Take two minutes to look over the text and respond to the prompts below.
    - What might be challenging about reading this article?
    - What might be interesting about reading this article?
    - What kind of text is this? How do you know?
    - What predictions can you make about the kind of science information it may contain?
    - What might you do to get as much out of the reading this article as possible?

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Pair discussion

- Take turns sharing your ideas for one minute each.
- Add notes about your partner's ideas onto your own response.
- **Stellar idea**: Select one response that you or your partner can share with the class. Mark it with a star.

Whole class discussion

- Share stellar ideas.
- Listen closely and respond to your classmates' ideas.
- Use science talk stems.
- Add peers' best ideas onto your own response.
- What new words can we add to our word wall?

Reading and making thinking visible

- **Talk to the text:** Individually talk to the text on "Hypernatremia due to dehydration in dementia."

Pair discussion

- Take out your science reading and talking stems.
- Talk with your table partners and take turns sharing your talk to the text comments, going paragraph by paragraph.
- Help each other work through any confusions or roadblocks you may encounter.
- Keep track of any new reading strategies you or your partner use to make sense of this text, and discuss with your partner: what could be added to our reading strategies list (RSL)?

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Generating questions about the phenomenon (partners/whole class)

- **Reading process:** What science reading processes were important for your reading? See if you can add any new ideas to your class' RSL.
- **Inquiry**: think about what you *understand* about this **86 year-old female patient** and/or **hypernatremia**, any *connections* you've made to what you already know, and write down other *questions* you have below.

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When Too Much Water Hurts a Runner

Individual think-write: preview

- Turn to Reader page R3 and take out your science reading and talking stems.
- Take two minutes to look over "When Too Much Water Hurts a Runner" and respond to the prompts below.
    - What might be challenging about reading this article?
    - What might be interesting about reading this article?
    - What kind of text is this? How do you know?
    - What predictions can you make about the kind of science information it may contain?
    - What might you do to get the most out of the reading this article as possible?

Pair share

- With your partner, preview this text and see if you can make some any *connections* between this text and the text on page R1 - R2: "Hypernatremia Due to Dehydration in Dementia."
- Use your talk stems bookmark to talk with your partner.
- Based on your preview of the text and any connections you made to the previous text, *set a purpose* for reading this article.
- Make sure you are ready to share you and your partner's ideas to the class!

Whole class discussion

- Share the ideas you and your partner came up with when you previewed the texts.
- Listen closely and respond to your classmates' ideas.
- Use science talk stems.

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Reading and making thinking visible (individual and partner)

Use your reading strategies bookmark and do a close reading of this text.
While you read, talk to the text to document your thinking and reading processes in the margins. Pay special attention to the connections you make and to the questions that the texts make you think about as you read.

Pair discussion

After reading, respond to the prompts below and discuss with your partner:

- **Sense-making:** Work together to make sense of the text.
- **Reading process:** What science reading processes were important for your reading?
- **Inquiry:** What are you noticing or wondering now about **hyponatremia**? What new understandings or connections are you forming? What is interesting? What is important? Write down those ideas in the space below.
- **Stellar ideas:** Select one reading process AND one idea or question about hyponatremia that you or your partner can share with the class. Mark each with a star.

Whole class discussion

Share stellar ideas about **reading process**

- What did you notice about your partner's (or your own) reading processes with this text?
- What reading challenges did you or your partner encounter and how did you respond to the reading challenge?
- What additions or revisions can we make on the reading strategies list poster?

Share stellar ideas about **hyponatremia**.

- What questions, connections, or ah-ha's do you have from your reading?
- What new words can we add to our word wall?

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Too much or too little… what's going on inside the body?

Phenomena are events or processes that occur in the world that can be explained by science. One of the ways that scientists do the important work of investigating and explaining phenomena is by gathering information from texts of all types, including written and visual text.

Hyper- and hyponatremia are the phenomena you are investigating. You and your classmates' have just read about two individuals experiencing some extreme conditions. Next you will work with your partner or tablemates and think about the similarities and differences in what's going on inside the body of someone who is *hyper* vs. *hypo*natremic.

Teacher model

- Listen and make notes below about the teacher's reading process. Pay particular attention to *how* the teacher identifies similarities and differences.

	Hypernatremic dementia patient	Hyponatremic marathon runner
Differences		
Similarities		

Whole class discussion

- What did you notice about how your teacher identified differences and similarities?

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Pairs/small groups

Work with your partner or tablemates and think about the similarities and differences in what's going on inside the body of someone who is *hyper* vs. *hypo*natremic.

- Put a star by ideas that are supported by the texts you've read. Put a question mark by the ideas that you may need to do more research to be sure about.
- Chose a similarity or a difference to share with the class.

	Hypernatremia dementia patient	Hyponatremic marathon runner
Differences		
Similarities		

Whole class discussion

- Share a similarity or difference and the reading strategies you used to identify it.
- What additions or revisions can we make on the reading strategies list poster?
- Add your peers' ideas to your own chart.

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Building our inquiry questions (IQs)

Scientists looking to understand puzzling phenomena don't find every answer using their lab equipment. They also do a lot of reading to help them identify the interesting questions that they want to pursue and investigate. Think about the questions you and your classmates have generated by reading.

Individual brainstorming

Based on your close reading of the two texts in this module and based on what you know, what questions do you have about **water**, **sodium**, and the **human body**? Jot them down in the space below:

Think-pair-share

- Share the inquiry questions you generated from these two texts. Which ones rise to the top as the most important? Why do you think these are the most important? How might these questions impact how you read? Circle the questions you would like to share with your classmates and be ready to share why you think this question is important.

Whole class discussion

- Share one of the questions you and your partner discussed.
- Use your science talk stems to contribute and listen and build on your classmate's ideas.
- Work together to create an inquiry question poster based on you and your classmates' questions about water, sodium, and the human body.

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Hyponatremia: what's going on inside the body?

Reading and making thinking visible

- Take out your science reading and talking bookmark and turn to Reader page R5.
- Read "Hyponatremia: what's going on inside the body?" and annotate the text, showing your reading and thinking process in the margins.

Pair share

After reading, respond to the prompts and discuss with your partner:

- **Sense-making**: Work together to make sense of the text.
- **Reading process**: What did you notice about your own reading and thinking process?
- **Inquiry:** What do you notice about the patient with and without hyponatremia?
- **Cross-text connections:** What connections can you make between "Hypernatremia due to Dehydration in Dementia, " "When Too Much Water Hurts a Runner" and the postered ideas you have generated as a class?

Whole class discussion

Ideas about **reading process**

- What did you notice about your partner's (or your own) reading processes with this text?
- What reading challenges did you or your partner encounter and how did you respond to the reading challenge?
- What additions or revisions can we make on the reading strategies list poster?

Share about **hypernatremia** and **hyponatremia**

- What new understandings about hyponatremia have you built? What new connections have you made? What new questions do you have?
- What new words can we add to our word wall?

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Reading and modifying scientific models (partner and whole class)

- Look back at the model criteria poster you built together as a class.
- Discuss with your partner and class:
    - **Criteria:** What are science models? What makes a good science model?
    - **Purpose:** Why do you think the authors created this model? What it is a model of? How do you know?
- **Extending the model:** Based on your thinking and reading, work with your partners to draw a model in the blank space on R5 of what might be happening inside a patient who has **hypernatremia,** like the dementia patient you read about in "Hypernatremia Due to Dehydration."
- Share your model with the class: Why did you choose to draw the model the way you did? What text-based information did you use to construct your model?
- Discuss this question with your class: **How would you describe differences in what's going on inside the bodies of someone with hypernatremia and hyponatremia?**

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Evidence and interpretation notetakers

One of the ways to keep track of the important ideas that we get from reading is through evidence and interpretation (E/I) charts. Although many ideas can be important or interesting, they may not all be considered evidence that relates to our inquiry questions about homeostasis.

Individual

Read the three words/concepts below and respond to the prompts.

- What do you know, think, or remember about each word?
- Describe a real life experience when you used information, evidence, and interpretations.

Information	Evidence	Interpretation

Pairs/table group

Take turns sharing your notes about the three words and your real life experience related to these three words. Discuss the similarities and differences.

Whole class discussion

- Share the ideas that you, your partner, and table group came up with about the difference between evidence, information, and interpretations.
- Look at the poster or list of inquiry questions you have been building about hypo and hypernatremia. Discuss this question with your class: **What kind of evidence might you look for to help you answer those questions?**
- Turn to your evidence and interpretation charts. Write down your ideas for what counts as evidence and interpretations in the top row of the table.

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Evidence and interpretation notetakers

Teacher model

- Listen and make notes in your own E/I notetaker as the teacher models the process of identifying evidence, making interpretations, and asking new questions.

Whole class discussion

- What did you notice about your teacher's thought processes as he/she identified evidence and formed interpretations?

Pair-think-write

- Turn to R1 - R5 in your reader and take out your science reading and talking stems.
- With your partner, identify one or more pieces of evidence from the articles and record these in your E/I notetaker.
- As you identify and record each piece of **evidence**, think about the **interpretations** you can make from them. For example, what does each piece of evidence tell you about hyponatremia, hypernatremia, or homeostasis?
- For each piece of evidence and interpretation, write down additional **questions** you now have in the last column of your E/I chart.
- Repeat these steps to find additional evidence, interpretations, and questions about hyponatremia, hypernatremia, or homeostasis.
- **Stellar idea**: Select one response that you or your partner can share with the class. Mark it with a star.

Whole class discussion

- Share your evidence, interpretations, and questions with the class.
- Discuss the following questions:
  - How do you know the evidence is important?
  - What are some inferences you might draw? Could you draw different inferences from the same piece of evidence?
  - How might the evidence, interpretation, or questions help you build an explanation that answers our inquiry questions?

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Homeostasis

Setting a purpose for reading (individual)

- Turn to page R6 – R7 ("Homeostasis") in your reader and take out your science reading and talking stems.
- Turn to the inquiry questions you and your classmates generated together. These may be located in your E/I notetaker, on your classroom inquiry questions poster, or recorded on page 8.
- Using these inquiry questions, set your purpose for reading this text.

Whole class discussion

- Share your purpose for reading with your classmates.
- Use your science talking stems to listen and respond to other's ideas.
- Discuss this with your class: How did you identify your purpose for reading? How does setting purposes for reading affect your reading process?

Reading and making thinking visible

- **Think aloud:** Partners take turns thinking aloud by paragraph for the first section. One partner thinks aloud while the other partner makes notes in the margin of the text about their partner's thoughts. Help each other make sense of the text.

OR

- **Talk to the text:** Individually talk to the text on the first section. Pairs take turns sharing their talk to the text annotations. Help each other make sense of the text.
- Use the science reading stems to help you share your reading process.

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Pair discussion

After reading, discuss and respond to the prompts.

- **Words:** What new words or word-uses did you encounter? How did you make sense of their meaning?
- **Confusions or clarifications**: What parts of the text (visual or written) were unclear? Where do you have questions? Work together to clarify confusing parts of the text and to answer questions that you have.
- **Reading process:** What other science reading processes were important for your reading?
- **Inquiry:** What are you noticing or wondering now about homeostasis, hypernatremia, or hyponatremia, during or after reading?

Whole class discussion

Ideas about reading process

- What did you notice about your partner's (or your own) reading processes with this text?
- What reading challenges did you or your partner encounter and how did you respond to the reading challenge?
- What additions or revisions can we make on the reading strategies list poster?

Share about homeostasis.

- What new understandings about homeostasis have you built? What new connections have you made? What new questions do you have?
- What new words can we add to our word wall?

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Looking for evidence and making interpretations to address our IQs

- Take out to your E/I notetaker. Look through this text and identify a single piece evidence you want to add to your notetaker and the interpretations and questions you have about that evidence.
- Share this idea with your partner and get feedback on your idea. How does it address your IQs? Switch roles and have your partner share their evidence.
- Return to your classroom IQs. Were you able to answer any of these questions with text-based evidence? Record answers to your inquiry questions on a new classroom poster.

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What's in our blood?

Previewing and setting purposes for reading (individual and partners)

- Take out and use the following set of tools to generate a goal for reading "What's in our blood?" (R8).
    - Science reading and talking book mark
    - E/I notetaker
    - The list of inquiry questions generated by your class
    - The prior texts in this module (R1 - R7)
- Take a minute to preview "What's in our blood?"

Pair share

- Discuss with your partner: What have you already figured out about hypo/hypernatremia, sodium, water, and the human body? What do else do you need to figure out? How might this text give you some of the information you still need?
- Establish your goal for reading, based on your analysis of what else you need to find out and what this text might offer. Write your goal below.

Reading and making thinking visible

- Individually talk to the text on each section of "What's in our blood?"
- Use your science reading stems to help you make your thinking visible by writing annotations in the margins.
- **Stellar ideas:** Select a new word, a confusion or clarification, or a reading process AND one idea or question about homeostasis, hypernatremia or hyponatremia that you can share with the class. Mark them on your text with a star.

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What's in our blood? continued

Think-pair-share:

- **Reading process:** Talk with your partner about your reading process:
    - What strategies helped you make sense of the text?
    - Did you read the diagram or written text on this page first? Why?
    - Were you able to make connections between the written text and the diagram? How did those connections help you read?
    - Did you make any connections to you already know or other texts we have read in this module?
- **About your stellar idea:** Share your stellar idea with your partner. Use your science talk stems to add, clarify, and respond to your partner's ideas.
- **Identifying evidence and making interpretations:**
    - Turn to your E/I notetaker. Identify new pieces of evidence, interpretation, or questions that arose from reading this text.

Whole class discussion:

- **Reading process:** What reading strategies helped you or your partner make sense of the text?
- **Stellar ideas:** Share stellar idea you or your partner came up with by reading.
- **Answers to our IQs:** Return to the list of inquiry questions (IQs) you and your classmates generated. As a class, see if you now have answers to some of those questions. Document these on the "Answers to our inquiry questions" poster in your class.

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Salt: A World History

Setting a purpose for reading

Look through the set of inquiry questions that you and your classmates have generated. Talk with one another, using your science reading and talking stems and the following prompts to get you started:

- What have we figured out about hyponatremia, hypernatremia, and homeostasis?
- What else do we need to find out?

Reading and making thinking visible

- Turn to "Salt: A World History" (R9).
- **Think aloud:** Partners take turns thinking aloud by paragraph for the first section. One partner thinks aloud while the other partner makes notes in the margin of the text about their partner's thoughts. Help each other make sense of the text.

OR

- **Talk to the text:** Individually talk to the text on the first section. Pairs take turns sharing their talk to the text comments. Help each other make sense of the text.
- Use the science reading stems to help you share your reading process.

Developing the "big idea" through reading

- As you share your reading and thinking processes with your partner, see if you can identify the big idea of this text.

Identify evidence, make interpretations and generate more questions

- Take out your E/I notetaker
- Review the notes you made on "Salt: a World History" and add a star to ideas that might go in your E/I notetaker.
- Share with your partner:
    - Why did you choose to star that idea?
    - How do you think it will help us understanding homeostasis, hypernatremia, or hyponatremia?
- After sharing and talking with your partner, work together to identify important pieces of evidence, interpretations, and question and record these in your E/I notetaker.

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Regulation of water by vasopressin

Preview

- Turn to "Regulation of water by vasopressin" on R12. Preview the text on your own or with a partner and then discuss the following questions:
    - How is this text *similar* or *different* than the other texts we've read up to this point?
    - What connections can you make to what we have discussed so far?
    - What do you think will make this text difficult or easy to read?

Reading and making thinking visible

- Use your science reading stems to read and annotate this text, using the following questions as a guide:
    - **Reading process:** What other science reading processes were important for your reading?
    - **Confusions or clarifications:** What was *confusing*, *interesting*, or *helpful* about this model?
    - **Cross-text connections:** What kinds of connections you can make to the previous texts?
    - **Inquiry:** How does this model help you understand how the body regulates sodium concentrations in blood? What new pieces of evidence can you identify in this text that will help answer the inquiry questions your class came up with?

Whole class discussion:

- What is this a science model of? What does it help explain? What does it *not* explain?
- How might you change this model to account for hyponatremic or hypernatremic patients? What might need to be added, removed, or modified?
- Support your ideas with text-based evidence from all the texts you have read so far in this module.

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Vaptans for the treatment of hyponatremia

You and your classmates have read a model for how sodium concentrations are regulated in the human body. As learners of science, one way we can assess our own understanding of something is when we try to apply what we know to something new.

Reading and making thinking visible

- Turn to page R13, "Vaptans for the treatment of hyponatremia" in your reader.
- Use your reading and talking stems to think aloud and talk to the text on your own or with a partner.
- Share your inquiry questions, connections, and reading roadblocks as you read. Try to see if you can help one another make sense of the text.

Making connections and using our models to explain phenomena

- After you read, if you haven't already, look back at "Regulation of water by vasopressin" and see if making connections between these two texts helps you understand how vaptans work to treat hyponatremia.
- Use the space below to jot down your ideas about vaptans, the kidney, vasopressin, and the sodium concentration in the blood.

Identify evidence and interpretations

- Turn to your E/I chart and record important pieces of evidence, interpretations, and questions that help you answer your inquiry questions from the last two texts ("Regulation of water by vasopressin" and "Vaptans for the treatment of hyponatremia").

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Putting it together: How does the body regulate sodium concentrations?

Think-pair-share:

- Take out your reader and E/I notetaker and look over the questions you and your classmates generated at the beginning of class.
- Spend some time thinking on your own about the questions you are able to answer, and then share your ideas with your partner. Be ready to share your ideas with your class!

Drawing on all that you now know, how would you explain **how the body regulates sodium concentrations and what happens when this balance is disrupted**? Use the space below to write down how you would explain these ideas to another student who was not a part of our class.

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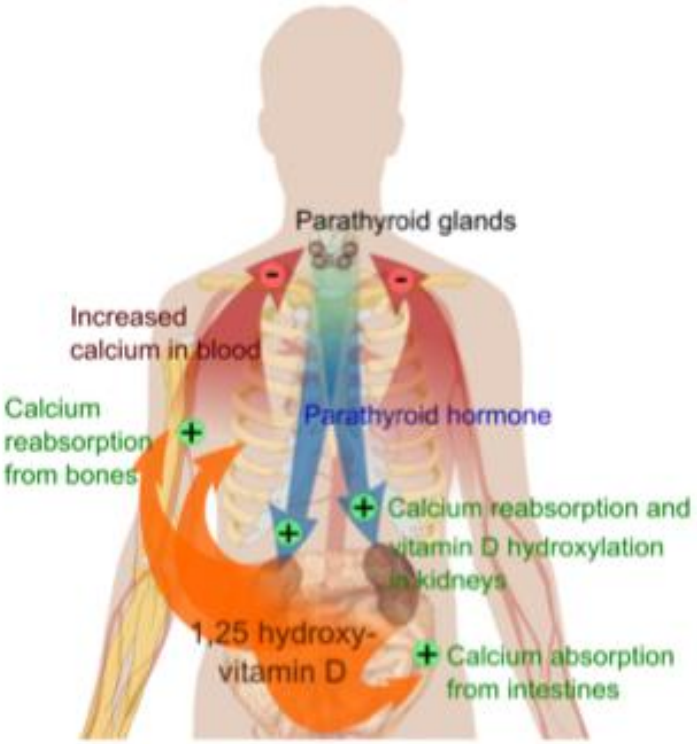
Name _____ Date _____

Teacher _____

Homeostasis Investigation, Part II



How does your body work to maintain balance?
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What can different types of text tell me?

Think-pair-share (individual and pairs)

- Individually turn to your Reader pages R14 - R17 and preview these three texts. What do you notice? Why might each be valuable to read? Jot a few notes about each.

- Discuss this question with a partner: Why might it be important to read texts from multiple sources?
- Then, work with your partner to record what you notice about these texts, and why it might be important to read each, in the table below.

Text	What you notice about this text
"Type 2 diabetes in the United States" *Los Angeles Times* R14	
"Kim's Story" *Diabetes in Education in Tribal Schools* R15-16	
"The Young Epidemic: The Rise in Type 2 Diabetes Among Children" *Good* R17	

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Developing inquiry questions from text

Turn to "Type 2 Diabetes in the United States," page R14.

Reading and making thinking visible

- **Think aloud:** Partners take turns thinking aloud by paragraph for the first section. One partner thinks aloud while the other partner makes notes in the margin of the text about their partner's thoughts. Help each other make sense of the text.

OR

- **Talk to the text:** Individually talk to the text on the first section. Pairs take turns sharing their talk to the text comments. Help each other make sense of the text.
- Use the science reading stems to help you share your reading process.

Pair discussion

After reading, discuss and respond to the prompts.

- **Words:** What new words or word-uses did you encounter? How did you make sense of their meaning?
- **Confusions or clarifications**: What parts of the text were unclear? Where do you have questions? Work together to clarify confusing parts of the text and to answer questions that you have.
- **Reading process:** What other science reading processes were important for your reading?
- **Inquiry:** What are you noticing or wondering now about type 2 diabetes, blood glucose regulation or homeostasis? What is interesting? What is important?
- **Stellar ideas:** Select a new word, a confusion or clarification, or a reading process AND one idea or question about type 2 diabetes, blood glucose regulation or homeostasis that you or your partner can share with the class. Mark them on your text with a star.

Whole class discussion

- Share a new word, confusion or clarification, or a reading process.
- Which reading strategies helped make sense of the text?
- What additions or revisions can we make on the reading strategies list poster?
- Share new ideas about type 2 diabetes, blood glucose regulation and homeostasis.
- Add ideas and questions to the evidence interpretation posters for type 2 diabetes, blood glucose regulation and homeostasis.
- What new words can we add to our word wall?

Repeat above steps for "Kim's story" and "The Young Epidemic."

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Developing inquiry questions from text, continued

Generating inquiry questions from text

- Look back at the stellar ideas you or your partners came up with for each text, use these to come up with inquiry questions about diabetes, blood glucose levels, or homeostasis.
- As you talk with your partner, record your inquiry questions in the space below, keeping track of which texts sparked which inquiry questions.

Our inquiry questions	Source text

Whole class discussion

Looking for evidence and making interpretations:

- Turn to your evidence and interpretation notetaker
- Decide as a class: what evidence will you look for in future texts to help you answer these questions? Make notes on your E/I notetaker to focus your work with new texts.
- Return to the three texts on page R14 - R17, identifying important pieces of evidence, interpretations, and questions in your E/I notetaker.

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How does the body regulate glucose?

Teacher model

- Locate your science reading stems.
- Locate "How does the body regulate glucose?" (R18 - R19).
- Listen and write down your teacher's annotations as he/she does the modeling.

Whole class discussion

- What did you notice about how your teacher read the science text?
- What are some science reading processes that you noticed?
- Which were new or particularly useful for this text?
- What additions or revisions can we make on the reading strategies list poster?

Reading and making thinking visible

- Try out some of the reading strategies yourself on a paragraph or two using the "Modeling" section of your science reading stems and the questions below:
    - How does _____ work?
    - Does _____lead to _____?
    - What steps cause the glucose concentration to increase or decrease?
- Check in with your partner or table group members to see how others are modeling in the margins. See if you can learn new ways to read and think from your classmates.

Model building

Think-pair-share

- Before you begin, think about the following questions and then share your ideas with your partner:
    - What is a science model?
    - What is the purpose of a science model?
    - What should our science model include or be able to explain?
    - What important ideas from your E/I notetakers might you want to include?
- Decide which of these ideas is a stellar idea. Be ready to share this with your class.

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Teacher model (modeling)

- Take out your science reading stems and turn to "How does the body regulate glucose?" (R18 - R19).
- Listen and write down your teacher's first modeling steps as he/she does the models for the class.

Whole class discussion

- Use your science talk stems to listen and respond to other's ideas during the discussion.
- What did you notice as your teacher was demonstrating how he/she models her ideas, based on the reading?
- What steps were helpful?

Individual/partner modeling

- Locate the annotations you used to make your reading and thinking visible on the text "How does the body regulate glucose" R18 - R19
- Work with your partner to discuss the following prompts:
    - Share some of the annotations you made on this text.
    - How do these annotations help you think about what should go in the model?
    - Using your annotations as the starting point, draw a model that explains **how the body keeps blood glucose concentrations in balance** on the next page.

Use the space on the next page to sketch out a model, keeping in mind that models help us *explain*, *understand*, and *make predictions* about science phenomena.

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Our model of how the body keeps blood glucose concentrations in balance:

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Sharing and critiquing science models

Norms for sharing and critiquing models

Discuss the norms you will use as a class for sharing and critiquing models, using the following prompts:

- What is the purpose of sharing our work in class?
- How might our models benefit from being shared and critiqued?
- What criteria should we use for commenting on one another's work?

Sharing and critiquing science models

- Take out your science talk stems bookmark and identify the talk stems that you think will be most helpful for this discussion.
- Listen carefully to other groups as they present their work.
- Use talk stems to help provide feedback to other group members.
- Your teacher may wish to have a couple students share their models. Use the same norms and talk stems to provide feedback to your peers' models.

Keeping track of what we know (and don't know!)

- Re-group with your tablemates and discuss the following questions:
    - How will you respond to the feedback you received?
    - What did you see or hear from other groups' models that you liked?
    - How will you modify your model, based on the classroom discussion?
- Use different colored sticky notes provided by your teacher to label parts of your models that you…
    - Are very confident about and want to keep.
    - Would like to add to your model.
    - Still have questions about.

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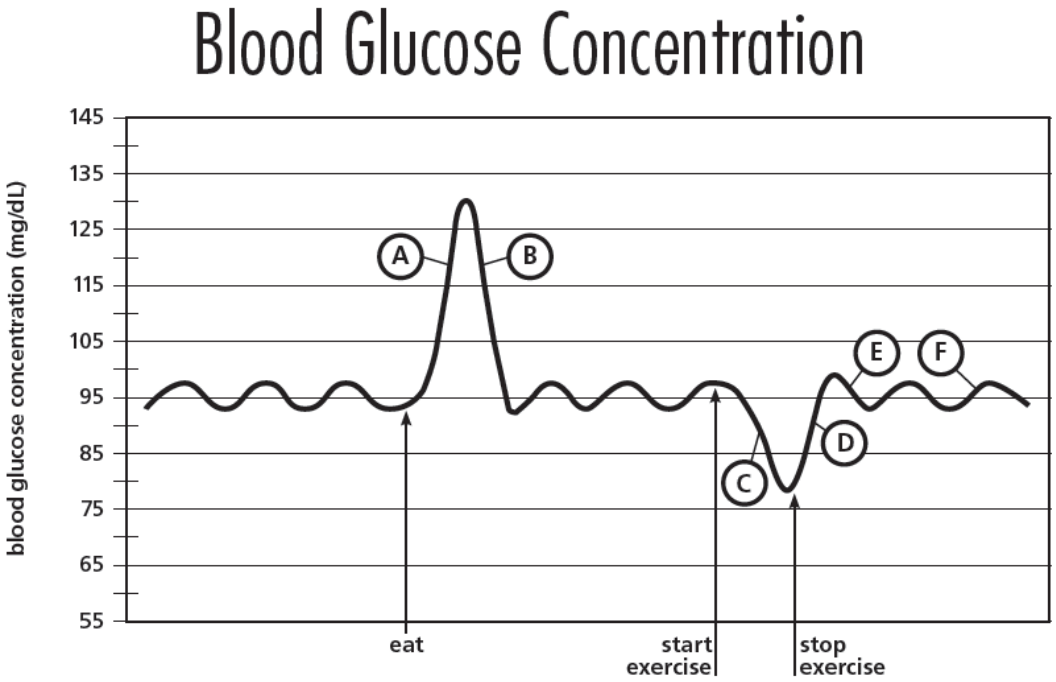
Keeping track of changes in blood glucose concentration

Preview

- Preview the model below individually and then talk with your partner about what you notice, find interesting or confusing.

Making your thinking visible and making cross-text connections

- Take out your science reading and thinking talk stems bookmark.
- Read the following diagram closely and annotate it. Look to make connections to the texts that we have read so far and to what you know about diabetes and homeostasis.



Graph obtained from Diabetes Education in Tribal Schools "Health Is Life Balance" curriculum.

On the following page, use your reading and thinking to determine what is happening to the person's blood concentration at points A-F.

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Point	Is blood glucose concentration increasing or decreasing?	What *causes* the change in blood glucose concentration?* *How do you know?*
A		
B		
C		
D		
E		
F		

* Use the model you built on page 27 to help you think about what causes these changes.

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Revising our model

Testing our models (partners and whole class)

Reflect on using your model: As you described what was happening to the blood glucose levels at points A-F and why those changes might be happening in a person's body, think about how you used your model to help you answer those questions.

- Reflect with your tablemates or your class: was your model a helpful tool for you?
- Did it help you *describe*, *explain*, or *make predictions* about what is going on inside the body?

Extending our model: Talk about this question with your partners:

- Could the same graph, "Blood Glucose Concentration," on page 29 be used to describe the blood glucose concentration for someone with diabetes? Why or why not?
    - Use your science talk stems to help add, clarify, and listen to one another.
    - How would this model look the same or different for someone with diabetes?
- After both partners share their ideas, come up with a consensus idea to share with your classmates.

Whole class discussion

- Use your science talk stems to listen, share, and add to your classmates' ideas.

Keeping track of our evidence and interpretation (E/I)

- Take out your E/I notetakers.
- Record any new pieces of evidence, interpretation, or questions you may have after reading, talking, and listening with your classmates

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Khan Academy video: glucose insulin and diabetes

Think-pair-share

- Have you thought about videos as a kind of *text*? Talk with your partners using the following questions:
    - How are videos the same or different than other kinds of text?
    - What might they have in common?
    - Why might someone use a video or online simulation instead of a written text to communicate their ideas?
- As you may already know, diabetes exists in two forms: Type 1 and Type 2.
    - What do you think it the difference between the two types?
    - What would you want to know about these two forms of diabetes?
- Record you and your partner's ideas below.
- **Stellar idea**: put a star next to one of the ideas that you'd like to share with your class.

Making reading and thinking visible:

- Take out your E/I notetaker.
- As your teacher plays the video, jot down what you notice as important ideas that help you better understand homeostasis, diabetes, or blood glucose.

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When cell communication goes wrong

Reading and making thinking visible

- **Think aloud:** Partners take turns thinking aloud by paragraph for the first section. One partner thinks aloud while the other partner makes notes in the margin of the text about their partner's thoughts. Help each other make sense of the text.

OR

- **Talk to the text:** Individually talk to the text on the first section. Pairs take turns sharing their talk to the text comments. Help each other make sense of the text.
- Use the science reading stems to help you share your reading process.

Pair discussion

After reading, discuss and respond to the prompts.

- **Words:** What new words or word-uses did you encounter? How did you make sense of their meaning?
- **Confusions or clarifications:** What parts of the text were unclear? Where do you have questions? Work together to clarify confusing parts of the text and to answer questions that you have.
- **Reading process:** What other science reading processes were important for your reading?
- **Inquiry:** What are you noticing or wondering now about type 2 diabetes or homeostasis? What is interesting? What is important?
- **Stellar ideas:** Select a new word, a confusion or clarification, or a reading process AND one idea or question about type 2 diabetes, blood glucose regulation or homeostasis that you or your partner can share with the class. Mark them on your text with a star.
- **Re-reading:** If your class has already read this text, think about the following:
    - What new insights, or questions do you have reading this for the second time?
    - What connections can you make between this text and your classroom conversations about *homeostasis* and *diabetes*?

Whole class discussion

- Share a new word, confusion or clarification, or a reading process.
- Which reading strategies helped make sense of the text?
- What additions or revisions can we make on the reading strategies list poster?
- Share new ideas about diabetes, homeostasis, or blood glucose regulation.
- Add new evidence, interpretations, and questions to your E/I notetaker.

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Revising models based on new evidence

The last time you reflected on your own models, you identified parts of the model that you wanted **keep**, parts of the model that you had **questions** about, and new things that you wanted to **add** to your model. Let's return to your previous model and see if we can revise it based on the new evidence we've gathered through our reading.

Model revision

Individual-think-write

Take out your Reader and E/I notetaker, your previous model on page 27 and your inquiry questions on page 24.

- Discuss with your tablemates and peers: how would you like to revise your model? The following questions may help get your discussion going:
- What questions did you have about that model that you can now answer?
- What new ideas would you like to incorporate into your model? What evidence supports your idea?
- How will you incorporate these new ideas to your model?
    - What new components need to be added?
    - What relationships between them need to be represented?
    - What kinds of visuals might help?

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Pair discussion

- Take turns sharing your ideas for one minute each.
- Add notes about your partner's ideas onto your own response.
- With the sticky notes that your teacher provides, determine which parts of the model you would like to *keep*, *revise*, *add*, or *remove*.
- Choose one of the changes you would like to make to your model to share with your class.

Color of sticky note	What we want to do about our model	Rationale for our decision
	KEEP this idea	We think that _____ part of our model should stay. We are confident about this because_____.
	REVISE part of an idea	We think _____ supports part of our model, but we would like to change _____ to make it more accurate.
	ADD a new idea	We think _____ supports our model, but it also tells us that _____ should be added to make it even *more* accurate.
	REMOVE or find out more	We think _____ contradicts _____ in our original model and that we need to *remove* or *find out more* about it.
	QUESTIONS	We still have questions about _____ because we read _____ and wanted more information about _____.

Whole Class discussion

- Share the change you and your partner would like to make to your old model.
- Use science talk stems. Ask a question or respond to the ideas that your peers share.
- Take notes on your classmates' ideas.

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Individual model revision

- Using your classmates' ideas, your E/I notetaker, and the texts in your reader, create a new model based the new evidence, interpretations, and questions you generated while reading the texts in this module.
- Make sure you are able to back up your ideas with evidence!

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Our **revised** model of how the body keeps blood glucose concentrations in balance:

Checklist for building models:

• Does the model illustrate what leads to increases or decreases in blood glucose concentration?
• Does the model include important players in glucose homeostasis, such as insulin, glucagon, pancreas, liver, etc.?
• Does the model describe the role of insulin resistance (type 2 diabetes) or the absence of insulin (type 1 diabetes)?

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Blood glucose model peer review

Presenting, reviewing and revising

Peer review is essential to science knowledge-building. Peer review provides assurance that someone who is well-informed about the field has double-checked new claims and findings. In peer review of models we ask:

- Does the model help us explain the phenomenon?
- Does our model help us address our investigation/inquiry questions?
- Does the model (explanation) account for all of the available evidence?
- Can we use the model to predict what will happen if we manipulate the phenomena?
- Does the model agree with our understandings about how the world works and other science models?

Presenters: Provide your model to your peers and give them some time to read it over before you present. Some points to address in your presentations are:

- **Significance:** The big question for us was _____. What was hard to explain was _____.
- **Purpose:** We built our model to try to explain _____. We think it helps explain, predict or describe _____ because _____.
- **Reliability and justification:** We are very confident about _____ parts of our model because _____. We are still unsure about _____ parts of **our model because** _____.
- **Future research:** We still have questions about _____.

Reviewers: Listen, read and make notes on:

- What is clear and what is unclear.
- What is misrepresented, mistaken or missing (such as evidence that is unaccounted for)?
- What does not belong in the model (things for which there are no evidence)?
- The questions you wonder about.
- Ideas for refinement or improvement.

<u>Revising</u>

- After hearing and feedback from your peers, return to make edits on your model on page 37.

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Source	Evidence	Interpretation

 © Project READI

Source	Evidence	Interpretation

 © Project READI

Source	Evidence	Interpretation

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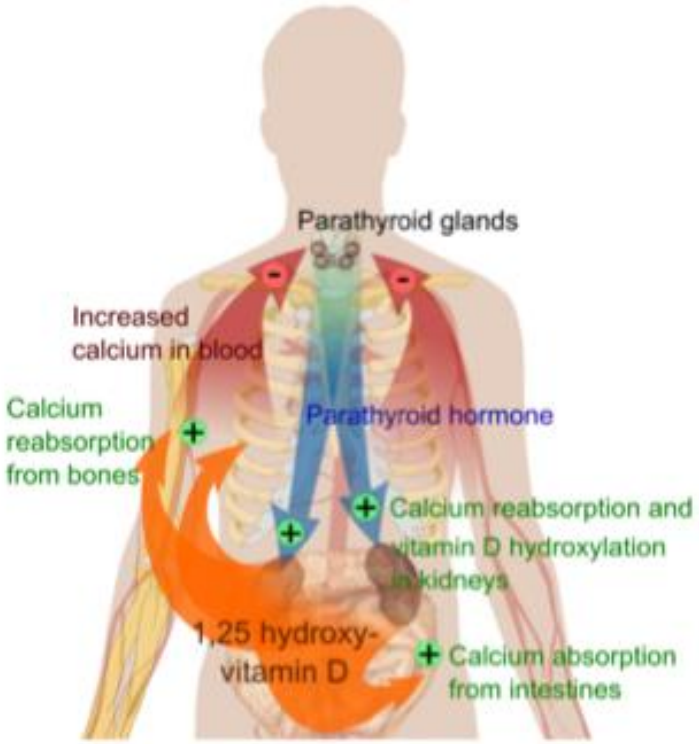
Name _____ Date _____

Teacher _____

Homeostasis Reader



How does your body work to maintain balance?
What happens when this balance is disrupted?

The intended use of these materials is in tandem with ongoing professional development focused on supporting reading as scientific practice. This work is funded by the Reading for Understanding Initiative of the Institute for Education Sciences, U.S. Department of Education, through Grant R305F100007 to University of Illinois at Chicago. The opinions expressed are those of the authors and do not represent views of the Institute or the U.S. Department of Education.

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Images obtained from: Walter F., PhD. Boron (2003) *Medical Physiology: A Cellular And Molecular Approach*, Elsevier/Saunders, pp. 1,300; BSCS Biology: A Human Approach 2nd edition; http://science.kennesaw.edu

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Name _____ Date _____

Teacher _____

Homeostasis Reader
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Hypernatremia Due to Dehydration in Dementia

Author: V. Dimov, M.D., Assistant Professor of Medicine and Pediatrics, University of Chicago
Reviewer: S. Randhawa, M.D., Allergist/Immunologist, Internist, Fort Lauderdale, FL

An 86-year-old African American female was admitted to the hospital after she had a seizure. Her family members report that the patient has baseline advanced dementia, which has been worsening over the last year. She is not verbal (she cannot conduct a meaningful verbal communication).

Past medical history

Dementia, hypertension, constipation.

Social history

The patient is a nursing home resident, and she is totally dependent in terms of activities of daily living.

Physical examination

The examination of Head, Eyes, Ears, Nose, and Throat showed that the head was normocephalic, atraumatic, and she had dry mucosal membranes.

The cardiovascular system examination showed that she had clear heart sounds but she was tachycardic. There were no murmurs, rubs or gallops.

The examination of the extremities showed no clubbing, cyanosis and edema. She had a decreased skin turgor.

What is the most likely diagnosis?

In her case, the seizure can be due to hypernatremia, or less likely, to an intracranial process.

Why does the patient have hypernatremia?

Poor oral intake of water is often seen in advanced dementia, and can lead to hypernatremia.

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What laboratory tests would you suggest?

Complete blood count with differential, basic metabolic panel to confirm the presence and to quantify the degree of hypernatremia, and to look for other metabolic abnormalities and signs of infection.

Adapted from: Case-Based Curriculum of Medicine by Assistant Professors at University of Chicago and NSU. http://clinicalcases.org/2004/05/hypernatremia-due-to-dehydration-in.htm

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The New York Times

By SUSAN GILBERT
Published November 2, 1999

When Too Much Water Hurts a Runner

Sports bottles of water have become indispensable accessories in gym bags and symbols of good health. But sports doctors are warning people not to drink too much water during endurance events like the New York City Marathon, which takes place on Sunday.

Though athletes need to drink regularly during a race to prevent dehydration, experts say that excess water can lead to hyponatremia, a potentially fatal condition that is rare but increasing among recreational athletes. Hyponatremia is an abnormally low concentration of sodium in the blood. The cause is unknown, but overconsumption of water is thought to increase the risk by diluting blood sodium.

Until recently, hyponatremia was seen almost exclusively in ultramarathons and other extremely high-endurance events, said Dr. Michael Sawka, chief of thermal and mountain medicine at the United States Army Research Institute of Environmental Medicine in Natick, Mass. "Now we're seeing it in marathons, hiking and military occupations," he said. Symptoms include nausea and vomiting, muscle weakness, headache and disorientation, as well as bloating and puffiness in the face and fingers. In the last year or so, a dozen marathon runners in this country were known or suspected of having hyponatremia, said Dr. William Roberts, a spokesman for the American College of Sports Medicine, the professional organization of sports physicians. One victim was a 43-year-old woman who died after running the Chicago Marathon last fall.

Doctors are looking for hyponatremia more now than ever before, but they say that increased vigilance does not fully explain the increased diagnoses. Another reason may be that many recreational athletes are drinking too much water. "We've done a good job of educating people on proper rehydration, but some people have taken that to the nth degree, thinking that the more you drink, the better," Dr. Sawka said. Doctors say that most of the marathon runners with hyponatremia were relatively inexperienced athletes who entered races to raise money for charity.

The condition seems more common among women than men. Medicine and Science in Sports and Exercise, a journal, recently reported that about half

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the women studied who finished the New Zealand Ironman triathlon developed hyponatremia, compared with 14 percent of the men. Doctors are not sure why. It may be that women simply drink more water than men. The guidelines, set by the sports medicine organization, call for about 17 ounces of fluid two hours before exercise, and then early and at regular intervals to replace all the water lost through perspiration.

Whether sports drinks help prevent hyponatremia is under study, the American College of Sports Medicine says. In any case, doctors say, an effective way for runners to maintain healthy blood sodium concentrations in Sunday's race is to salt their food every day between now and then.

Adapted from The New York Times
http://www.nytimes.com/1999/11/02/health/when-too-much-water-hurts-a-runner.html

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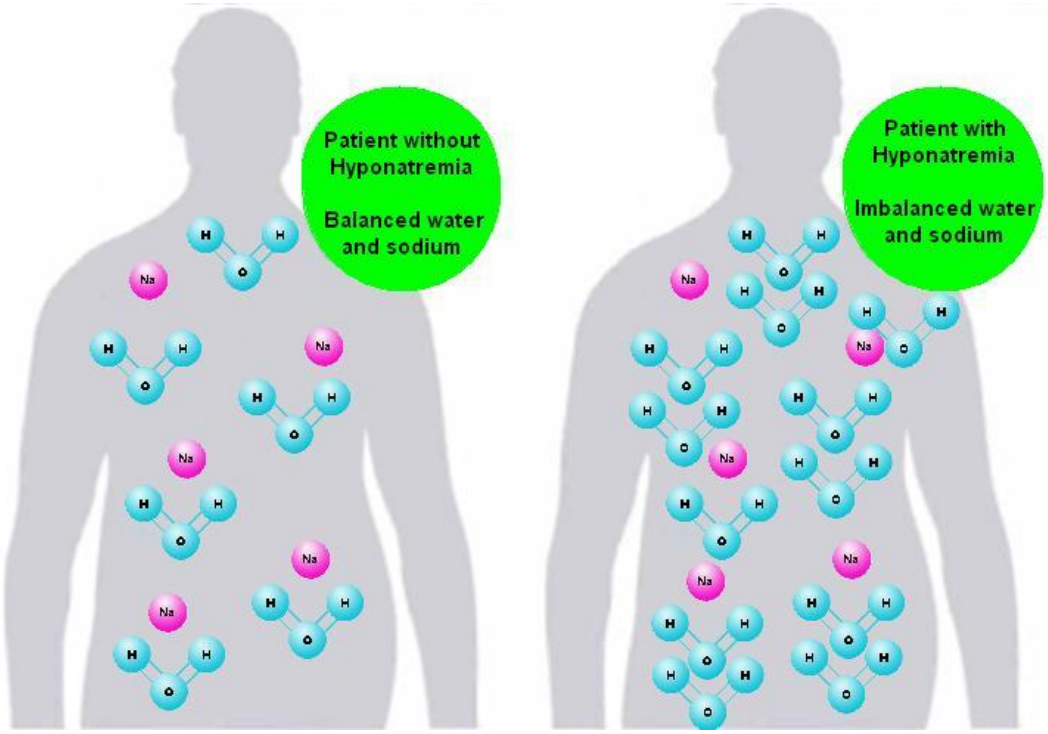
Hyponatremia: what's going on inside the body?



Source: http://trialx.com/curetalk/wp-content/blogs.dir/7/files/2011/05/diseases/Euvolemic_Hyponatremia-1.jpg

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Homeostasis

Have you ever wondered why you don't faint every time you stand up? Does it surprise you that even if you skip lunch you still can walk and talk? Explanations of those occurrences are quite complex. For instance, the cells in your brain all are exceedingly sensitive to tiny changes in the levels of oxygen and sugar. Even small decreases in those critical substances can cause fainting. Your blood pressure automatically rises when you stand up in order to maintain adequate oxygen flow to your brain. Likewise, you can skip lunch because a declining level of sugar in your bloodstream triggers your liver to release sugar held in storage. Your body must continuously make adjustments to create and maintain an environment for your brain to function.

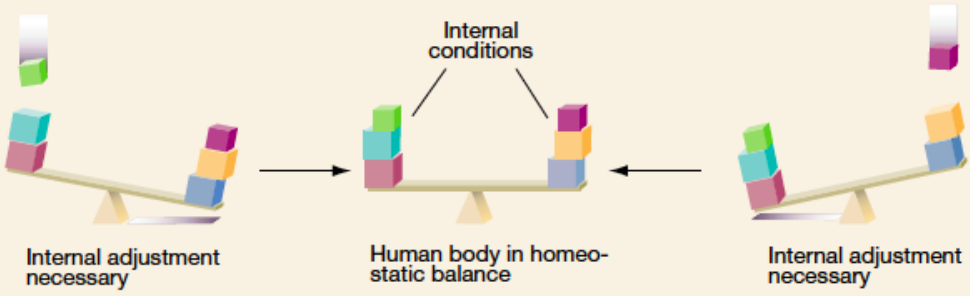

Figure E5.1 Homeostasis The human body is maintained in a state in which the internal conditions are balanced. When the balance is disturbed, the body adjusts its internal conditions to restore balance.

These adjustments are made *automatically* and assure that conditions within your body remain within rather narrowly defined limits, a condition of balance called **homeostasis** (see Figure E5.1). Humans are not the only organisms that maintain homeostasis. In fact, homeostasis is a fundamental characteristic of all living systems. In animals, internal organs that are similar in function to those in humans help to maintain homeostasis. In plants, specialized structures, such as those illustrated in Figure E5.2, enable plants to maintain balance. Although organisms use different mechanisms to remove wastes and maintain balance, all organisms depend on maintaining homeostasis. Maintaining balance means life, and losing homeostatic balance for an extended period of time means death. To maintain homeostasis, two things are required. First, an organism must be able to sense when changes have occurred in the external and internal environment. Second, it must be able to respond with appropriate adjustments.

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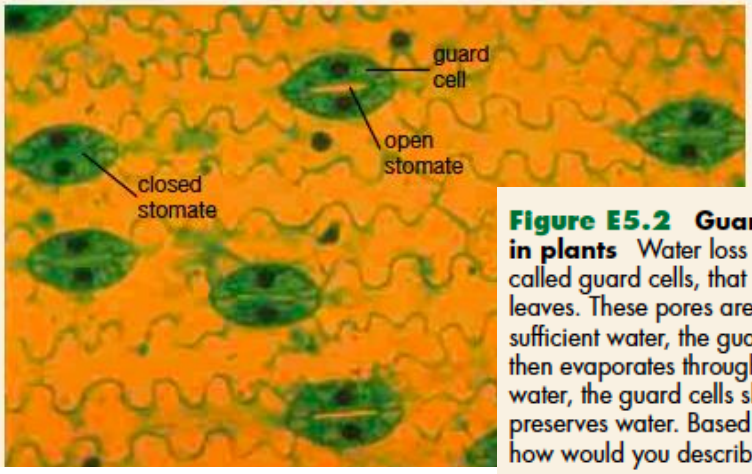

Figure E5.2 Guard cells control the rate of water loss in plants Water loss is controlled by the condition of special cells, called guard cells, that regulate the size of microscopic pores in leaves. These pores are called **stomates.** When the plant has sufficient water, the guard cells swell and the stomates open. Water then evaporates through the stomates. When the plant is low on water, the guard cells shrink, and the stomates remain closed, which preserves water. Based on the appearance of stomates in this leaf, how would you describe this plant's water balance?

For example, humans can monitor stimuli, or external signals such as cold, because we have sensory neurons in our skin that allow us to feel the outside temperature. Once the message "cold" is received in the brain, our body can respond by changing blood flow. Our heart rate may increase, and certain blood vessels may constrict. This change is involuntary, or automatic. We do not consciously control this physiological process. In other words, we do not decide what the body should do. The body attempts to keep the brain, heart, and liver at a nearly constant temperature even if that means sacrificing fingers and toes.

The human body's response to change is quite specific as well as involuntary. For example, the body responds to cold temperature by diverting circulation to keep the most important internal organs warm. This type of response is appropriate for the external conditions. If the body becomes too hot, however, the circulatory system diverts blood flow away from the internal organs to protect them from damage caused by excess heat.

These examples are rather dramatic, but the human body routinely senses and responds to thousands of small changes each day. It is through many small, specific, automatic changes that living organisms sense and react to an environment that is ever changing and sometimes hostile. Luckily, the mechanisms for maintaining balance are always on the job.

Adapted from: *BSCS Biology: A Human Approach,* 2nd edition.

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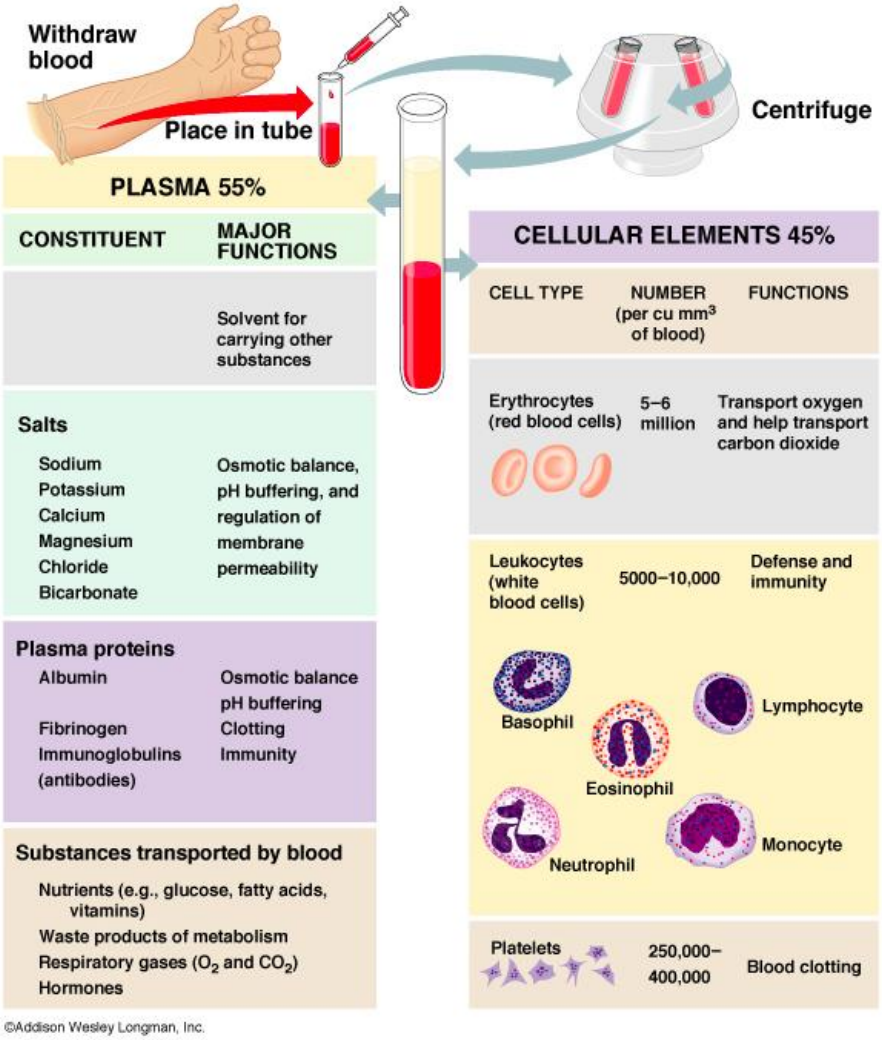
What's in our blood?



Plasma is the liquid portion of blood – a protein-salt solution in which red and white blood cells and platelets are suspended. Plasma, which is 92 percent water, constitutes 55 percent of blood volume. Plasma contains albumin (the chief protein constituent), fibrinogen (responsible, in part, for the clotting of blood) and globulins (including antibodies). Plasma serves a variety of functions, from maintaining a satisfactory blood pressure and volume to supplying critical proteins for blood clotting and immunity. It also serves as the medium for exchange of vital minerals such as sodium and potassium and helps to maintain a proper pH (acid-base) balance in the body, which is critical to cell function. Plasma is obtained by separating the liquid portion of blood from the cells.

Diagram from: http://www.iteachbio.com/Anatomy-Physiology/Circulatory%20System/ComponentsofBlood.png;
Text from American Red Cross http://www.redcrossblood.org/learn-about-blood/blood-components/plasma

Salt: A World History

Mark Kurlansky

"Without sodium, which the body can not manufacture, the body would be unable to transport nutrients or oxygen, transmit nerve impulses, or move muscles including the heart. An adult human being contains about 250 grams of salt, which would fill three or four salt shakers, but is constantly losing it through bodily functions. It is essential to replace this lost salt."

"Modern scientists argue about how much salt an adult needs to be healthy. Estimates range from two-thirds of a pound to more than sixteen pounds each year. People who live in hot weather, especially if they do physical labor, need more salt because they must replace the salt that is lost in sweating. This is why West Indian slaves were fed salted food. But if they do not sweat excessively, people who eat red meat appear to derive from it all the salt they need. The Masai, nomadic cattle herders in East Africa, meet their salt needs by bleeding livestock and drinking the blood. But vegetable diets, rich in potassium, offer little sodium chloride. Wherever records exist of humans in different stages of development, as in seventeenth- and eighteenth-century North America, it is generally found that hunter tribes neither made nor traded for salt but agricultural tribes did. On every continent, once human beings began cultivating crops, they began looking for salt to add to their diet. How they learned of this need is a mystery. A victim of starvation experiences hunger, and so the need for food is apparent. Salt deficiency causes headaches and weakness, then light-headedness, then nausea. If deprived long enough, the victim will die...most people choose to eat far more salt than they need, and perhaps this urge - the simple fact that we like the taste of salt- is a natural defense."

"The other development that created a need for salt was the move to raise animals for meat rather than kill wild ones. Animals also need salt. Wild carnivores, like humans, can meet their salt needs by eating meat. Wild herbivores forage for it, and one of the earliest ways humans searched for salt was to follow animal trails. Eventually they all lead to a salt lick or a brine spring or some other source of salt. But domesticated animals need to be fed salt. A horse can require five times the salt intake of a human, and a cow needs as much as ten times the amount of salt a human requires."

Excerpts taken from: Kurlansky, M. (2002). *Salt: A World History.* Toronto: Alfred A. Knopf Canada

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THE NEW YORKER

ANNALS OF MEDICINE

SLOW IDEAS

By Atul Gawande, MD
July 29, 2013

In 1968, *The Lancet* published the results of a modest trial of what is now regarded as among the most important medical advances of the twentieth century. It wasn't a new drug or vaccine or operation. It was basically a solution of sugar, salt, and water that you could make in your kitchen. The researchers gave the solution to victims of a cholera outbreak in Dhaka, the capital of what is now Bangladesh, and the results were striking.

Cholera is a violent and deadly diarrheal illness, caused by the bacterium *Vibrio cholera*, which the victim usually ingests from contaminated water. The bacteria secrete a toxin that triggers a rapid outpouring of fluid into the intestine. The body, which is sixty per cent water, becomes like a sponge being wrung out. The fluid pouring out is a cloudy white, likened to the runoff of washed rice. It produces projectile vomiting and explosive diarrhea. Children can lose 1/3 of their body's water in less than 24 hours, a fatal volume. Drinking water to replace the fluid loss is ineffective, because the intestine won't absorb it. As a result, mortality commonly reached 70 percent or higher. During the nineteenth century, cholera pandemics killed millions across Asia, Europe, Africa, and North America. The disease was dubbed the Blue Death because of the cyanotic blue-gray color of the skin from extreme dehydration.

In 1906, a partially effective treatment was found: intravenous (IV) fluid solutions reduced mortality to 30 percent. Prevention was the most effective approach. Modern sewage and water treatment eliminated the disease in affluent countries. Globally, though, millions of children continued to die from diarrheal illness each year. Even if victims made it to a medical facility, the needles, plastic tubing, and litres of intravenous fluid required for treatment were expensive, in short supply, and dependent on medical workers who were themselves in short supply, especially in outbreaks that often produced thousands of victims.

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Then, in the nineteen-sixties, scientists discovered that sugar helps the gut absorb fluid. Two American researchers, David Nalin and Richard Cash, were in Dhaka during a cholera outbreak. They decided to test the scientific findings, giving victims an oral rehydration solution containing sugar as well as salt. Many people doubted that victims could drink enough of it to restore their fluid losses, typically ten to twenty liters a day. So the researchers confined the Dhaka trial to 29 patients. The subjects proved to have no trouble drinking enough to reduce or even eliminate the need for intravenous fluids, and none of them died.

Modified excerpt taken from *The New Yorker*
http://www.newyorker.com/reporting/2013/07/29/130729fa_fact_gawande?currentPage=all

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Regulation of water by vasopressin

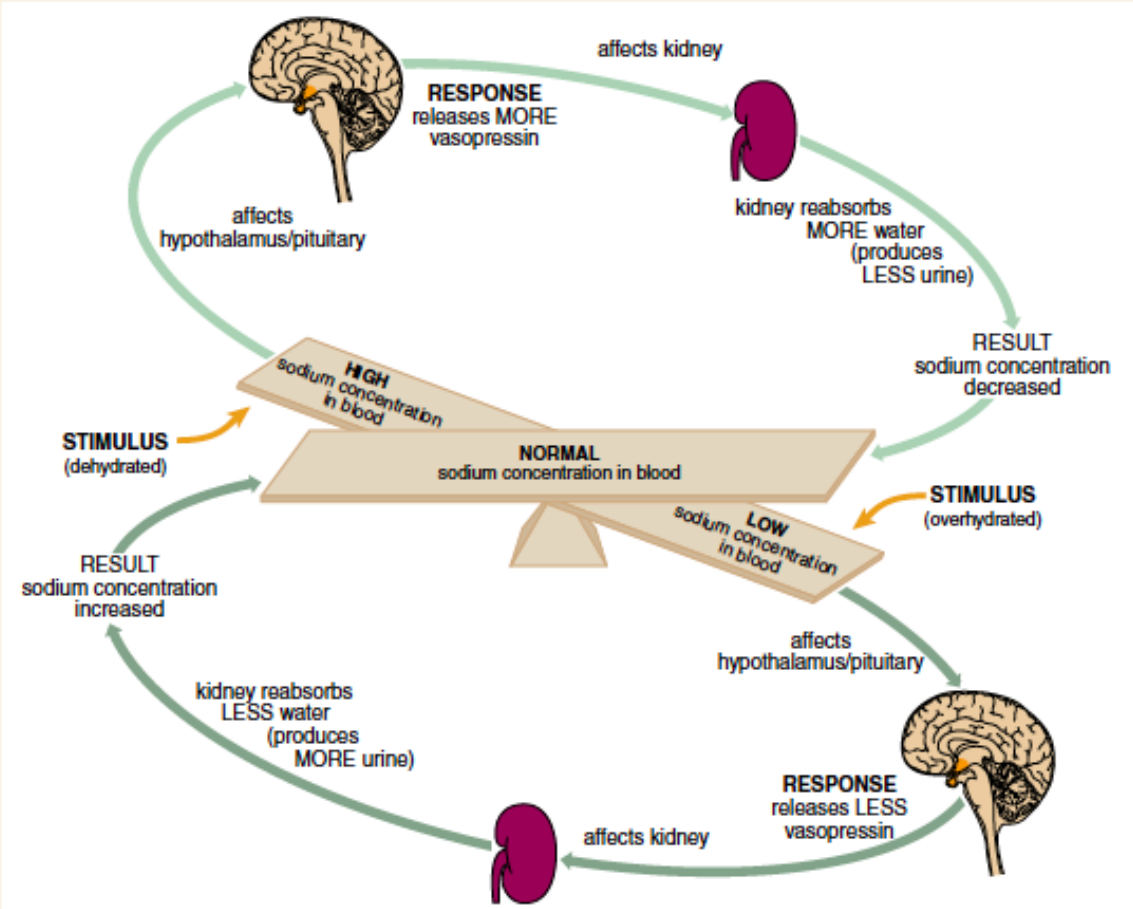

Figure E5.6 Regulation of water balance by vasopressin (also known as ADH) When the sodium concentration in the blood rises, the hypothalamus and pituitary gland in the brain respond. This causes the release of vasopressin (ADH), which stimulates the kidneys to reabsorb more water. As a result, the sodium concentration decreases, restoring water balance. What would happen if a person consumed a diuretic, such as caffeine or alcohol? Diuretics block the production of vasopressin.

Figure from: *BSCS Biology: A Human Approach*, 2nd edition.

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nature REVIEWS ENDOCRINOLOGY

Vaptans for the treatment of hyponatremia

Nature Reviews Endocrinology 7, 151-161 (March 2011)

Gary L. Robertson, MD. Professor Emeritus in Medicine-Endocrinology at Northwestern University Feinberg School of Medicine

Vaptans constitute a new class of pharmaceuticals developed for the treatment of the some forms of hyponatremia. Vaptans are *vasopressin antagonists* that interfere the hormone vasopressin, also called AVP, by competitively binding to its receptors in the kidney. Vassopressin performs two primary roles in the body: 1) retain water in the body and 2) constrict blood vessels.

One of the most important roles of AVP is to regulate the body's retention of water; it is released when the body is dehydrated and causes the kidneys to conserve water, thus concentrating the urine and reducing urine volume.

This blockade results in water diuresis that, if not offset by increased fluid intake, reduces body water content and raises plasma sodium levels. Nonetheless, vaptans are particularly useful to treat hypervolemic hyponatremia associated with severe congestive heart failure or chronic liver failure, as the only other treatments currently available, such as fluid restriction and diuretics, are slow-acting and minimally effective.

The use of Vaptans to treat acute, symptomatic forms of hyponatremia is still debatable, because their effects on plasma sodium vary unpredictably from patient to patient

Excerpts from: *Nature Reviews Endocrinology* 7, 151-161 (March 2011)
http://www.nature.com/nrendo/journal/v7/n3/full/nrendo.2010.229.html

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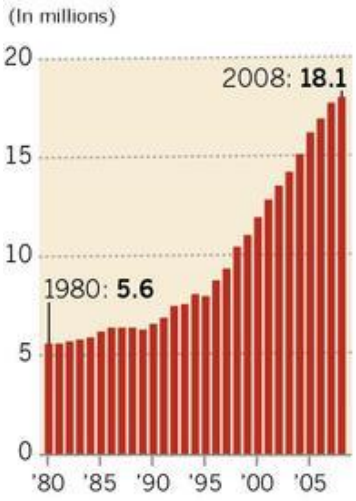
Los Angeles Times

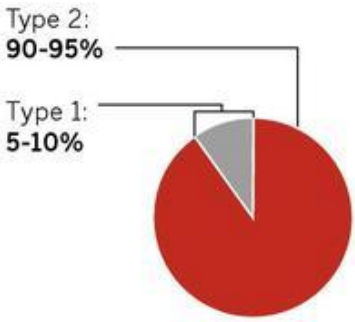
Type 2 diabetes in the United States

One in three adults could have diabetes by 2050, compared with today's 1 in 10, according to the Centers for Disease Control and Prevention. Type 2, the most common form of diabetes, can usually be controlled with diet, execise, weight loss and oral medication.

Number of people with diabetes in the U.S.



Percentage of all cases that are Type 1 or Type 2



Some diabetes-related complications

Number of diabetics who have visual impairment	3.7 million (in 2008)
Number of diabetics with cardiovascular disease	5.9 million (in 2007)
Number of diabetics who had non-traumatic lower limb amputations	71,000 (in 2005)

Note: Figures shown are for the most recent year available.

Sources: National Institute of Diabetes and Digestive and Kidney Diseases, Centers for Disease Control and Prevention

Graphics reporting by TIA LAI

Los Angeles Times

Graphic obtained from LA Times: http://www.latimes.com/health/lat-b82485127z.1-20101029223751-000gs20101029,0,3776283.graphic#axzz2uYMwV5Vb

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My Story

My name is Kimberly Marie Thiele. (My Dakota name is "Mahpiya Duta Winyan" which translates as "Red Cloud Woman." This name had been given to me by my grandfather from Canada.)

My life began on a summer day on July 17, 1987. I was born early, weighing only 3 pounds and 7 ounces. I developed yellow jaundice a couple of days later so I stayed for an extra week. Other than that, I was healthy and went home after two weeks. It took me a while to catch up with the other kids my age but after a while I caught up and grew up to be a healthy and happy little girl.

As I grew into my teens, my life was good; I came from a two-parent family, had good friends, and enjoyed school. In January of 2003, I noticed something was wrong. I was always thirsty, like really thirsty to the point where I started bringing a glass with a pitcher of water to my bedroom at night, and then of course, I was also urinating a lot, especially at night, maybe two, three times a night. I lost a lot of weight. It didn't really dawn on my to think that I might have some type of disorder like diabetes.

On April 26, 2003, in school, I had a headache, was tired, and weak. I called my father, and he came after me. We went to the clinic, and I signed up as a walk-in and waited. My name was called. They took my temp and blood pressure, etc., etc. My father asked if they could check my sugar. In the past weeks, little did I know, my father would wake up every time I went to the bathroom during the night. (He noticed how frequently I was visiting the restroom.) He suspected diabetes but didn't really think that it could be it, after all, I was only 16 years old. The nurse did a blood sugar test, and my blood sugar was 670* that day. I was given a dose of insulin and was prescribed diabetes pills. (A year later, I was switched from pills to insulin.)

I had been diagnosed with type 2 diabetes. After the doctor informed me I had diabetes, I was sent to talk to a dietician and a public health nurse. Both of these people are also certified diabetes educators. They explained to me that the type of diabetes I had was usually found in older people but was increasingly being diagnosed in young children and teenagers. They also explained to me that I would have to do A1c testing every three to six months. (What an A1c test does is monitor the glucose control of diabetics over time; it also aids in treatment decisions.) They also taught me how to check my blood sugar and how often (twice a day), and explained that I could control my diabetes with diet and exercise.

When I was diagnosed, I never thought too much about it. It didn't really matter because I didn't know what diabetes was all about. On the other hand, my parents were heartbroken. It was heartbreaking for them because I was just 16, and they had seen what effects diabetes had on the human body and also the pain that it causes emotionally and physically.

After learning all about diabetes and that it is a lifelong disease with severe consequences if not taken care of, I went into denial big time. I told myself, "I don't have diabetes, how can I? I am only 16 years old." I wouldn't test my blood sugar, on some days I didn't take my insulin, and I ate whatever I wanted and whenever I wanted.

*670 milligrams / deciliter (mg/dL)

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My parents enrolled us in an educational counseling program taught by a nurse, but I wouldn't cooperate and didn't believe I needed to be there.

One day in school, my blood sugar became so low that I got a headache and was shaky, tingly, confused. I got the scare of my life. After that incident, I was determined to take care of myself, and it went well for while. Then I was back in denial and fell back into not taking care of myself again. I didn't want to be treated any different that anyone else. I figured at one point, what's the use? My death will have something to do with diabetes anyway.

In the spring of 2005, I suspected that I was pregnant, and in May it was confirmed. I didn't want to tell my parents and break their hearts again. I tried to wait a couple of more months to July when I would be turning 18 years old. I was told by my school counselor that, because of my health, if I didn't tell my parents that day that she would. I couldn't face them so I e-mailed my mom. (Yes I know that sounds crazy but you just had to be there to understand the situation I was in.) We all went thought accepting the fact, that yes, I was pregnant, and went from there. My parents supported me, especially my dad, who drove me once a month and then twice a week to the special prenatal clinic which was a 180-mile round-trip. Thank you, Dad, I love you.

Obtained from Diabetes Education in Tribal Schools "Health Is Life Balance" curriculum.

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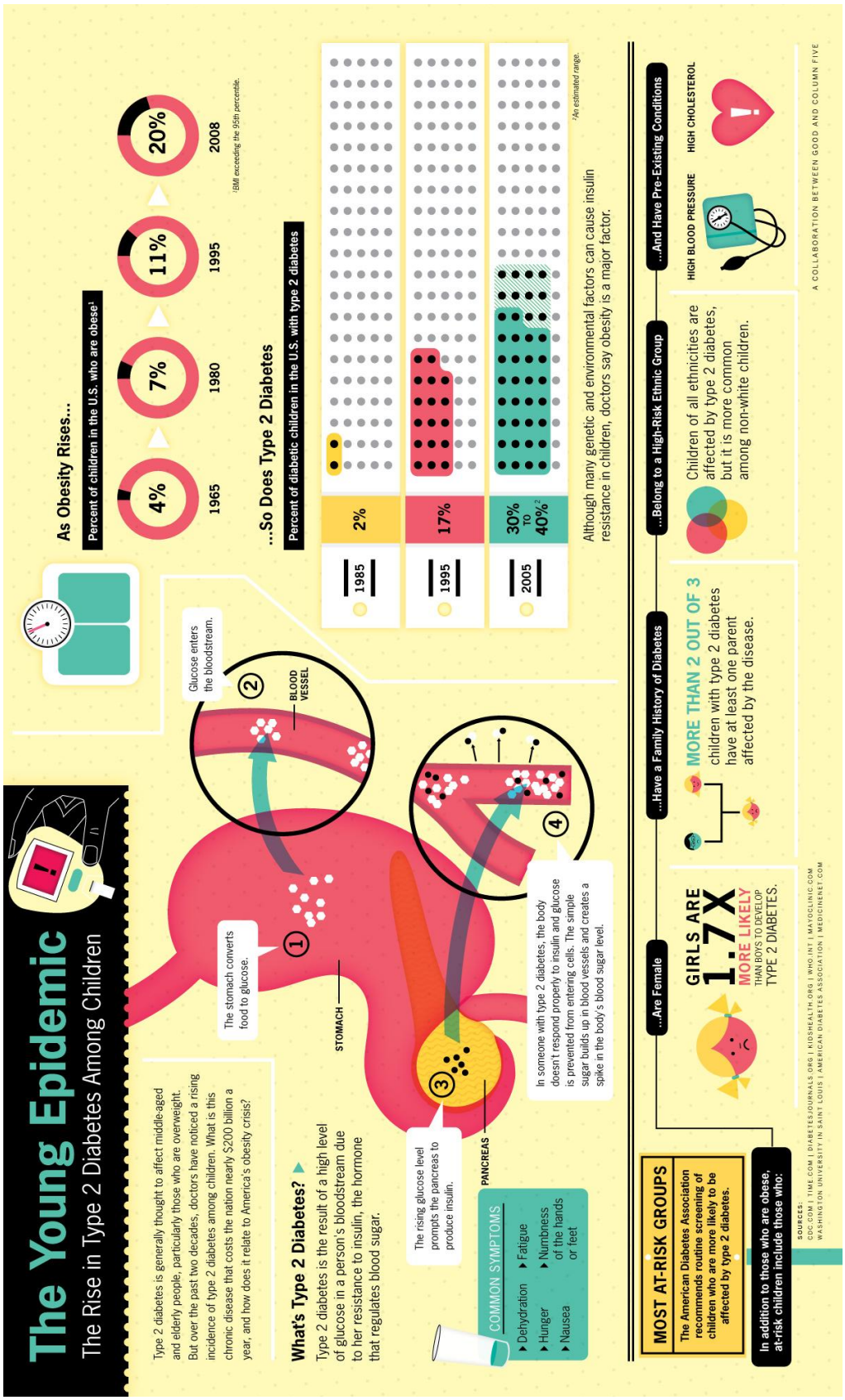

Source: *Good Magazine* http://magazine.good.is/articles/the-young-epidemic-the-rise-of-type-2-diabetes-in-children

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How Does the Body Regulate Glucose?

The body normally keeps the blood glucose concentration between about 70 and 140 milligrams per deciliter. To do this, your body has to have a way to determine when the amount of glucose in the blood is either low or high. Two hormones play important roles in keeping the glucose concentration in this normal range. Hormones are a type of chemical messenger in the body. They are released from specialized cells or glands into the blood. The blood carries them to other cells where they cause a specific response. The two hormones that regulate glucose in the body are insulin and glucagon. Both hormones are made by cells in the pancreas.

Insulin and glucagon have opposite effects to control the concentration of glucose in the blood. The pancreas always makes and releases small amounts of insulin and glucagon. When a person eats carbohydrates, they are broken down into glucose, and the amount of glucose in the blood increases. The body detects this increase and triggers specific cells in the pancreas to release insulin. The insulin acts on many other cells in the body so they can take up the glucose. This lowers the concentration of glucose in the blood. Glucagon is released from the pancreas when the concentration of glucose in the blood is low. Glucagon stimulates primarily the cells of the liver to release stored glucose into the blood. This makes the blood glucose concentration increase.

It is the controlled release of both of these hormones that keeps the blood glucose concentration within the normal range. Eating carbohydrates stimulates the release of insulin from cells of the pancreas. The glucose inhibits or "turns off" the release of glucagon from the pancreas. Insulin in the blood also inhibits the release of glucagon. When the concentration of glucose in the blood is low, the cells in the pancreas that produce glucagon are stimulated and they release their hormone into the blood.

This coordinated release of insulin and glucagon and is an example of a feedback system. A feedback system can be defined as a situation in which one activity of a body system affects another, which in turn affects the first. Feedback systems are important ways in which the body maintains balance. A high blood glucose concentration triggers the release of insulin. When the blood glucose concentration decreases, it signals the pancreas to stop releasing insulin. When the blood glucose concentration is low, cells in the pancreas are stimulated to release glucagon. When the blood glucose concentration increases, the cells release much less glucagon.

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The cells of the pancreas can sense small changes in blood glucose concentration. Because they are so sensitive, the cells of the pancreas can respond to changes before the blood glucose concentration can increase or decrease much. This is also a constant process. If a person eats a meal with a lot of carbohydrates, a larger amount of insulin will be released. If a person eats a meal with less carbohydrates, the pancreas releases a smaller amount of insulin. In the same way, the amount of glucagon that is released depends on how close or how far below normal the blood glucose concentration is.

The actions of insulin and glucagon to control the amount of glucose in the blood, along with feedback mechanisms that can either turn on or turn off the release of these hormones into the blood, are all part of homeostasis. Homeostasis refers to the processes used by the body to maintain conditions within a narrow range. For example, the body normally maintains blood glucose concentrations at around 95 milligrams per deciliter (mg/dL) in a healthy person. After a person eats and the blood glucose concentration is high, insulin works to lower the level to around 95 milligrams per deciliter (mg/dL). If the blood glucose concentration is low, glucagon released into the blood functions to increase the concentration. Therefore, by making adjustments to raise or lower the blood glucose concentration, the body can maintain a relatively stable environment.

Obtained from: Diabetes Education in Tribal Schools "Health Is Life Balance" curriculum.

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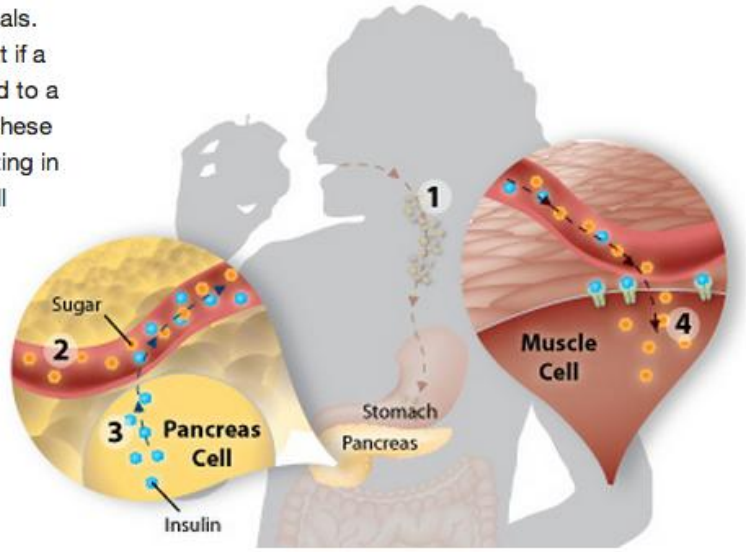
WHEN CELL COMMUNICATION GOES WRONG

The cells in our bodies are constantly sending out and receiving signals. But what if a cell fails to send out a signal at the proper time? Or what if a signal doesn't reach its target? What if a target cell does not respond to a signal, or a cell responds even though it has not received a signal? These are just a few ways in which cell communication can go wrong, resulting in disease. In fact, most diseases involve at least one breakdown in cell communication.

Losing The Signal

The food that you eat is broken down into sugar, which enters the blood stream. Normally, cells in the pancreas release a signal, called insulin, that tells your liver, muscle and fat cells to store this sugar for later use. In type I diabetes, the pancreatic cells that produce insulin are lost. Consequently, the insulin signal is also lost. As a result, sugar accumulates to toxic levels in the blood. Without treatment, diabetes can lead to kidney failure, blindness and heart disease in later life.



Normal blood sugar regulation. After food enters the body (1), it is broken down and sugar enters the bloodstream (2). Sugar stimulates cells in the pancreas to release insulin (3). Insulin travels through the blood to other cells in the body and signals them to take up sugar (4).

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When A Signal Doesn't Reach Its Target

Multiple sclerosis is a disease in which the protective wrappings around nerve cells in the brain and spinal cord are destroyed. The affected nerve cells can no longer transmit signals from one area of the brain to another. The nerve damage caused by multiple sclerosis leads to many problems, including muscle weakness, blurred or double vision, difficulty with balance, uncontrolled movements, and depression.

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When The Target Ignores The Signal

Type I and type II diabetes have very similar symptoms, but they have different causes. While people who have type I diabetes are unable to produce the insulin signal, those with type II diabetes do produce insulin. However, the cells of type II diabetics have lost the ability to respond to insulin. The end result is the same - blood sugar levels become dangerously high.

Type I Diabetes
No insulin signal

Type II Diabetes
No response

Excitotoxicity: After a brain injury such as a stroke, lethal amounts of signaling molecules leak out of dying nerve cells resulting in widespread damage to the brain.

Too Much Signal

A stroke occurs when a blockage forms in a blood vessel, cutting off blood flow to part of the brain. The immediate result is the death of nearby brain cells. But the most catastrophic event comes later, when the dying cells release large amounts of the signaling molecule glutamate. Low concentrations of glutamate control many actions in the brain, but at high concentrations it is toxic to cells. Through a process called excitotoxicity, glutamate spreads through the brain and kills cells that were not affected by the blockage, often leading to widespread brain damage.

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Multiple Breakdowns

Cell growth and division is such an important process that it is under tight control with many checks and balances. But even so, cell communication can break down. The result is uncontrolled cell growth, often leading to cancer. Cancer can occur in many ways, but it always requires multiple signaling breakdowns. Often, cancer begins when a cell gains the ability to grow and divide even in the absence of a signal. Ordinarily this unregulated growth triggers a signal for self-destruction. But when the cell also loses the ability to respond to death signals, it divides out of control, forming a tumor. Later cell communication events cause blood vessels to grow into the tumor, enabling it to grow larger. Additional signals allow the cancer to spread to other parts of the body.

Many mechanisms maintain appropriate cell growth: Cell division occurs in response to external signals (1). Enzymes repair damaged DNA (2). Cells make connections with their neighbors (3). If these connections suddenly change, neighboring cells send out an alert. Cells respect and stay within tissue boundaries (4). If a cell is beyond repair, it initiates its own death (5).

Treatments

Just as cell communication can go wrong resulting in disease, many disease treatments rely on cell communication. If you think of disease as a roadblock in cell communication, treatment is an alternate route. The first step is to locate the problem. The second step is to find a way around the problem. Sometimes it's easy. The treatment for type I diabetes is to inject insulin into the blood stream. Other times it's more difficult, especially in diseases such as cancer where cell communication has broken down in multiple places.

During an asthma attack, signaling molecules cause a narrowing of breathing passages in the lungs, making it difficult to breathe.

Many drugs that treat asthma mimic natural signals that tell muscle cells in the lungs to relax, allowing breathing passages to open.

Source: The Learn Genetics Center, The University of Utah.
http://learn.genetics.utah.edu/content/begin/cells/badcom/

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Optional

MAYO CLINIC

Diseases and Conditions

Is the glycemic index diet useful if you have diabetes?

Answers from Maria Collazo-Clavell, M.D.

Some people with diabetes use the glycemic index (GI) as a guide in selecting foods — especially carbohydrates — for meal planning. The glycemic index classifies carbohydrate-containing foods according to their potential to raise your blood sugar level. Foods with a high glycemic index value tend to raise your blood sugar faster and higher than do foods with a lower value. The glycemic index diet has potential benefits but may be problematic as well:

Possible benefits	Potential problems
• Lowers blood sugar level	• Includes single food items rather than combinations of foods, which can impact blood sugar differently
• Helps regulate blood sugar level throughout the day, which may reduce the risk of insulin resistance	• Doesn't consider all variables that affect blood sugar, such as how food is prepared or how much is eaten
• Reduces the need for diabetes medication	• Only includes foods that contain carbohydrates
• Controls appetite and delays hunger cues, which may help with weight management	• Doesn't rank foods based on nutrient content — foods with a low GI ranking may be high in calories, sugar or saturated fat

It can be difficult to follow a glycemic index diet on your own. For one thing, most foods aren't ranked by glycemic index. Packaged foods don't generally list their GI ranking on the label, and it can be hard to estimate what it might be. Still, basic principles of the glycemic index diet may help you better manage and control your blood sugar:

- Choose high-fiber foods, such as whole grains, legumes, fruits and vegetables.
- Choose fresh or raw foods over canned or processed foods.

If you have diabetes, the glycemic index diet is just one tool to consider when determining your diet. If you're interested in learning more, talk to a registered dietitian. He or she can help you make changes in your diet.

Source: http://www.mayoclinic.org/diseases-conditions/diabetes/expert-answers/diabetes/faq-200

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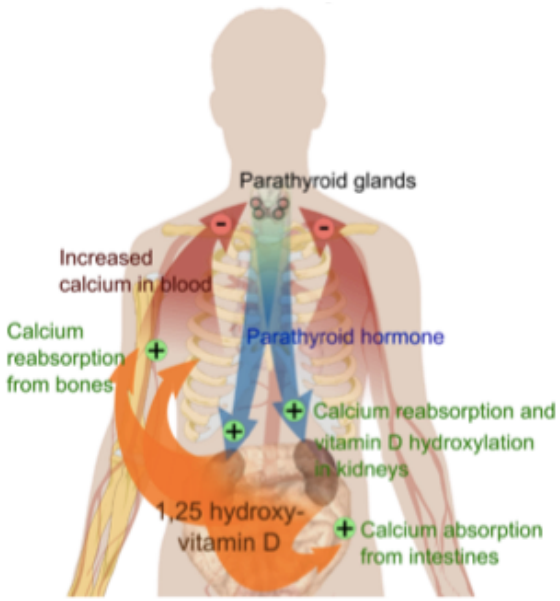
Name _____ Date _____
Teacher _____

Homeostasis Investigation



How does your body work to maintain balance?
What happens when this balance is disrupted?

The intended use of these materials is in tandem with ongoing professional development focused on supporting reading as scientific practice. This work is funded by the Reading for Understanding Initiative of the Institute for Education Sciences, U.S. Department of Education, through Grant R305F100007 to University of Illinois at Chicago. The opinions expressed are those of the authors and do not represent views of the Institute or the U.S. Department of Education.

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Images obtained from: Walter F., PhD. Boron (2003) *Medical Physiology: A Cellular And Molecular Approach*, Elsevier/Saunders, pp. 1,300; BSCS Biology: A Human Approach 2nd edition; http://science.kennesaw.edu

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Name _____ Date _____
Teacher _____

Mon-lin Ko 9/17/2014 9:50 AM
Comment [1]: Teacher notes

Purpose of teacher notes
The goal of the teacher notes is to highlight the opportunities and challenges to this specific module, focusing on supporting learners in developing their ability to read complex texts and generate explanations and arguments using text-based evidence.

The notes are not meant to be scripted nor a comprehensive guide. Teacher expertise, craft, and artistry is the foundation of great teaching. It is our sincere aspiration that these notes support you in your deeply important work.

Text and Task Analysis:
Do and re-do the reading and writing tasks in advance of using this with your students. This can be an opportunity for you to assess the opportunities and challenges for your students, at this given point in time, and set more targeted plans for aspects of this module. This may include making a goal to use specific talking and reading stems that have not been advanced, or to generate new ones. Constantly assessing and challenging students will keep the practices fresh and prevent them from becoming rote.

Posters:
Decide how posters will be managed. Reading Strategy Lists (RSLs) and other posters will persist, while others will be generated through the investigations. You may want to consider first the set of posters for part I (salt/water balance) and part II (sugar balance) separately, and also if you want to have a poster that documents students' emerging ideas about Homeostasis in the human body writ large, as students think about both phenomena.

Opening the module:
The first text is a great way to motivate students to thinking about the role of balance in the body. Another way is to have students preview the reader and/or investigation notebook. Discussion prompts might be: what did you notice, think, predict, or wonder about?

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Hypernatremia Due to Dehydration in Dementia

Individual think-write: preview

- Take out your science reading and talking stems, then turn to the text "Hypernatremia Due to Dehydration in Dementia," page R1 in your Reader.
- Take two minutes to look over the text and respond to the prompts below.
    - What might be challenging about reading this article?
    - What might be interesting about reading this article?
    - What kind of text is this? How do you know?
    - What predictions can you make about the kind of science information it may contain?
    - What might you do to get as much out of the reading this article as possible?

Mon-lin Ko 8/26/2014 10:06 AM

Comment [2]:

Routines for reading, thinking, and reasoning

Throughout the investigation notebook, there are introductions and directions for students (e.g. individual think-write, pair share, whole class discussion). **Treat these as texts to be read by students.** Having students read directions, make interpretations, put them in their own words, ask questions and/or clarify with a partner is another way to support the norm of reading and reasoning – even directions can be read and made sense of! This ensures the students are continually doing the 'heavy lifting' of sense-making and monitoring their comprehension of the tasks.

Pair discussion

- Take turns sharing your ideas for one minute each.
- Add notes about your partner's ideas onto your own response.
- **Stellar idea**: Select one response that you or your partner can share with the class. Mark it with a star.

Whole class discussion

- Share stellar ideas.
- Listen closely and respond to your classmates' ideas.
- Use science talk stems.
- Add peers' best ideas onto your own response.
- What new words can we add to our word wall?

Reading and making thinking visible

- **Talk to the text:** Individually talk to the text on "Hypernatremia due to dehydration in dementia."

Pair discussion

- Take out your science reading and talking stems.
- Talk with your table partners and take turns sharing your talk to the text comments, going paragraph by paragraph.
- Help each other work through any confusions or roadblocks you may encounter.
- Keep track of any new reading strategies you or your partner use to make sense of this text, and discuss with your partner: what could be added to our reading strategies list (RSL)?

Mon-lin Ko 8/26/2014 10:54 AM
Comment [3]:

Formative assessment:
It is crucial to get a sense of what students are discussing in small groups. Listening to these discussions can help you facilitate the whole class discussion that follows.

Owning science reading and talking
Smaller pair discussions are another opportunity for students to utilize the science reading and talking stems, working towards independence and ownership of a wide range of reading and reasoning practices. Identifying the ways students are talking with one another is one more way to formatively assess and make changes both in-the-moment as well as during planning.

Mon-lin Ko 8/26/2014 10:55 AM
Comment [4]:

Honoring and encouraging multiple perspectives and viewpoints

The goal of whole class discussions, as designed here, is to always encourage and elicit multiple perspectives and ideas, both about reading and thinking as well as the content. One way to uphold this could be to encourage the articulation of reading and reasoning if students quickly offer up claims. This makes the "how he or she got there" visible for the other students in the class. Conversely, if students only share about their reading processes, a nice next step might be pushing for them to generate some predictions, inferences, questions, etc. Constantly tethering reading and reasoning together with knowledge-building communicates that the two go hand-in-hand in science.

Generating questions about the phenomenon (partners/whole class)

- **Reading process:** What science reading processes were important for your reading? See if you can add any new ideas to your class' RSL.
- **Inquiry**: think about what you *understand* about this **86 year-old female patient** and/or **hypernatremia**, any *connections* you've made to what you already know, and write down other *questions* you have below.

Mon-lin Ko 8/26/2014 10:56 AM

Comment [5]:

Apprenticing Student in Science Inquiry: The goal here is to foster students' scientific curiosity by giving them practice in inventing/creating their own questions.

Use your text and task analysis to field and organize inquiry questions (and posters)
Use your own analysis of the text to guide how you solicit and organize the inquiry questions that emerge. It may be helpful to organize the questions based on the kinds of connections students are making to what they already know, the connections they are making between different lines of text in this single text, etc. This can help guide you decision about how to make these questions public.

Reminder: Reading is inquiry
Offer opportunities to discuss various types of inquiry questions – whether big or small. Try to keep these questions in mind as the class progresses through the module and read additional texts. It may help to keep these questions at the forefront so that students dive into new texts anticipating bits and pieces of text that will help them form answers to existing questions, and also that new questions will (and always do!) emerge.

There will be another opportunity for students to publicly document inquiry questions after reading multiple texts (see page 8).

When Too Much Water Hurts a Runner

Individual think-write: preview

- Turn to Reader page R3 and take out your science reading and talking stems.
- Take two minutes to look over "When Too Much Water Hurts a Runner" and respond to the prompts below.
    - What might be challenging about reading this article?
    - What might be interesting about reading this article?
    - What kind of text is this? How do you know?
    - What predictions can you make about the kind of science information it may contain?
    - What might you do to get the most out of the reading this article as possible?

Pair share

- With your partner, preview this text and see if you can make some any *connections* between this text and the text on page R1 - R2: "Hypernatremia Due to Dehydration in Dementia."
- Use your talk stems bookmark to talk with your partner.
- Based on your preview of the text and any connections you made to the previous text, *set a purpose* for reading this article.
- Make sure you are ready to share you and your partner's ideas to the class!

Whole class discussion

- Share the ideas you and your partner came up with when you previewed the texts.
- Listen closely and respond to your classmates' ideas.
- Use science talk stems.

Mon-lin Ko 8/26/2014 10:56 AM
Comment [6]:

A note about the complexity of salt and water balance:

In the research and design of this module, we uncovered what a complex phenomenon of salt balance can be! We are simply touching on it through this module. For instance, there are different types of hyper- and hyponatremia, based on the ratio between the amount of fluid and salt in an individual. We only scratch the surface here to bring to light just one of the processes that are constantly being regulated and re-set, often times without deliberate effort.

Reading and making thinking visible (individual and partner)

Use your reading strategies bookmark and do a close reading of this text.
While you read, talk to the text to document your thinking and reading processes in the margins. Pay special attention to the connections you make and to the questions that the texts make you think about as you read.

Pair discussion

After reading, respond to the prompts below and discuss with your partner:

- **Sense-making:** Work together to make sense of the text.
- **Reading process:** What science reading processes were important for your reading?
- **Inquiry:** What are you noticing or wondering now about **hyponatremia**? What new understandings or connections are you forming? What is interesting? What is important? Write down those ideas in the space below.
- **Stellar ideas:** Select one reading process AND one idea or question about hyponatremia that you or your partner can share with the class. Mark each with a star.

Whole class discussion

Share stellar ideas about **reading process**

- What did you notice about your partner's (or your own) reading processes with this text?
- What reading challenges did you or your partner encounter and how did you respond to the reading challenge?
- What additions or revisions can we make on the reading strategies list poster?

Share stellar ideas about **hyponatremia**.

- What questions, connections, or ah-ha's do you have from your reading?
- What new words can we add to our word wall?

Will Brown 8/25/2014 1:40 PM

Comment [7]:
Framing the Reading Work
Frame reading longer and harder science texts as solving a puzzle to encourage and challenge students to dig in and to make sense of it. This makes visible the accomplishment of tackling a harder piece.

Mon-lin Ko 8/26/2014 10:57 AM

Comment [8]:

Sharing stellar ideas:
The pair discussions are designed to foster rich discussion as students work in pairs. The Stellar ideas prompt is to have students sort through the range of ideas they discussed and identify one that they would like to share with the class. – both something about how they read and also what they figured out through reading.

These norms for talking in pairs uphold the norm of sharing confusions and a culture that invites students into problem-solving practices.

Too much or too little… what's going on inside the body?

Phenomena are events or processes that occur in the world that can be explained by science. One of the ways that scientists do the important work of investigating and explaining phenomena is by gathering information from texts of all types, including written and visual text.

Hyper- and hyponatremia are the phenomena you are investigating. You and your classmates' have just read about two individuals experiencing some extreme conditions. Next you will work with your partner or tablemates and think about the similarities and differences in what's going on inside the body of someone who is *hyper* vs. *hypo*natremic.

Teacher model

- Listen and make notes below about the teacher's reading process. Pay particular attention to *how* the teacher identifies similarities and differences.

	Hypernatremic dementia patient	Hyponatremic marathon runner
Differences		
Similarities		

Whole class discussion

- What did you notice about how your teacher identified differences and similarities?

Mon-lin Ko 8/26/2014 10:58 AM
Comment [9]:

Teacher modeling
Keep the modeling short and sweet, and remember that you are not modeling what the similarities and differences are, but the PROCESS of thinking that led you to just one or two of those ideas. Keep the model brief. Leave obvious and important similarities and differences for students to uncover.

In preparation for this model, it may be helpful to look back to the notes from watching and analyzing the "Superman and me" video on PD days 6 and 9.

One way to prepare for the teacher model is work backwards. Look at one idea you put down as a similarity or difference, and then ask, "what did I do to arrive at these ideas? What parts of the text did I use? What connections did I make? What questions did I ask myself (even if implicitly!) that led me to this idea?" Making this inferential reasoning explicit for yourself, and then think about one small slice you'd like to model for the students.

Inviting students to model for one another
You may want to use the reciprocal modeling approach, where you model one part of the text and invite students model another. This can be followed by a metacognitive conversation about what the student modeled.

Pairs/small groups

Work with your partner or tablemates and think about the similarities and differences in what's going on inside the body of someone who is *hyper* vs. *hypo*natremic.

- Put a star by ideas that are supported by the texts you've read. Put a question mark by the ideas that you may need to do more research to be sure about.
- Chose a similarity or a difference to share with the class.

	Hypernatremia dementia patient	Hyponatremic marathon runner
Differences		
Similarities		

Whole class discussion

- Share a similarity or difference and the reading strategies you used to identify it.
- What additions or revisions can we make on the reading strategies list poster?
- Add your peers' ideas to your own chart.

Mon-lin Ko 8/25/2014 1:57 PM
Comment [10]:

The practice of identifying evidence-based ideas

One good way of scaffolding the practice of generating evidence-based explanations and models is to practice sorting through some ideas and seeing if there's evidence to back them up. This prompt here encourages students to identify which ideas they jumped to (perhaps without evidence from the text) and to slow down and think about if and how the text supports these claims. This also opens up opportunities for students to point out which ideas are good, educated guesses, or connections, that need to be further examined as the module progresses. Encouraging this self-monitoring keeps the of justification and critique at the forefront, without discounting students' ideas.

Mon-lin Ko 8/26/2014 11:00 AM
Comment [11]:

Foregrounding the Metacognition
Keep the norm of making thinking visible with the task of identifying similarities and differences. This activity is not meant to be a "fill in the worksheet" activity – but an authentic meaning-making process of sorting and reasoning through ideas.

Keeping reading "fresh"
Revisiting the RSL and encouraging students to exercise existing strategies and invent new ones that support their comprehension prevents this list from becoming an ancient artifact that is only used the first couple of weeks of school. This is a great opportunity to identify the expertise students have been developing up this point in the strategies they use to make sense of text and to encourage the invention and exercise of new ones as they see fit.

Documenting students' ideas
There is limited space on this page for documenting students' ideas. One way to consolidate students' ideas is to do this overhead or document camera, or have students listen for ideas that are new to each student.

Building our inquiry questions (IQs)

Scientists looking to understand puzzling phenomena don't find every answer using their lab equipment. They also do a lot of reading to help them identify the interesting questions that they want to pursue and investigate. Think about the questions you and your classmates have generated by reading.

Individual brainstorming

Based on your close reading of the two texts in this module and based on what you know, what questions do you have about **water**, **sodium**, and the **human body**? Jot them down in the space below:

Think-pair-share

- Share the inquiry questions you generated from these two texts. Which ones rise to the top as the most important? Why do you think these are the most important? How might these questions impact how you read? Circle the questions you would like to share with your classmates and be ready to share why you think this question is important.

Whole class discussion

- Share one of the questions you and your partner discussed.
- Use your science talk stems to contribute and listen and build on your classmate's ideas.
- Work together to create an inquiry question poster based on you and your classmates' questions about water, sodium, and the human body.

Mon-lin Ko 8/26/2014 11:00 AM
Comment [12]:

Texts and "hands-on labs" go hand in hand
This can be a support for discussing the epistemology of science and the value of texts in advancing science ideas. Scientists publish new findings in journals, other scientists read and critique them. These texts are not just the outcomes of doing science work – they ARE the work.

Mon-lin Ko 8/26/2014 11:01 AM
Comment [13]:

Generating inquiry questions never stops
Inquiry questions posters are malleable – you may want students to continue to add to the list, keeping track of which ones are answered over the course of the module.

Monitoring progress
One way to monitor progress on these questions by generating a "evidence-based ideas about…." poster, list, etc. and cross out the questions that are no longer "burning" for the class. There are many others – use your expertise to decide how you want to make student progress public.

Hyponatremia: what's going on inside the body?

Reading and making thinking visible

- Take out your science reading and talking bookmark and turn to Reader page R5.
- Read "Hyponatremia: what's going on inside the body?" and annotate the text, showing your reading and thinking process in the margins.

Pair share

After reading, respond to the prompts and discuss with your partner:

- **Sense-making**: Work together to make sense of the text.
- **Reading process**: What did you notice about your own reading and thinking process?
- **Inquiry:** What do you notice about the patient with and without hyponatremia?
- **Cross-text connections:** What connections can you make between "Hypernatremia due to Dehydration in Dementia," "When Too Much Water Hurts a Runner" and the postered ideas you have generated as a class?

Whole class discussion

Ideas about **reading process**

- What did you notice about your partner's (or your own) reading processes with this text?
- What reading challenges did you or your partner encounter and how did you respond to the reading challenge?
- What additions or revisions can we make on the reading strategies list poster?

Share about **hypernatremia** and **hyponatremia**

- What new understandings about hyponatremia have you built? What new connections have you made? What new questions do you have?
- What new words can we add to our word wall?

Mon-lin Ko 8/26/2014 11:01 AM

Comment [14]:

A note about reading models:

Realizing that science models can be read and made sense just like written text can be difficult. Often times when things are "right there on the page," it takes even more work to really get at what the model is about because it obfuscates how much is actually understood/internalized as a mental model.

This is the first time a science model is introduced in this module. As always, a text-and-task analysis may help you anticipate the kinds of connections students might make between the first two texts and this model of Hyponatremia.

There are many other models of hypo- and hypernatremia out there – our purpose here was not to select "the best one." Instead, students should take liberties in imagining and practicing how they might model it differently. What may be helpful here is to think about the ways that students can draw on their existing knowledge to make connections to what they know. The prompt under "Pair share" encourages that.

Even though the model may seem uncomplicated, keep an eye out for the various kinds of connections students might make.

A teacher or reciprocal model may be appropriate here if students need some scaffolds to meaningfully make sense of the model on R5.

Reading and modifying scientific models (partner and whole class)

- Look back at the model criteria poster you built together as a class.
- Discuss with your partner and class:
  - **Criteria:** What are science models? What makes a good science model?
  - **Purpose:** Why do you think the authors created this model? What it is a model of? How do you know?
- **Extending the model:** Based on your thinking and reading, work with your partners to draw a model in the blank space on R5 of what might be happening inside a patient who has **hypernatremia**, like the dementia patient you read about in "Hypernatremia Due to Dehydration."
- Share your model with the class: Why did you choose to draw the model the way you did? What text-based information did you use to construct your model?
- Discuss this question with your class: **How would you describe differences in what's going on inside the bodies of someone with hypernatremia and hyponatremia?**

Mon-lin Ko 8/26/2014 11:02 AM

Comment [15]:

Models can be tweaked

Models are malleable. They aren't perfect and are always changing, based on new evidence. Our role as scientists and science readers is to keep an eye out for new ideas that might make us change our existing models.

Use your discretion to decide if you would like the 'extending the model' part of this activity to be done individually, in partners, or as a whole class. Similar to all whole-class discussions, encourage students to articulate their reasoning and rationale behind their decisions. You may want to return to the dementia patient and marathon runner and ask students how their models help explain what's going inside the body, or return to the similarities/differences table on page 7 to further explore the fit between the model and the questions that students have posed about balance in the body.

Evidence and interpretation notetakers

One of the ways to keep track of the important ideas that we get from reading is through evidence and interpretation (E/I) charts. Although many ideas can be important or interesting, they may not all be considered evidence that relates to our inquiry questions about homeostasis.

Individual

Read the three words/concepts below and respond to the prompts.

- What do you know, think, or remember about each word?
- Describe a real life experience when you used information, evidence, and interpretations.

Information Evidence Interpretation

Mon-lin Ko 8/26/2014 11:03 AM
Comment [16]:

Reminder:
It is important to frame this brainstorming and the discussions that follow it as an opportunity to bring in prior knowledge and build on it (and at times, question it) in your class. "Wrong ideas" still count – the purpose is to get the multiple meanings of the word "information," "evidence," and "interpretation" out on the table and begin a discussion, and then to continually refine the distinctions between them as students progress through the module.

Pairs/table group

Take turns sharing your notes about the three words and your real life experience related to these three words. Discuss the similarities and differences.

Whole class discussion

Mon-lin Ko 8/26/2014 11:03 AM
Comment [17]:

Generating working definitions:

Though the distinctions between information, evidence and interpretations needn't be "set in stone", it may be helpful to get working definitions up to help support students in using the evidence/interpretation notetakers from this point forward. As students work towards making these three ideas more clear, these definitions can be updated accordingly.

- Share the ideas that you, your partner, and table group came up with about the difference between evidence, information, and interpretations.
- Look at the poster or list of inquiry questions you have been building about hypo and hypernatremia. Discuss this question with your class: **What kind of evidence might you look for to help you answer those questions?**
- Turn to your evidence and interpretation charts. Write down your ideas for what counts as evidence and interpretations in the top row of the table.

Evidence and interpretation notetakers

Teacher model

- Listen and make notes in your own E/I notetaker as the teacher models the process of identifying evidence, making interpretations, and asking new questions.

Whole class discussion

- What did you notice about your teacher's thought processes as he/she identified evidence and formed interpretations?

Pair-think-write

- Turn to R1 - R5 in your reader and take out your science reading and talking stems.
- With your partner, identify one or more pieces of evidence from the articles and record these in your E/I notetaker.
- As you identify and record each piece of **evidence**, think about the **interpretations** you can make from them. For example, what does each piece of evidence tell you about hyponatremia, hypernatremia, or homeostasis?
- For each piece of evidence and interpretation, write down additional **questions** you now have in the last column of your E/I chart.
- Repeat these steps to find additional evidence, interpretations, and questions about hyponatremia, hypernatremia, or homeostasis.
- **Stellar idea**: Select one response that you or your partner can share with the class. Mark it with a star.

Whole class discussion

- Share your evidence, interpretations, and questions with the class.
- Discuss the following questions:
  - How do you know the evidence is important?
  - What are some inferences you might draw? Could you draw different inferences from the same piece of evidence?
  - How might the evidence, interpretation, or questions help you build an explanation that answers our inquiry questions?

Mon-lin Ko 8/26/2014 11:04 AM
Comment [18]:

Reminder:

Keep teacher modeling short, and use reciprocal modeling to put students at the center of the work. Focus the modeling on the metacognitive processes, not the products or accuracy of your thinking.

Homeostasis

Setting a purpose for reading (individual)

- Turn to page R6 – R7 ("Homeostasis") in your reader and take out your science reading and talking stems.
- Turn to the inquiry questions you and your classmates generated together. These may be located in your E/I notetaker, on your classroom inquiry questions poster, or recorded on page 8.
- Using these inquiry questions, set your purpose for reading this text.

Whole class discussion

- Share your purpose for reading with your classmates.
- Use your science talking stems to listen and respond to other's ideas.
- Discuss this with your class: How did you identify your purpose for reading? How does setting purposes for reading affect your reading process?

Reading and making thinking visible

- **Think aloud:** Partners take turns thinking aloud by paragraph for the first section. One partner thinks aloud while the other partner makes notes in the margin of the text about their partner's thoughts. Help each other make sense of the text.

OR

- **Talk to the text:** Individually talk to the text on the first section. Pairs take turns sharing their talk to the text annotations. Help each other make sense of the text.
- Use the science reading stems to help you share your reading process.

Mon-lin Ko 8/13/2014 3:04 PM
Comment [19]:

Framing:

At this point in the module, students have read 3 texts that make the role of salt and water in the human body the focus of their inquiry.

As students move forward, asking questions should continue, but with an eye towards resolving some of the questions that were posed when reading the first 3 texts.

Keeping the inquiry questions at the forefront compels students to read in anticipation of identifying evidence that addresses those questions.

Mon-lin Ko 8/13/2014 3:08 PM
Comment [20]:

Reminder:

Use your expertise and knowledge of your students to decide what participation structure works best.

Formative assessment:
The text has both figures and written text. If you find students attending to only written text, up the ante by challenging them to think about the relationship between the two kinds of text.

Pair discussion

After reading, discuss and respond to the prompts.

- **Words:** What new words or word-uses did you encounter? How did you make sense of their meaning?
- **Confusions or clarifications**: What parts of the text (visual or written) were unclear? Where do you have questions? Work together to clarify confusing parts of the text and to answer questions that you have.
- **Reading process:** What other science reading processes were important for your reading?
- **Inquiry:** What are you noticing or wondering now about homeostasis, hypernatremia, or hyponatremia, during or after reading?

Whole class discussion

Ideas about reading process

- What did you notice about your partner's (or your own) reading processes with this text?
- What reading challenges did you or your partner encounter and how did you respond to the reading challenge?
- What additions or revisions can we make on the reading strategies list poster?

Share about homeostasis.

- What new understandings about homeostasis have you built? What new connections have you made? What new questions do you have?
- What new words can we add to our word wall?

Looking for evidence and making interpretations to address our IQs

- Take out to your E/I notetaker. Look through this text and identify a single piece evidence you want to add to your notetaker and the interpretations and questions you have about that evidence.
- Share this idea with your partner and get feedback on your idea. How does it address your IQs? Switch roles and have your partner share their evidence.
- Return to your classroom IQs. Were you able to answer any of these questions with text-based evidence? Record answers to your inquiry questions on a new classroom poster.

Mon-lin Ko 8/13/2014 3:58 PM
Comment [21]:

Reminder:

The practice of reading new texts, making connections to previous texts, generating new questions and answering old ones and documenting ideas that are supported through is a routine that is supported in the modules.

Mon-lin Ko 8/26/2014 11:05 AM
Comment [22]:

Formative assessment using E/I note takers:

The E/I note taker can be a natural place to check in on student progress. What kinds of evidence-based evidence are students pulling out? What are students calling evidence? What kinds of interpretations are students making and how are they resolving IQs, and what new questions arise?

Getting a pulse on this can inform how you plan for upcoming texts, recognize the need for additional modeling or other supports, and establish a baseline for progress as students practice identifying evidences and making interpretations from text.

What's in our blood?

Previewing and setting purposes for reading (individual and partners)

- Take out and use the following set of tools to generate a goal for reading "What's in our blood?" (R8).
  - Science reading and talking book mark
  - E/I notetaker
  - The list of inquiry questions generated by your class
  - The prior texts in this module (R1 - R7)
- Take a minute to preview "What's in our blood?"

Pair share

- Discuss with your partner: What have you already figured out about hypo/hypernatremia, sodium, water, and the human body? What do else do you need to figure out? How might this text give you some of the information you still need?
- Establish your goal for reading, based on your analysis of what else you need to find out and what this text might offer. Write your goal below.

Reading and making thinking visible

- Individually talk to the text on each section of "What's in our blood?"
- Use your science reading stems to help you make your thinking visible by writing annotations in the margins.
- **Stellar ideas:** Select a new word, a confusion or clarification, or a reading process AND one idea or question about homeostasis, hypernatremia or hyponatremia that you can share with the class. Mark them on your text with a star.

What's in our blood? continued

Think-pair-share:

- **Reading process:** Talk with your partner about your reading process:
  - What strategies helped you make sense of the text?
  - Did you read the diagram or written text on this page first? Why?
  - Were you able to make connections between the written text and the diagram? How did those connections help you read?
  - Did you make any connections to you already know or other texts we have read in this module?
- **About your stellar idea:** Share your stellar idea with your partner. Use your science talk stems to add, clarify, and respond to your partner's ideas.
- **Identifying evidence and making interpretations:**
  - Turn to your E/I notetaker. Identify new pieces of evidence, interpretation, or questions that arose from reading this text.

Whole class discussion:

- **Reading process:** What reading strategies helped you or your partner make sense of the text?
- **Stellar ideas:** Share stellar idea you or your partner came up with by reading.
- **Answers to our IQs:** Return to the list of inquiry questions (IQs) you and your classmates generated. As a class, see if you now have answers to some of those questions. Document these on the "Answers to our inquiry questions" poster in your class.

Salt: A World History

Setting a purpose for reading

Look through the set of inquiry questions that you and your classmates have generated. Talk with one another, using your science reading and talking stems and the following prompts to get you started:

- What have we figured out about hyponatremia, hypernatremia, and homeostasis?
- What else do we need to find out?

Reading and making thinking visible

- Turn to "Salt: A World History" (R9).
- **Think aloud:** Partners take turns thinking aloud by paragraph for the first section. One partner thinks aloud while the other partner makes notes in the margin of the text about their partner's thoughts. Help each other make sense of the text.

OR

- **Talk to the text:** Individually talk to the text on the first section. Pairs take turns sharing their talk to the text comments. Help each other make sense of the text.
- Use the science reading stems to help you share your reading process.

Developing the "big idea" through reading

- As you share your reading and thinking processes with your partner, see if you can identify the big idea of this text.

Identify evidence, make interpretations and generate more questions

- Take out your E/I notetaker
- Review the notes you made on "Salt: a World History" and add a star to ideas that might go in your E/I notetaker.
- Share with your partner:
  - Why did you choose to star that idea?
  - How do you think it will help us understanding homeostasis, hypernatremia, or hyponatremia?
- After sharing and talking with your partner, work together to identify important pieces of evidence, interpretations, and question and record these in your E/I notetaker.

Mon-lin Ko 8/13/2014 3:49 PM
Comment [23]:

A note about "Slow Ideas" (optional text (R10-11))

There are no pages that accompany this text. A text-and-task analysis can help identify whether or not to include this text for your students, and what supports you might want to accompany that text.

If you haven't already, review the full text for "Hypernatremia due to demnentia" (see http://www.renalandurologynews.com/hypernatremia-due-to-hypovolemia-in-dementia/article/200789/). Treatments in the US vs. abroad could offer an opportunity for rich discussions about designing solutions when limitations abound!

Regulation of water by vasopressin

Preview

- Turn to "Regulation of water by vasopressin" on R12. Preview the text on your own or with a partner and then discuss the following questions:
  - How is this text *similar* or *different* than the other texts we've read up to this point?
  - What connections can you make to what we have discussed so far?
  - What do you think will make this text difficult or easy to read?

Reading and making thinking visible

- Use your science reading stems to read and annotate this text, using the following questions as a guide:
  - **Reading process:** What other science reading processes were important for your reading?
  - **Confusions or clarifications:** What was *confusing*, *interesting*, or *helpful* about this model?
  - **Cross-text connections:** What kinds of connections you can make to the previous texts?
  - **Inquiry:** How does this model help you understand how the body regulates sodium concentrations in blood? What new pieces of evidence can you identify in this text that will help answer the inquiry questions your class came up with?

Whole class discussion:

- What is this a science model of? What does it help explain? What does it *not* explain?
- How might you change this model to account for hyponatremic or hypernatremic patients? What might need to be added, removed, or modified?
- Support your ideas with text-based evidence from all the texts you have read so far in this module.

Mon-lin Ko 8/13/2014 3:53 PM
Comment [24]:

Preparing for teaching:

A text and task analysis will be helpful here, as the first half of the Homeostasis module comes to a close. This text (R12) introduces how sodium/water balance is maintained in a healthy individual – and thus, the "health" model. In contrast, the cases presented at the beginning of the module were "disease" cases.

By conducting a TATA and doing the task yourself, you can identify focused goals for this text and the accompanying investigation pages.

Mon-lin Ko 8/26/2014 11:05 AM
Comment [25]:

Updating or revising models to help explain phenomena

As mentioned above, this model doesn't address the hyper- and hyponatremia cases the module began with. It's the students' job to figure out how to build on this model (small additions or wholesale changes are both encouraged!) to explain how this balance is disrupted.

Evidence-based revisions/additions

Keep an eye out for how students use the texts leading up this task to make revision to the model. E/I note takers may be especially helpful here.

Teacher or reciprocal modeling may be appropriate here, as you see fit.

Vaptans for the treatment of hyponatremia

You and your classmates have read a model for how sodium concentrations are regulated in the human body. As learners of science, one way we can assess our own understanding of something is when we try to apply what we know to something new.

Reading and making thinking visible

- Turn to page R13, "Vaptans for the treatment of hyponatremia" in your reader.
- Use your reading and talking stems to think aloud and talk to the text on your own or with a partner.
- Share your inquiry questions, connections, and reading roadblocks as you read. Try to see if you can help one another make sense of the text.

Making connections and using our models to explain phenomena

- After you read, if you haven't already, look back at "Regulation of water by vasopressin" and see if making connections between these two texts helps you understand how vaptans work to treat hyponatremia.
- Use the space below to jot down your ideas about vaptans, the kidney, vasopressin, and the sodium concentration in the blood.

Identify evidence and interpretations

- Turn to your E/I chart and record important pieces of evidence, interpretations, and questions that help you answer your inquiry questions from the last two texts ("Regulation of water by vasopressin" and "Vaptans for the treatment of hyponatremia").

Mon-lin Ko 8/26/2014 11:07 AM

Comment [26]:

Preparation for teaching:

This text fits nicely with the model of water regulation (R12), exploring the use of an experimental drug for hyponatremia.

Doing the task ahead of teaching will be helpful here, especially looking at both texts R12 and R13 side-by-side, looking for opportunities to students to apply what they know and evaluate how vaptans might restore balance in hyponatremic patients.

Formative assessment

It can be valuable to monitor your students progress as they evaluate how the vaptans work to treat hyponatremia. Listen to how they talk with their partners about their thinking processes, listen for active engagement and how they work through challenges together. Make the confusions and meaning making public and have students share about their thinking processes and what they figured out.

Putting it together: How does the body regulate sodium concentrations?

Think-pair-share:

- Take out your reader and E/I notetaker and look over the questions you and your classmates generated at the beginning of class.
- Spend some time thinking on your own about the questions you are able to answer, and then share your ideas with your partner. Be ready to share your ideas with your class!

Drawing on all that you now know, how would you explain **how the body regulates sodium concentrations and what happens when this balance is disrupted**? Use the space below to write down how you would explain these ideas to another student who was not a part of our class.

Mon-lin Ko 8/18/2014 10:52 AM
Comment [27]:

Summative assessment

As the final task for the Homeostasis part I, you may want to decide on a rubric or criteria for evaluating this written explanation. Co-constructing one with your class, highlighting the importance of using multiple texts, for instance, is one aspect of a "good explanation" that you may want to highlight.

Making these expectations public can help de-mystify how you plan to grade the explanation.

Writing this summary/explanation should not feel disconnected to the reading, thinking, and reasoning work that has been emphasized all along. Research suggests that students need support and practice in writing explanations, and especially when it comes to reasoning – connecting the claims with the evidence, and understanding *how* the evidence supports those claims.

Use your teacher expertise to decide what modeling might be needed so that students can be successful in synthesizing their ideas into a strong explanation

What can different types of text tell me?

Think-pair-share (individual and pairs)

- Individually turn to your Reader pages R14 - R17 and preview these three texts. What do you notice? Why might each be valuable to read? Jot a few notes about each.

- Discuss this question with a partner: Why might it be important to read texts from multiple sources?
- Then, work with your partner to record what you notice about these texts, and why it might be important to read each, in the table below.

Text	What you notice about this text
"Type 2 diabetes in the United States" *Los Angeles Times* R14	
"Kim's Story" *Diabetes in Education in Tribal Schools* R15-16	
"The Young Epidemic: The Rise in Type 2 Diabetes Among Children" *Good* R17	

Mon-lin Ko 8/26/2014 11:09 AM
Comment [28]:

Homeostasis II begins here

Making connections to biology principles:
Consider how text-and-task analyses and working through the investigation support how you'd like to build connections across the two phenomenon explored in this module: salt/water balance and sugar balance in the body, and the principle of homeostasis in the body. This could mean, for example, highlighting opportunities to engage in metacognitive conversations about what these phenomena tell us about biological systems. The graphic on the first page of the investigation, or other systems that are kept in homeostasis could be explored or discussed. The specific cases in this module simply foreground a fundamental aspect of biological systems – both on the micro and macro level.

Preparation for model building and revision
It may be especially important to do these tasks with an eye towards building and revising an explanatory model of how the body maintains blood glucose levels (see page 27).

Mon-lin Ko 8/18/2014 11:09 AM
Comment [29]:

Formative assessment
An opportunity is provided here for students to compare and contrast the three "problematizing" texts for the 2nd half of this module.

Look for ways to use this as a way to deepen students' repertoire of reading strategies – discussions about features of these texts could be accompanied by a return to the reading/talking bookmarks to see what stems could be used, or what new strategies that might be needed. Doing this early on can provide you with a keen eye towards how you'd like to tailor how students' engage with the texts that remain in the module.

Developing inquiry questions from text

Turn to "Type 2 Diabetes in the United States," page R14.

Reading and making thinking visible

- **Think aloud:** Partners take turns thinking aloud by paragraph for the first section. One partner thinks aloud while the other partner makes notes in the margin of the text about their partner's thoughts. Help each other make sense of the text.

OR

- **Talk to the text:** Individually talk to the text on the first section. Pairs take turns sharing their talk to the text comments. Help each other make sense of the text.
- Use the science reading stems to help you share your reading process.

Pair discussion

After reading, discuss and respond to the prompts.

- **Words:** What new words or word-uses did you encounter? How did you make sense of their meaning?
- **Confusions or clarifications**: What parts of the text were unclear? Where do you have questions? Work together to clarify confusing parts of the text and to answer questions that you have.
- **Reading process:** What other science reading processes were important for your reading?
- **Inquiry:** What are you noticing or wondering now about type 2 diabetes, blood glucose regulation or homeostasis? What is interesting? What is important?
- **Stellar ideas:** Select a new word, a confusion or clarification, or a reading process AND one idea or question about type 2 diabetes, blood glucose regulation or homeostasis that you or your partner can share with the class. Mark them on your text with a star.

Whole class discussion

- Share a new word, confusion or clarification, or a reading process.
- Which reading strategies helped make sense of the text?
- What additions or revisions can we make on the reading strategies list poster?
- Share new ideas about type 2 diabetes, blood glucose regulation and homeostasis.
- Add ideas and questions to the evidence interpretation posters for type 2 diabetes, blood glucose regulation and homeostasis.
- What new words can we add to our word wall?

Repeat above steps for "Kim's story" and "The Young Epidemic."

Developing inquiry questions from text, continued

Generating inquiry questions from text

- Look back at the stellar ideas you or your partners came up with for each text, use these to come up with inquiry questions about diabetes, blood glucose levels, or homeostasis.
- As you talk with your partner, record your inquiry questions in the space below, keeping track of which texts sparked which inquiry questions.

Our inquiry questions	Source text

Mon-lin Ko 8/26/2014 11:17 AM
Comment [30]:

Formative assessment (developing inquiry questions)

It may help at this point to review the inquiry questions that were developed for Homeostasis part I (page 8) to inform how you support small group work and facilitate the whole discussion. What kinds of questions are students developing? Are they descriptive? Explanatory? Are they just about diabetes? Do they make connections to salt/water balance from prior texts? Are there questions about the ***how*** and the ***why***?

Whole class discussion

Looking for evidence and making interpretations:

- Turn to your evidence and interpretation notetaker
- Decide as a class: what evidence will you look for in future texts to help you answer these questions? Make notes on your E/I notetaker to focus your work with new texts.
- Return to the three texts on page R14 - R17, identifying important pieces of evidence, interpretations, and questions in your E/I notetaker.

How does the body regulate glucose?

Teacher model

- Locate your science reading stems.
- Locate "How does the body regulate glucose?" (R18 - R19).
- Listen and write down your teacher's annotations as he/she does the modeling.

Whole class discussion

- What did you notice about how your teacher read the science text?
- What are some science reading processes that you noticed?
- Which were new or particularly useful for this text?
- What additions or revisions can we make on the reading strategies list poster?

Reading and making thinking visible

- Try out some of the reading strategies yourself on a paragraph or two using the "Modeling" section of your science reading stems and the questions below:
    - How does _____ work?
    - Does _____lead to _____?
    - What steps cause the glucose concentration to increase or decrease?
- Check in with your partner or table group members to see how others are modeling in the margins. See if you can learn new ways to read and think from your classmates.

Model building

Think-pair-share

- Before you begin, think about the following questions and then share your ideas with your partner:
    - What is a science model?
    - What is the purpose of a science model?
    - What should our science model include or be able to explain?
    - What important ideas from your E/I notetakers might you want to include?
- Decide which of these ideas is a stellar idea. Be ready to share this with your class.

Teacher model (modeling)

- Take out your science reading stems and turn to "How does the body regulate glucose?" (R18 - R19).
- Listen and write down your teacher's first modeling steps as he/she does the models for the class.

Whole class discussion

- Use your science talk stems to listen and respond to other's ideas during the discussion.
- What did you notice as your teacher was demonstrating how he/she models her ideas, based on the reading?
- What steps were helpful?

Individual/partner modeling

- Locate the annotations you used to make your reading and thinking visible on the text "How does the body regulate glucose" R18 - R19
- Work with your partner to discuss the following prompts:
    - Share some of the annotations you made on this text.
    - How do these annotations help you think about what should go in the model?
    - Using your annotations as the starting point, draw a model that explains **how the body keeps blood glucose concentrations in balance** on the next page.

Use the space on the next page to sketch out a model, keeping in mind that models help us *explain*, *understand*, and *make predictions* about science phenomena.

Our model of how the body keeps blood glucose concentrations in balance:

Mon-lin Ko 8/26/2014 11:18 AM
Comment [31]:

Reminder: **modeling and models work to support our thinking**. It may help to think about what aspects of this model the class is sure about, based on available evidence, and what aspects still need to be refined, questioned, and returned to (this is similar to the supports on the top of page 7).

Sharing and critiquing science models

Norms for sharing and critiquing models

Discuss the norms you will use as a class for sharing and critiquing models, using the following prompts:

- What is the purpose of sharing our work in class?
- How might our models benefit from being shared and critiqued?
- What criteria should we use for commenting on one another's work?

Sharing and critiquing science models

- Take out your science talk stems bookmark and identify the talk stems that you think will be most helpful for this discussion.
- Listen carefully to other groups as they present their work.
- Use talk stems to help provide feedback to other group members.
- Your teacher may wish to have a couple students share their models. Use the same norms and talk stems to provide feedback to your peers' models.

Keeping track of what we know (and don't know!)

- Re-group with your tablemates and discuss the following questions:
  - How will you respond to the feedback you received?
  - What did you see or hear from other groups' models that you liked?
  - How will you modify your model, based on the classroom discussion?
- Use different colored sticky notes provided by your teacher to label parts of your models that you…
  - Are very confident about and want to keep.
  - Would like to add to your model.
  - Still have questions about.

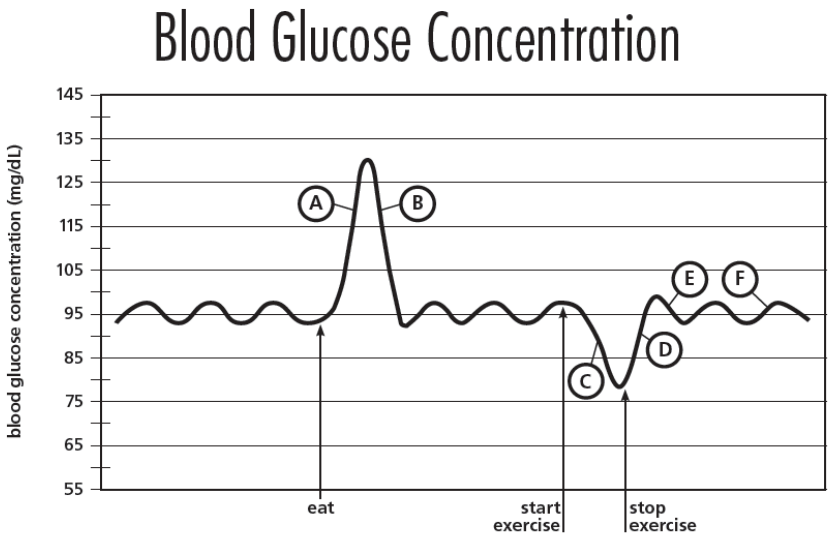
Keeping track of changes in blood glucose concentration

Preview

- Preview the model below individually and then talk with your partner about what you notice, find interesting or confusing.

Making your thinking visible and making cross-text connections

- Take out your science reading and thinking talk stems bookmark.
- Read the following diagram closely and annotate it. Look to make connections to the texts that we have read so far and to what you know about diabetes and homeostasis.



Graph obtained from Diabetes Education in Tribal Schools "Health Is Life Balance" curriculum.

On the following page, use your reading and thinking to determine what is happening to the person's blood concentration at points A-F.

Point	Is blood glucose concentration increasing or decreasing?	What *causes* the change in blood glucose concentration?* *How do you know?*
A		
B		
C		
D		
E		
F		

* Use the model you built on page 27 to help you think about what causes these changes.

Revising our model

Testing our models (partners and whole class)

Reflect on using your model: As you described what was happening to the blood glucose levels at points A-F and why those changes might be happening in a person's body, think about how you used your model to help you answer those questions.

- Reflect with your tablemates or your class: was your model a helpful tool for you?
- Did it help you *describe*, *explain*, or *make predictions* about what is going on inside the body?

Extending our model: Talk about this question with your partners:

- Could the same graph, "Blood Glucose Concentration," on page 29 be used to describe the blood glucose concentration for someone with diabetes? Why or why not?
    - Use your science talk stems to help add, clarify, and listen to one another.
    - How would this model look the same or different for someone with diabetes?
- After both partners share their ideas, come up with a consensus idea to share with your classmates.

Whole class discussion

- Use your science talk stems to listen, share, and add to your classmates' ideas.

Keeping track of our evidence and interpretation (E/I)

- Take out your E/I notetakers.
- Record any new pieces of evidence, interpretation, or questions you may have after reading, talking, and listening with your classmates

Khan Academy video: glucose insulin and diabetes

Think-pair-share

- Have you thought about videos as a kind of *text*? Talk with your partners using the following questions:
  - How are videos the same or different than other kinds of text?
  - What might they have in common?
  - Why might someone use a video or online simulation instead of a written text to communicate their ideas?
- As you may already know, diabetes exists in two forms: Type 1 and Type 2.
  - What do you think it the difference between the two types?
  - What would you want to know about these two forms of diabetes?
- Record you and your partner's ideas below.
- **Stellar idea**: put a star next to one of the ideas that you'd like to share with your class.

Making reading and thinking visible:

- Take out your E/I notetaker.
- As your teacher plays the video, jot down what you notice as important ideas that help you better understand homeostasis, diabetes, or blood glucose.

When cell communication goes wrong

Reading and making thinking visible

- **Think aloud:** Partners take turns thinking aloud by paragraph for the first section. One partner thinks aloud while the other partner makes notes in the margin of the text about their partner's thoughts. Help each other make sense of the text.

OR

- **Talk to the text:** Individually talk to the text on the first section. Pairs take turns sharing their talk to the text comments. Help each other make sense of the text.
- Use the science reading stems to help you share your reading process.

Pair discussion

After reading, discuss and respond to the prompts.

- **Words:** What new words or word-uses did you encounter? How did you make sense of their meaning?
- **Confusions or clarifications:** What parts of the text were unclear? Where do you have questions? Work together to clarify confusing parts of the text and to answer questions that you have.
- **Reading process:** What other science reading processes were important for your reading?
- **Inquiry:** What are you noticing or wondering now about type 2 diabetes or homeostasis? What is interesting? What is important?
- **Stellar ideas:** Select a new word, a confusion or clarification, or a reading process AND one idea or question about type 2 diabetes, blood glucose regulation or homeostasis that you or your partner can share with the class. Mark them on your text with a star.
- **Re-reading:** If your class has already read this text, think about the following:
  - What new insights, or questions do you have reading this for the second time?
  - What connections can you make between this text and your classroom conversations about *homeostasis* and *diabetes*?

Whole class discussion

- Share a new word, confusion or clarification, or a reading process.
- Which reading strategies helped make sense of the text?
- What additions or revisions can we make on the reading strategies list poster?
- Share new ideas about diabetes, homeostasis, or blood glucose regulation.
- Add new evidence, interpretations, and questions to your E/I notetaker.

Mon-lin Ko 8/26/2014 11:18 AM
Comment [32]:

Reminder: opportunity here to tie back to Cell Biology texts and key ideas from earlier in the semester.

This same text was provided as a candidate text for the Cell Biology section for this semester. If your class is returning to this a second time, this is an opportunity to formatively assess both reading processes and also how students think about cells in relationship to the principle of Homeostasis.

Revising models based on new evidence

The last time you reflected on your own models, you identified parts of the model that you wanted **keep**, parts of the model that you had **questions** about, and new things that you wanted to **add** to your model. Let's return to your previous model and see if we can revise it based on the new evidence we've gathered through our reading.

Model revision

Individual-think-write

Take out your Reader and E/I notetaker, your previous model on page 27 and your inquiry questions on page 24.

- Discuss with your tablemates and peers: how would you like to revise your model? The following questions may help get your discussion going:
- What questions did you have about that model that you can now answer?
- What new ideas would you like to incorporate into your model? What evidence supports your idea?
- How will you incorporate these new ideas to your model?
    - What new components need to be added?
    - What relationships between them need to be represented?
    - What kinds of visuals might help?

Mon-lin Ko 8/26/2014 11:19 AM
Comment [33]:

Reminder:

Reading/talking stems may further support this conversation (see stems under **Modeling** and **Generating explanations/models and using evidence to support ideas)**.

Pair discussion

- Take turns sharing your ideas for one minute each.
- Add notes about your partner's ideas onto your own response.
- With the sticky notes that your teacher provides, determine which parts of the model you would like to *keep*, *revise*, *add*, or *remove*.
- Choose one of the changes you would like to make to your model to share with your class.

Color of sticky note	What we want to do about our model	Rationale for our decision
	KEEP this idea	We think that _____ part of our model should stay. We are confident about this because_____.
	REVISE part of an idea	We think _____ supports part of our model, but we would like to change _____ to make it more accurate.
	ADD a new idea	We think _____ supports our model, but it also tells us that _____ should be added to make it even *more* accurate.
	REMOVE or find out more	We think _____ contradicts _____ in our original model and that we need to *remove* or *find out more* about it.
	QUESTIONS	We still have questions about _____ because we read _____ and wanted more information about _____.

Whole Class discussion

- Share the change you and your partner would like to make to your old model.
- Use science talk stems. Ask a question or respond to the ideas that your peers share.
- Take notes on your classmates' ideas.

Mon-lin Ko 8/26/2014 11:20 AM
Comment [34]:

Reminder:

Supporting equity
Ensure that both partners get to share their ideas about how to revise and update their models. The talking and reading stems can work as tools to foster productive talk.

Citing evidence and using texts as the basis of revision
Having the E/I charts and the Reader handy can support the use of text-based evidence and the use of multiple kinds of texts when creating revision to the model.

Staying open to multiple interpretations and strategies, and types of models
Anticipate that some groups may revamp their models completely at any given point. Revision is inherent to the work of building models. Encourage multiple types of models – as long as the rationale and reasoning behind its design is made clear.

Simplicity vs. complexity
Bare-bones models may need additional supports to help the reader understand how the model describes, explains or allows one to make predictions about phenomena.
A word-y model may be so complex that it is difficult to read. Engage in discussions to make these design decisions and questions public. Similar to metacognitive conversations about reading, students may benefit from hearing the problems and solutions faced by other groups.

Individual model revision

- Using your classmates' ideas, your E/I notetaker, and the texts in your reader, create a new model based the new evidence, interpretations, and questions you generated while reading the texts in this module.
- Make sure you are able to back up your ideas with evidence!

Our **revised** model of how the body keeps blood glucose concentrations in balance:

Checklist for building models:

• Does the model illustrate what leads to increases or decreases in blood glucose concentration?
• Does the model include important players in glucose homeostasis, such as insulin, glucagon, pancreas, liver, etc.?
• Does the model describe the role of insulin resistance (type 2 diabetes) or the absence of insulin (type 1 diabetes)?

Blood glucose model peer review

Presenting, reviewing and revising

Peer review is essential to science knowledge-building. Peer review provides assurance that someone who is well-informed about the field has double-checked new claims and findings. In peer review of models we ask:

- Does the model help us explain the phenomenon?
- Does our model help us address our investigation/inquiry questions?
- Does the model (explanation) account for all of the available evidence?
- Can we use the model to predict what will happen if we manipulate the phenomena?
- Does the model agree with our understandings about how the world works and other science models?

Presenters: Provide your model to your peers and give them some time to read it over before you present. Some points to address in your presentations are:

- **Significance:** The big question for us was _____. What was hard to explain was _____.
- **Purpose:** We built our model to try to explain _____. We think it helps explain, predict or describe _____ because _____.
- **Reliability and justification:** We are very confident about _____ parts of our model because _____. We are still unsure about _____ parts of **our model because** _____.
- **Future research:** We still have questions about _____.

Reviewers: Listen, read and make notes on:

- What is clear and what is unclear.
- What is misrepresented, mistaken or missing (such as evidence that is unaccounted for)?
- What does not belong in the model (things for which there are no evidence)?
- The questions you wonder about.
- Ideas for refinement or improvement.

Revising

- After hearing and feedback from your peers, return to make edits on your model on page 37.

Mon-lin Ko 8/18/2014 12:03 PM
Comment [35]:

Preparation for Peer Review:

Think back (or look over!) the summer PD notes you made when we built the MRSA model and engaged in peer critique. What did you notice during this process? What was helpful about this process of listening, reviewing, and revising your own model?

Draw on this experience to inform your own vision for students' peer review. It may be helpful to look over students' models and think about effective pairings/groupings: do you want groups with very similar or different models to talk with one another? How might this inform your goals for the peer review?