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Scientists can make things invisible

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13th August, 2008

THE ARTICLE

Scientists in the USA say they are a step closer to developing materials that could make people invisible. Researchers at the University of California have found a way to cloak humans and objects using special materials that redirect light around things. The findings, led by Professor Xiang Zhang, were published in the journals 'Nature' and 'Science'. Zhang works at the Nanoscale Science and Engineering Centre at the university. His team developed a set of artificial "meta-materials" on a microscopic scale that is measured in billionths of a metre. The researchers said the special "fishnet structure" of the nano-sized objects do not absorb or reflect light, which makes them seem invisible. They compared the light to "water flowing around a rock".

The new discovery is a huge step forward from earlier technology that only allowed the concealing of two-dimensional objects. In the future, scientists could make "invisibility clothing" to hide people and large objects. However, scientists are still a long way from designing and manufacturing invisibility cloaks. The U.S. military is extremely interested in developing this idea to bring the technology to the battlefield. The U.S. Army Research Office funded part of Dr. Zhang's research. The technology could also lead to more powerful microscopes that are able to look more closely at living cells and even tinier objects. This means scientists could look at how viruses are formed and how they grow.

WARM-UPS

1. SCIENCE: Walk around the class and talk to other students about science. Change partners often. After you finish, sit with your partner(s) and share your findings.

2. CHAT: In pairs / groups, decide which of these topics or words from the article are most interesting and which are most boring.

scientists / developing materials / being invisible / light / measurements / water / new discoveries / steps forward / invisibility clothing / battlefield technology / viruses

Have a chat about the topics you liked. Change topics and partners frequently.

3. INVISIBILITY: Would you like to be invisible? Look at the situations below. With your partner(s), write ideas about the benefits of being invisible in these situations. Change partners and share your ideas.

Situations	Benefits
Shopping	
At school / work	
Travelling	
At home	
Important meetings	
Other _____	

4. BEING INVISIBLE: Students A strongly believe being invisible will only be used in good ways; Students B strongly believe being invisible will be used in bad ways. Change partners again and talk about your roles and conversations.

5. STEPS CLOSER: With your partner(s), put a year, decade, century, or 'never' next to these possible future developments. Discuss which ones you would like to see.

- | | |
|--------------------------------------|--|
| _____ Invisibility clothing | _____ Talent downloads into the brain |
| _____ Time travel | _____ An eternal youth pill |
| _____ Holidays to Mars | _____ Personal backpack jets / helicopters |
| _____ Carbon-zero cars and factories | _____ A cure for all diseases |

6. LIGHT: Spend one minute writing down all of the different words you associate with the word 'light'. Share your words with your partner(s) and talk about them. Together, put the words into different categories.

BEFORE READING / LISTENING

1. TRUE / FALSE: Look at the article's headline and guess whether these sentences are true (T) or false (F):

- | | |
|--|-------|
| a. Scientists have invented a cloak to make people who wear it invisible. | T / F |
| b. The invisibility is created by redirecting light around objects. | T / F |
| c. The scale if the new discovery is measured in billionths of a metre. | T / F |
| d. The new discovery can stop water flowing around rocks. | T / F |
| e. Earlier technology focused on two-dimensional objects. | T / F |
| f. America's Army said it has very little interest in this new technology. | T / F |
| g. Scientists say the new research will lead to more powerful telescopes. | T / F |
| h. The technology will allow scientists to study viruses more closely. | T / F |

2. SYNONYM MATCH: Match the following synonyms from the article:

- | | |
|---------------|--------------|
| 1. closer | a. appear |
| 2. cloak | b. financed |
| 3. artificial | c. enormous |
| 4. seem | d. cover |
| 5. compared | e. very |
| 6. huge | f. synthetic |
| 7. concealing | g. smaller |
| 8. extremely | h. nearer |
| 9. funded | i. hiding |
| 10. tinier | j. likened |

3. PHRASE MATCH: Match the following phrases from the article (sometimes more than one combination is possible):

- | | |
|--|----------------------------|
| 1. developing materials that could | a. flowing around a rock |
| 2. materials that redirect | b. in developing this idea |
| 3. measured in | c. step forward |
| 4. absorb or reflect | d. billionths of a metre |
| 5. They compared the light to water | e. to the battlefield |
| 6. The new discovery is a huge | f. how viruses are formed |
| 7. The U.S. military is extremely interested | g. light around things |
| 8. bring the technology | h. make people invisible |
| 9. look more closely at living cells and | i. light |
| 10. scientists could look at | j. even tinier objects |

WHILE READING / LISTENING

GAP FILL: Put the words into the gaps in the text.

Scientists in the USA say they are a _____ closer to developing materials that could make people invisible. Researchers at the University of California have found a way to _____ humans and objects using special materials that _____ light around things. The findings, led by Professor Xiang Zhang, were published in the _____ 'Nature' and 'Science'. Zhang works at the Nanoscale Science and Engineering Centre at the university. His team developed a _____ of artificial "meta-materials" on a microscopic _____ that is measured in billionths of a metre. The researchers said the special "fishnet structure" of the nano-_____ objects do not absorb or reflect light, which makes them seem invisible. They _____ the light to "water flowing around a rock".

The new discovery is a _____ step forward from earlier technology that only allowed the concealing of two-dimensional _____. In the future, scientists could make "invisibility clothing" to _____ people and large objects. However, scientists are still a long _____ from designing and manufacturing invisibility cloaks. The U.S. military is extremely interested in developing this _____ to bring the technology to the _____. The U.S. Army Research Office funded part of Dr. Zhang's research. The technology could also lead to more powerful microscopes that are able to look more _____ at living cells and even tinier objects. This means scientists could look at how viruses are formed and how they _____.

set
redirect
compared
step
scale
journals
sized
cloak

hide
battlefield
idea
objects
grow
huge
closely
way

LISTENING: Listen and fill in the spaces.

Scientists in the USA say they are a _____ developing materials that could make people invisible. Researchers at the University of California have found _____ humans and objects using special materials _____ around things. The findings, led by professor Xiang Zhang, were published in the journals 'Nature' and 'Science'. Zhang works at the Nanoscale Science and Engineering Centre at the university. His team developed _____ artificial "meta-materials" on a microscopic _____ measured in billionths _____. The researchers said the special "fishnet structure" of the nano-sized objects do not absorb or reflect light, which makes them seem invisible. They compared the light to "water _____ rock".

The new discovery _____ forward from earlier technology that only allowed _____ two-dimensional objects. In the future, scientists could make "invisibility clothing" to hide people _____. However, scientists are still a long way from designing and manufacturing invisibility cloaks. The U.S. military is _____ in developing this _____ technology to the battlefield. The U.S. Army Research Office funded part of Dr. Zhang's research. The technology could also lead to more powerful microscopes that are able to _____ at living cells and even tinier objects. This means scientists could look at how _____ and how they grow.

AFTER READING / LISTENING

1. WORD SEARCH: Look in your dictionaries / computer to find collocates, other meanings, information, synonyms ... for the words 'nature' and 'science'.

nature	science
---------------	----------------

- Share your findings with your partners.
- Make questions using the words you found.
- Ask your partner / group your questions.

2. ARTICLE QUESTIONS: Look back at the article and write down some questions you would like to ask the class about the text.

- Share your questions with other classmates / groups.
- Ask your partner / group your questions.

3. GAP FILL: In pairs / groups, compare your answers to this exercise. Check your answers. Talk about the words from the activity. Were they new, interesting, worth learning...?

4. VOCABULARY: Circle any words you do not understand. In groups, pool unknown words and use dictionaries to find their meanings.

5. TEST EACH OTHER: Look at the words below. With your partner, try to recall how they were used in the text:

<ul style="list-style-type: none">• step• cloak• journals• set• fishnet• rock	<ul style="list-style-type: none">• forward• clothing• a long way• battlefield• microscopes• viruses
--	---

STUDENT INVISIBILITY SURVEY

Write five GOOD questions about invisibility in the table. Do this in pairs. Each student must write the questions on his / her own paper.

When you have finished, interview other students. Write down their answers.

	STUDENT 1 _____	STUDENT 2 _____	STUDENT 3 _____
Q.1.			
Q.2.			
Q.3.			
Q.4.			
Q.5.			

- Now return to your original partner and share and talk about what you found out. Change partners often.
- Make mini-presentations to other groups on your findings.

INVISIBILITY DISCUSSION

STUDENT A's QUESTIONS (Do not show these to student B)

- a) What did you think when you read the headline?
- b) What springs to mind when you hear the word 'invisible'?
- c) Would you like the ability to become invisible?
- d) What would you do if you could become invisible?
- e) What uses could an invisibility cloak have?
- f) What do you think of Professor Zhang's research?
- g) Do you think invisibility is something only from science fiction?
- h) What do you think of the idea of a two-hour invisibility pill?
- i) Would you like a job as a researcher?
- j) Can you remember how the new technology works?

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INVISIBILITY DISCUSSION

STUDENT B's QUESTIONS (Do not show these to student A)

- a) Did you like reading this article?
- b) Are you interested in reading about new discoveries in science?
- c) How much would you pay for an invisibility cloak?
- d) How do you think invisibility cloaks would change the battlefield?
- e) What kinds of large objects might people want to hide, and why?
- f) What other huge steps forward have you read about recently?
- g) Do you think other countries will worry about America's invisibility technology?
- h) Do you think more powerful microscopes will find things we never new existed?
- i) Do you think this new discovery will help in fighting diseases?
- j) What questions would you like to ask Professor Xiang Zhang?

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LANGUAGE

Scientists in the USA say they are a (1) _____ closer to developing materials that could make people invisible. Researchers at the University of California have found a way to (2) _____ humans and objects using special materials that redirect light around things. The (3) _____, led by Professor Xiang Zhang, were published in the journals 'Nature' and 'Science'. Zhang works at the Nanoscale Science and Engineering Centre at the university. His team developed a set (4) _____ artificial "meta-materials" on a microscopic scale that is measured in billionths (5) _____ a metre. The researchers said the special "fishnet structure" of the nano-sized objects do not absorb or reflect light, which makes them (6) _____ invisible. They compared the light to "water flowing around a rock".

The new discovery is a huge step forward (7) _____ earlier technology that only allowed the concealing of two-dimensional objects. In the future, scientists could make "invisibility clothing" to hide people and large objects. However, scientists are still a long way (8) _____ designing and manufacturing invisibility cloaks. The U.S. military is (9) _____ interested in developing this idea to bring the technology to the battlefield. The U.S. Army Research Office (10) _____ part of Dr. Zhang's research. The technology could also lead to more powerful microscopes that are (11) _____ to look more closely at living cells and even tinier objects. This means scientists could look at how viruses are formed and how they (12) _____.

Put the correct words from the table below in the above article.

- | | | | | |
|-----|-------------|---------------|---------------|----------------|
| 1. | (a) ladder | (b) steps | (c) stair | (d) step |
| 2. | (a) cloak | (b) croak | (c) choke | (d) coke |
| 3. | (a) finding | (b) findings | (c) funding | (d) find |
| 4. | (a) by | (b) for | (c) of | (d) with |
| 5. | (a) by | (b) for | (c) of | (d) with |
| 6. | (a) seems | (b) seem | (c) seam | (d) seams |
| 7. | (a) with | (b) by | (c) for | (d) from |
| 8. | (a) from | (b) by | (c) with | (d) for |
| 9. | (a) extreme | (b) extremely | (c) extremity | (d) extremes |
| 10. | (a) find | (b) fund | (c) funding | (d) funded |
| 11. | (a) capable | (b) ability | (c) able | (d) capability |
| 12. | (a) grow | (b) growth | (c) grown | (d) growing |

WRITING:

Write about **invisibility** for 10 minutes. Correct your partner’s paper.

HOMework

1. VOCABULARY EXTENSION: Choose several of the words from the text. Use a dictionary or Google's search field (or another search engine) to build up more associations / collocations of each word.

2. INTERNET: Search the Internet and find out more about Professor Zhang's research. Share what you discover with your partner(s) in the next lesson.

3. DISCOVERIES: Make a poster about the new technologies scientists will be working on in the year 2100. Show your work to your classmates in the next lesson. Did you all have similar things?

4. INVISIBLE: Write a magazine article about the invisibility cloak. Include imaginary interviews with two very different people who bought one. What did they do with it?

Read what you wrote to your classmates in the next lesson. Write down any new words and expressions you hear from your partner(s).

5. LETTER: Write a letter to Professor Xiang Zhang. Ask him three questions about his research. Make three suggestions on what he should work on in the future. Read your letter to your partner(s) in your next lesson. Your partner(s) will answer your questions.

6. DIARY / JOURNAL: You bought an invisibility cloak. Write about what you have done with it. Read your entry to your classmates in the next lesson.

ANSWERS

TRUE / FALSE:

- a. F b. T c. T d. F e. T f. F g. F h. T

SYNONYM MATCH:

- | | | | |
|-----|------------|----|-----------|
| 1. | closer | a. | appear |
| 2. | cloak | b. | financed |
| 3. | artificial | c. | enormous |
| 4. | seem | d. | cover |
| 5. | compared | e. | very |
| 6. | huge | f. | synthetic |
| 7. | concealing | g. | smaller |
| 8. | extremely | h. | nearer |
| 9. | funded | i. | hiding |
| 10. | tinier | j. | likened |

PHRASE MATCH:

- | | | | |
|-----|---|----|-------------------------|
| 1. | developing materials that could | a. | flowing around a rock |
| 2. | materials that redirect | b. | in developing this idea |
| 3. | measured in | c. | step forward |
| 4. | absorb or reflect | d. | billionths of a metre |
| 5. | They compared the light to water | e. | to the battlefield |
| 6. | The new discovery is a huge | f. | how viruses are formed |
| 7. | The U.S. military is extremely interested | g. | light around things |
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| 9. | look more closely at living cells and | i. | light |
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GAP FILL:

Scientists can make things invisible

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The new discovery is a **huge** step forward from earlier technology that only allowed the concealing of two-dimensional **objects**. In the future, scientists could make "invisibility clothing" to **hide** people and large objects. However, scientists are still a long **way** from designing and manufacturing invisibility cloaks. The U.S. military is extremely interested in developing this **idea** to bring the technology to the **battlefield**. The U.S. Army Research Office funded part of Dr. Zhang's research. The technology could also lead to more powerful microscopes that are able to look more **closely** at living cells and even tinier objects. This means scientists could look at how viruses are formed and how they **grow**.

LANGUAGE WORK

- 1 - d 2 - a 3 - b 4 - c 5 - c 6 - b 7 - d 8 - a 9 - b 10 - d 11 - c 12 - a