TEXTO 1

NEW RESEARCH SUGGESTS AN OLD IDEA OF GEOENGINEERING HAS MORE MERIT THAN LONG SUSPECTED

As the earth continues to warm, it is becoming increasingly clear that we cannot ignore the possibilities of geoengineering, the branch of science that develops techniques to artificially cool the planet. Indeed, it may soon become necessary to take drastic action to prevent the worst effects of climate change. However, that does not mean that geoengineering experiments should be undertaken without caution and care, because the underlying impact of those experiments could very well end up causing more harm than help.

Iron fertilization, which is a geoengineering method mostly considered in the late 1990s to early 2000s, came about as an idea because of a very fundamental oceanographic question: why do certain areas of the ocean have very low amounts of plankton, even when they have enough nutrients for those plankton to grow?

In most areas of the ocean, phytoplankton, the tiny plant-like creatures that produce most of the oxygen in the ocean (and about half of the oxygen on the planet), need only two things to grow: light and nutrients. But there are some areas of the ocean that contain high levels of nutrients and no phytoplankton, even during times of the year when light conditions are right. These regions, called high-nutrient, low-chlorophyll regions, puzzled oceanographers until 1990, when a scientist named John Martin proposed that iron might be the missing link.

Iron is a micronutrient – living things do not need a lot of it, but what they do need, they cannot do without. Places like the Southern Ocean, off the coast of Antarctica, have almost no iron at all. This is because iron is a terrestrial micronutrient, meaning it comes from the land. The most common sources of iron to the ocean are rivers and wind-blown dust from deserts. Antarctica, covered in ice and isolated from other continents, has none of that. Martin proposed that that was why the phytoplankton were not growing. To prove it, scientists went out and conducted iron fertilization experiments by artificially adding iron to the ocean and see if the phytoplankton grew. Within a day of adding dissolved iron into the ocean, scientists observed a phytoplankton bloom.

That research was interesting and exciting, but the most exciting part for some people was an interesting link between phytoplankton and carbon dioxide. See, just like plants on land, phytoplankton are photosynthesizers. They use up carbon dioxide to create oxygen, and with so much open, iron-limited space in the Southern Ocean, oceanographic researchers across multiple institutions worldwide started to wonder if, with just enough iron, we could stop climate change completely.

It did not work out quite that nicely. Artificial iron fertilization was proven to be ineffective at removing carbon from the atmosphere. And over concerns, published in a letter to Science in 2008, that continuing to conduct these studies might harm the natural environment by allowing invasive species to grow or by altering the ecosystem in ways they could not predict, the research was effectively halted. (Some continued under the table. In 2012, a US-based entrepreneur named Russ George defied an ocean-dumping moratorium, convincing the Haida Nation to conduct an iron fertilization project off the coast of British Columbia, Canada, to boost salmon populations, with the idea that salmon would feed off of the resulting phytoplankton bloom.)

Since 2008, there have been almost no papers talking about iron in the Southern Ocean affecting the climate. However, new research by Gary Shaffer, a researcher at the University of Magallanes in Punta Arenas, Chile, and Fabrice Lambert, an assistant professor at the Pontifical Catholic University of Chile, suggests that the question of iron is not fully closed. Their research, which is focused on atmospheric dust, a major source of oceanic iron, suggests that dust, and the iron in it, may have contributed to the onset of the ice ages. And understanding how the Earth has naturally cooled in the past, prior to human intervention, would allow us to better understand how Earth might cool in the future.

FONTE: Adaptado de: E. Bonnin. **How atmospheric dust might help cool the planet.** Disponível em: https://massivesci.com/articles/dust-ice-age-climate-change-geoengineering/. Acesso em 11 mai 2018.

TEXTO 2

ENGINEERS DEVELOP TECHNIQUE TO MAKE ADAPTIVE MATERIALS

Engineers at the U.S. Army Research Laboratory (ARL) and the University of Maryland have developed a technique that causes a composite material to become stiffer and stronger on-demand when exposed to ultraviolet light. This on-demand control of composite behavior could enable a variety of new capabilities for future Army rotorcraft design, performance and maintenance.

ARL's Dr. Frank Gardea, a research engineer, said the focus of the research was on controlling how molecules interact with each other. He said the aim was to "have them interact in such a way that changes at a small size, or nanoscale, could lead to observed changes at a larger size, or macroscale."

Dr. Bryan Glaz, chief scientist of ARL's Vehicle Technology Directorate said "an important motivation for this work is the desire to engineer new structures, starting from the nanoscale, to enable advanced rotorcraft concepts that have been proposed in the past, but were **infeasible** due to limitations in current composites. One of the most important capabilities envisioned by these concepts is a significantly reduced maintenance burden due to compromises we make to fly at high speeds", he said.

The reduced scheduled maintenance of future Army aviation platforms is an important technological driver for future operating concepts. "The enhanced mechanical properties with potentially low weight penalties, enabled by the new technique, could lead to nanocomposite based structures that would enable rotorcraft concepts that we cannot build today," Glaz said.

The joint work, recently published in Advanced Materials Interfaces, shows that these composite materials could become 93-percent stiffer and 35-percent stronger after a five minute exposure to ultraviolet light. The technique consists of attaching ultraviolet light reactive molecules to reinforcing agents like carbon nanotubes. These reactive reinforcing agents are then embedded in a polymer. Upon ultraviolet light exposure, a chemical reaction occurs such that the interaction between the reinforcing agents and the polymer increases, thus making the material stiffer and stronger.

The researchers said the chemistry used here is generally applicable to a variety of reinforcement/polymer combinations thereby expanding the utility of this control method to a wide range of material systems. "This research shows that it is possible to control the overall material property of these nanocomposites through molecular engineering at the interface between the composite components. This is not only important for fundamental science but also for the optimization of structural component response," said Dr. Zhongjie Huang, a postdoctoral research fellow at the University of Maryland.

Army researchers conceived of this fundamental approach for the potential of "enabling new leap-ahead capabilities in support of the Future Vertical Lift Army Modernization Priority," officials said. "In this instance, the development of advanced structures to enable leap-ahead Army aviation capabilities not currently feasible due to limitations in mechanical properties of current materials," Glaz said. "This is especially important for the envisioned future operating environment which will require extended periods of operation without the opportunity to return to stationary bases for maintenance."

Collaboration between the ARL and the University of Maryland was crucial in the development of this method. "In our lab at UMD we have been developing unique carbon nanomaterials and chemistry but it was not until Gardea approached us did we become aware of the intriguing challenge and opportunity for reconfigurable composite materials," said Dr. YuHuang Wang, professor of the Department of Chemistry and Biochemistry at the University of Maryland. "Together we have achieved something that is quite remarkable."

FONTE: Adaptado de: U.S. Army Research Laboratory. **Engineers develop technique to make adaptive materials.** Disponível em: https://www.sciencedaily.com/releases/2018/04/180417155603.htm. Acesso em 11 mai 2018.

QUESTÕES

As questões de 1 a 5 referem-se ao TEXTO 1:

1) O texto NÃO oferece uma definição para

(A) dióxido de carbono.

(B) fertilização por ferro.

(C) fitoplâncton.

(D) geoengenharia.

2) O texto alerta para

(A) a escassez de espaços com alta presença de iluminação natural.

(B) a necessidade de se criar fitoplâncton artificialmente.

(C) as consequências do uso de dióxido de carbono como nutriente.

(D) os perigos dos experimentos inadequados da geoengenharia.

3) Como o texto responde a pergunta apresentada no 2º parágrafo?

4) O que a pesquisa mais recente aponta sobre as mudanças climáticas do passado e as possíveis mudanças futuras?

5) O Analise as afirmativas abaixo e assinale a seguir.

I. A utilização de ferro nos oceanos teve impacto no aumento de fitoplâncton.
II. Após 2008, o uso de ferro nos oceanos foi completamente descontinuado.
III. A pesquisa da universidade chilena contradisse o proposto por John Martin.

(A) I e III estão corretas.

(B) II e III estão corretas.

(C) Apenas I está correta.

(D) Apenas II está correta.

As questões de 6 a 10 referem-se ao TEXTO 2:

6) A nova técnica desenvolvida pelo Army Research Laboratory (ARL) e pela Universidade de Maryland

(A) depende do uso da luz ultravioleta.

(B) não tem aplicabilidade imediata.

(C) ocorre apenas na macroescala.

(D) reduz os custos dos compósitos.

7) O sentido de "infeasible", destacado no 3º parágrafo, corresponde ao seguinte trecho:

(A) "… starting from the nanoescale…" (3º parágrafo).

(B) "… that we cannot build today…" (4º parágrafo).

(C) "… enabling new leap-ahead capabilities…" (7º parágrafo).

(D) "… something that is quite remarkable" (8º parágrafo).

8) Como o 5º parágrafo do texto detalha as informações contidas no 1º parágrafo?

9) O Analise as afirmativas abaixo e assinale a seguir.

I. Os cientistas da ARL não se valeram de técnicas de engenharia molecular.
II. A técnica desenvolvida não tem sua utilização restringida à indústria bélica.
III. Os pesquisadores da Universidade de Maryland foram os usuários pioneiros de compósitos reconfiguráveis.

(A) Apenas I está correta.

(B) Apenas II está correta.

(C) I e III estão corretas.

(D) II e III estão corretas.

10) Para quais avanços futuros a pesquisa descrita no texto é considerada fundamental?

RASCUNHO