

Source: Okayama University (JAPAN), Public Relations and Information Strategy

For immediate release: 18 March 2019

Okayama University research: Game changer: How do bacteria play Tag?

(Okayama, 18 March) **In a recent study published in *Proteins and Proteomics* researchers at Okayama University show how bacteria attach to organisms before infecting them.**

Bacteria have been long invading animals and plants. One of their most intricate but less understood mechanisms is their ability to adhere to other organisms. A research team led by Professor Takashi Tamura at Okayama University has unravelled the role of a molecule, DsbA, and how its chemical properties control this adhering function of bacteria.

Professor Tamura have previously shown that before bacteria can adhere to other living objects certain structures on the bacteria's surface must be stabilized to form a strong scaffold. Special proteins found within the bacteria are responsible for this stabilization. To understand this process better, Professor Takashi Tamura's team used a virus that attacks bacteria only (bacteriophage). This virus binds to an appendage-like structure found on the bacterial surface. DsbA is the protein responsible for stabilizing this appendage to facilitate this attachment. To decipher how DsbA does its job, the team created several mutants of bacteria, each with a different form of the DsbA protein. The code responsible for conferring DsbA a chemical charge was different in each mutant. A bacteriophage called as M13 was then introduced into these bacteria, grown on a plate.

Ideally, when M13 successfully attaches to and infects bacteria, "plaques" of viral colonies will be observed on the plate, in place of the bacterial colonies. These plaques were measured for all the different mutants. It was found that one particular mutant (DsbA [CDIC]) had 40 times more plaques than any other mutant or the unmutated bacteria. The charge on this mutant was much lower than the unmutated protein. However, another mutant, also with a low charge, did not have more plaques. This suggested that the mutated code of (DsbA [CDIC]) could be bringing about additional effects. Using structural mapping the team then found that DsbA [CDIC] had enlarged binding pockets, compared to the other variants. This could facilitate better binding of the scaffolding appendage.

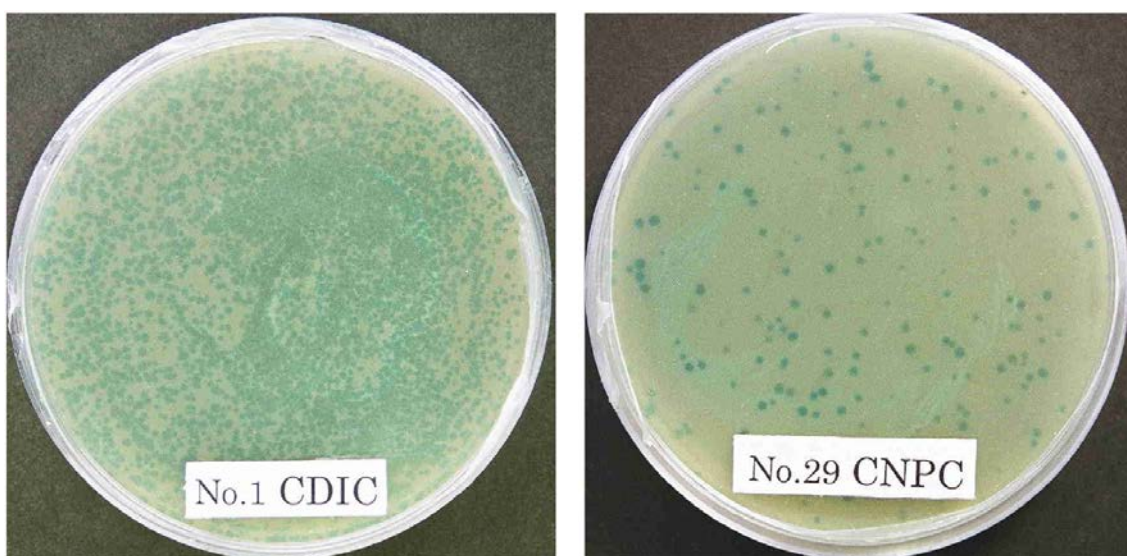
Insights into these mechanisms of their attachment can help build strategies to combat bacteria. Antibiotic resistance is also spread from one bacterium to another by close contact. Designing drugs that could inactivate the factors driving DsbA function seems like one such strategy.

Background

Proteins and structure: Proteins that bind to and modulate the activity of other proteins are known as enzymes. Special regions on these proteins called active sites are responsible for

this function. The active site consists of a 'binding site', a pocket where the partner protein actually binds and a 'catalytic site' which gives the protein a chemical charge. This charge provides the energy for the protein to undergo a chemical reaction. In the case of DsbA, codes on the catalytic site were changed to create the mutants.

Bacteriophage: Bacteriophage or "bacteria eaters" are viruses that attack and subsequently hijack bacteria. The first step in this process requires the bacteriophage to attach itself onto the bacterial surface. Typically, the bacteriophage does this by binding to F-pilus, an appendage-like structure found on the bacteria's surface.



Caption

DsbA [CDIC] could generate many more viral plaques (green dots) compared to another DsbA mutant (right).

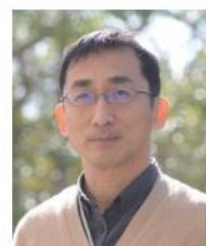
Reference

Shinya Sutoh, Yuko Uemura, Yuko Yamaguchi, Asako Kiyotou, Rena Sugihara, Makiko Nagayasu, Mihoko Kurokawa, Koreaki Ito, Naoki Tsunekawa, Michiko Nemoto, Kenji Inagaki, Takashi Tamura. Redox-tuning of oxidizing disulfide oxidoreductase generates a potent disulfide isomerase. *Biochimica et Biophysica Acta - Proteins and Proteomics*, 1867(2019), 194-201.

[DOI : doi.org/10.1016/j.bbapap.2018.12.005](https://doi.org/10.1016/j.bbapap.2018.12.005)

Correspondence to

Professor Takashi Tamura, Ph.D.
 Department of Bioresources Chemistry,
 Okayama University Graduate School of Environmental
 and Life Science, 1-1-1, Tsushima-naka, Kita-ku, Okayama
 700-8530, Japan.
 E-mail: tktamura@okayama-u.ac.jp



Professor Takashi Tamura

Further information

Okayama University

1-1-1 Tsushima-naka , Kita-ku , Okayama 700-8530, Japan

Public Relations and Information Strategy

E-mail: www-adm@adm.okayama-u.ac.jp

Website: http://www.okayama-u.ac.jp/index_e.html

Okayama Univ. e-Bulletin: <http://www.okayama-u.ac.jp/user/kouhou/ebulletin/>

About Okayama University (YouTube):

<https://www.youtube.com/watch?v=iDL1coqPRYI>

Okayama University Image Movie (YouTube):

<https://www.youtube.com/watch?v=KU3hOIXS5kk>



OKAYAMA
UNIVERSITY

Okayama University Medical Research Updates (OU-MRU)

The whole volume : [OU-MRU \(1-\)](#)

Vol.1 : [Innovative non-invasive 'liquid biopsy' method to capture circulating tumor cells from blood samples for genetic testing](#)

Vol.2 : [Ensuring a cool recovery from cardiac arrest](#)

Vol.3 : [Organ regeneration research leaps forward](#)

Vol.4 : [Cardiac mechanosensitive integrator](#)

Vol.5 : [Cell injections get to the heart of congenital defects](#)

Vol.6 : [Fourth key molecule identified in bone development](#)

Vol.7 : [Anticancer virus solution provides an alternative to surgery](#)

Vol.8 : [Light-responsive dye stimulates sight in genetically blind patients](#)

Vol.9 : [Diabetes drug helps towards immunity against cancer](#)

Vol.10 : [Enzyme-inhibitors treat drug-resistant epilepsy](#)

Vol.11 : [Compound-protein combination shows promise for arthritis treatment](#)

Vol.12 : [Molecular features of the circadian clock system in fruit flies](#)

Vol.13 : [Peptide directs artificial tissue growth](#)

Vol.14 : [Simplified boron compound may treat brain tumours](#)

Vol.15 : [Metamaterial absorbers for infrared inspection technologies](#)

Vol.16 : [Epigenetics research traces how crickets restore lost limbs](#)

Vol.17 : [Cell research shows pathway for suppressing hepatitis B virus](#)

Vol.18 : [Therapeutic protein targets liver disease](#)

Vol.19 : [Study links signalling protein to osteoarthritis](#)

Vol.20 : [Lack of enzyme promotes fatty liver disease in thin patients](#)

Vol.21 : [Combined gene transduction and light therapy targets gastric cancer](#)

Vol.22 : [Medical supportive device for hemodialysis catheter puncture](#)

Vol.23 : [Development of low cost oral inactivated vaccines for dysentery](#)

Vol.24 : [Sticky molecules to tackle obesity and diabetes](#)

Vol.25 : [Self-administered aroma foot massage may reduce symptoms of anxiety](#)

Vol.26 : [Protein for preventing heart failure](#)

Vol.27 : [Keeping cells in shape to fight sepsis](#)

Vol.28 : [Viral-based therapy for bone cancer](#)

Vol.29 : [Photoreactive compound allows protein synthesis control with light](#)

- Vol.30 : [Cancer stem cells' role in tumor growth revealed](#)
- Vol.31 : [Prevention of RNA virus replication](#)
- Vol.32 : [Enzyme target for slowing bladder cancer invasion](#)
- Vol.33 : [Attacking tumors from the inside](#)
- Vol.34 : [Novel mouse model for studying pancreatic cancer](#)
- Vol.35 : [Potential cause of Lafora disease revealed](#)
- Vol.36 : [Overloading of protein localization triggers cellular defects](#)
- Vol.37 : [Protein dosage compensation mechanism unravelled](#)
- Vol.38 : [Bioengineered tooth restoration in a large mammal](#)
- Vol.39 : [Successful test of retinal prosthesis implanted in rats](#)
- Vol.40 : [Antibodies prolong seizure latency in epileptic mice](#)
- Vol.41 : [Inorganic biomaterials for soft-tissue adhesion](#)
- Vol.42 : [Potential drug for treating chronic pain with few side effects](#)
- Vol.43 : [Potential origin of cancer-associated cells revealed](#)
- Vol.44 : [Protection from plant extracts](#)
- Vol.45 : [Link between biological-clock disturbance and brain dysfunction uncovered](#)
- Vol.46 : [New method for suppressing lung cancer oncogene](#)
- Vol.47 : [Candidate genes for eye misalignment identified](#)
- Vol.48 : [Nanotechnology-based approach to cancer virotherapy](#)
- Vol.49 : [Cell membrane as material for bone formation](#)
- Vol.50 : [Iron removal as a potential cancer therapy](#)
- Vol.51 : [Potential of 3D nanoenvironments for experimental cancer](#)
- Vol.52 : [A protein found on the surface of cells plays an integral role in tumor growth and sustenance](#)
- Vol.53 : [Successful implantation and testing of retinal prosthesis in monkey eyes with retinal degeneration](#)
- Vol.54 : [Measuring ion concentration in solutions for clinical and environmental research](#)
- Vol.55 : [Diabetic kidney disease: new biomarkers improve the prediction of the renal prognosis](#)
- Vol.56 : [New device for assisting accurate hemodialysis catheter placement](#)
- Vol.57 : [Possible link between excess chewing muscle activity and dental disease](#)
- Vol.58 : [Insights into mechanisms governing the resistance to the anti-cancer medication cetuximab](#)
- Vol.59 : [Role of commensal flora in periodontal immune response investigated](#)
- Vol.60 : [Role of commensal microbiota in bone remodeling](#)
- Vol.61 : [Mechanical stress affects normal bone development](#)
- Vol.62 : [3D tissue model offers insights into treating pancreatic cancer](#)
- Vol.63 : [Promising biomarker for vascular disease relapse revealed](#)
- Vol.64 : [Inflammation in the brain enhances the side-effects of hypnotic medication](#)



Okayama University supports the Sustainable Development Goals

◆About Okayama University

Okayama University is one of the largest comprehensive universities in Japan with roots going back to the Medical Training Place sponsored by the Lord of Okayama and established in 1870. Now with 1,300 faculty and 13,000 students, the University offers courses in specialties ranging from medicine and pharmacy to humanities and physical sciences.

Okayama University is located in the heart of Japan approximately 3 hours west of Tokyo by Shinkansen.

Website: http://www.okayama-u.ac.jp/index_e.html



Japan (日本)



Hirofumi Makino, M.D., Ph.D.
President, Okayama University

“Okayama University supports the Sustainable Development Goals”



OKAYAMA UNIVERSITY
×
SDGs

