

[Login](#) [Register](#) [Contact Us](#)

[HOME](#) [NEWS](#) [VIDEOS](#) [RARE DISEASES](#) [IWISH](#) [SPONSOR US](#) [LINKS](#)

[JOBS](#) [ABOUT US](#) [EVENTS](#) [CONTACT US](#)

Home > News > Research > DNA and the 'magic rings' trick

Research News

[All](#) [People](#) [Research](#) [Treatment](#) [Submit News](#)

Find Articles Search

DNA and the 'Magic Rings' Trick

[f](#) [t](#) [v](#) [p](#) [+](#) More

Thursday, October 14, 2010

A new study from UC Davis shows how, like a conjuring trick with interlocking rings, two interlocked pieces of DNA are separated after DNA is copied or repaired.

The finding was published online Oct. 10 in the journal Nature Structural and Molecular Biology.

While reconstituting the DNA repair system of yeast in a test tube, the researchers found that a complex of proteins called Sgs1, Top3 and Rmi1 allow one DNA strand to open and the other to pass through.

"This protein complex does what magicians do," said lead researcher Stephen Kowalczykowski, distinguished professor of microbiology in the UC Davis College of Biological Sciences and a member of the of the UC Davis Cancer Center.

The discovery may hold answers to a human disease called Bloom's syndrome, which increases the risk of cancer, among other health problems. Sgs1 appears to be the yeast equivalent of the human protein tied to Bloom's syndrome, Kowalczykowski said.

DNA suffers damage all the time both from outside influences, such as radiation or chemicals, and also from normal cellular processes. Unrepaired, DNA damage can lead to cancer or birth defects. Several genes linked to a high risk of cancer, such as the "breast cancer gene" BRCA2, have turned out to be involved in DNA repair.

When damage crosses both strands of the DNA double helix, a sophisticated repair process is activated that uses the same DNA sequence on the matching chromosome. One of the strands is stripped back, leaving an exposed single strand. The matching chromosome is brought alongside and partly unwound, and acts as a template to repair the broken piece.

At this point, the two chromosomes are intact but attached at two points through structures called "Holliday junctions," where DNA strands from the two chromosomes cross each other. To finish the process, the chromosomes have to separate -- like the magician's interlocking rings, one has to pass through the other.

Working with a mix of yeast proteins and DNA in a test tube, Kowalczykowski and his colleagues showed that the Sgs1/Top3/Rmi1 protein complex attaches to the paired DNA at the Holliday junction, opens up a gap in one strand and passes the other through it, allowing the two chromosomes to separate cleanly and dissolving the junction.

Patients with Bloom's syndrome show extensive swapping of chunks of DNA between chromosomes. Kowalczykowski is convinced that the problem is due to poor dissolution of Holliday junctions in these patients.

Holliday junctions were only definitively shown to exist in mitotically dividing cells in April this year, in a paper by UC Davis researchers Malgosia Bzymek and Neil Hunter, associate professor of microbiology.

Kowalczykowski's collaborators in the new study were UC Davis postdoctoral researchers Petr Cejka and Jody Plank, and Oxford University scientists Csanad Bachrati and Ian Hickson.

In a paper published in Nature last month, Kowalczykowski's lab also showed that the Sgs1/Top3/Rmi1 complex of proteins is involved in the first step of DNA repair -- cleaning the broken end to leave a single strand of DNA.

The research was funded by the National Institutes of Health, the Swiss National Science Foundation, and Cancer Research UK.

About UC Davis

For more than 100 years, UC Davis has engaged in teaching, research and public service that matter to California and transform the world. Located close to the state capital, UC Davis has 32,000 students, an annual research budget that exceeds \$600 million, a comprehensive health system and 13 specialized research centers. The university offers interdisciplinary graduate study and more than 100 undergraduate majors in four colleges -- Agricultural and Environmental Sciences, Biological Sciences, Engineering, and Letters and Science. It also houses six professional schools -- Education, Law, Management, Medicine, Veterinary Medicine and the Betty Irene Moore School of Nursing.

Media contact(s):

Stephen Kowalczykowski
Microbiology
(530) 752-5938
skowalczykowski@ucdavis.edu

Andy Fell, UC Davis News Service
(530) 752-4533
ahfell@ucdavis.edu
Source: [UC Davis](#)

0 votes **You need to be [logged in](#) to rate.**

[Log in now](#) to comment.

Recent

[Most Viewed](#)

[Comments](#)

[Dogs Provide Insight Into Rare Genetic ...](#)

A rare genetic disease may be going to the dogs. About six in 100,000 babies are born ... [more...](#)

[Unraveling the Genetic Mystery of ...](#)

Why was there a sudden drop in the incidence of leprosy at the end of the Middle Ages? To ... [more...](#)

[Mount Sinai Researchers Succeed In ...](#)

New York - By transferring four genes into mouse fibroblast cells, researchers at the ... [more...](#)

[Metabolic Molecule Drives Growth Of ...](#)

COLUMBUS, Ohio - A study led by researchers at The Ohio State University Comprehensive ... [more...](#)

[Victoza® \(Liraglutide \[RDNA Origin\] ...](#)

BAGSVAERD, Denmark and PLAINSBORO, N.J., Novo Nordisk presented data further supporting ... [more...](#)

[Subscribe](#) [More Topics](#)

[Woman Suffers Rare Paralysis After Flu ...](#)

[FDA Accepts Once Daily 23 Mg Aricept\(R ...](#)

[Seattle Genetics Initiates Pivotal ...](#)

[Novartis International AGACZ885 Phase ...](#)

[Bharatbook.com Distributes](#)

[Subscribe](#) [More Topics](#)

[Rare disease affects one in a million people \(1\)](#)

[NW Bio Announces That Another Brain Cancer Patient From Phase I/II DCVax@-L Trials Has Surpassed Ten-Year Cancer-Free Survival \(1\)](#)

[New York - By transferring four genes into mouse fibroblast cells, researchers at the ... third for area in recent months \(1\)](#)

[Has The Pendulum Swung Too Far in Favor of Rare Diseases? \(1\)](#)

[Quetiapine-Related Dysphagia \(1\)](#)