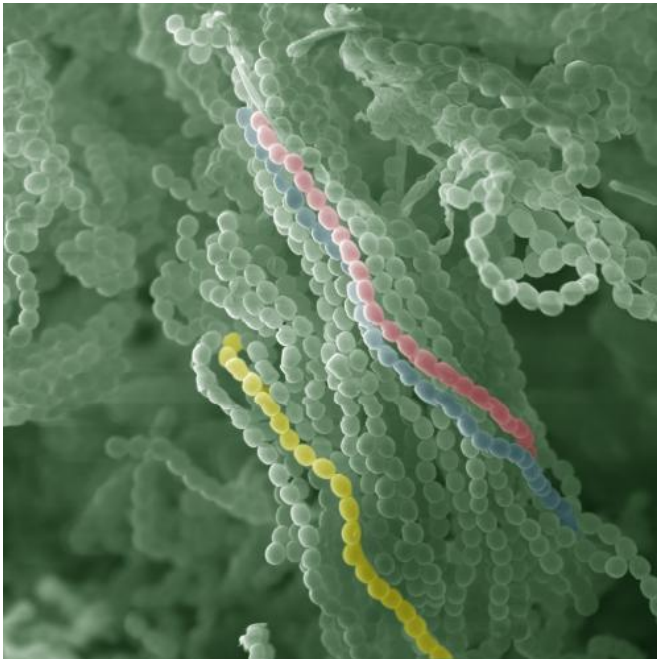


Molds are able to reproduce sexually, unlike we thought for 100 years

8 January 2013, by Dr. Julia Weiler



Scanning electron microscopic image of asexual conidiospores from the penicillin producer *Penicillium chrysogenum* © Lehrstuhl Allgemeine und Molekulare Botanik, RUB

For over 100 years, it was assumed that the penicillin-producing mould fungus *Penicillium chrysogenum* only reproduced asexually through spores. An international research team led by Prof. Dr. Ulrich Kück and Julia Böhm from the Chair of General and Molecular Botany at the Ruhr-Universität has now shown for the first time that the fungus also has a sexual cycle, i.e. two "genders". Through sexual reproduction of *P. chrysogenum*, the researchers generated fungal strains with new biotechnologically relevant properties - such as high penicillin production without the contaminating chrysogenin.

The team from Bochum, Göttingen, Nottingham (England), Kundl (Austria) and Sandoz GmbH

reports in *PNAS*. The article will be published in this week's Online Early Edition and was selected as a cover story.

Only penicillin producer

About 100 years ago, [Alexander Fleming](#) demonstrated the formation of penicillin in *Penicillium chrysogenum*. To date, there is no other known producer of the antibiotic penicillin, which has an annual global market value of about six billion Euros.

Combining genes and breeding offspring with new properties

Not only animals and plants, but also many microorganisms such as fungi and algae can reproduce sexually. The advantage: the progenies possess a combination of genes from both mating partners and thus have new properties. [Sexual reproduction](#) in fungi is, however, not the rule. Most reproduce via [spores](#) which, in the case of moulds, occur as white, green or black deposits on spoiled food. These spores only bear the genes of one parent fungus. "Five years ago we already detected the existence of so-called sex genes in *Penicillium chrysogenum*", says Prof. Kück. Now, the researchers have discovered specific environmental conditions in which the fungus actually reproduces sexually. The decisive thing was to breed fungal strains in the dark under [oxygen deprivation](#) conditions in a nutrient medium supplemented with the vitamin biotin. The offspring exhibited new properties, both at the molecular level, as well as in their phenotypes.

Results could be applicable to other fungi

Using so-called microarray analysis, the biologists also investigated the activity of all the approximately 12,000 genes of the mould [fungus](#). The result: the sex genes control the activity of biologically relevant genes, for example those for

penicillin production. "We presume that the findings can also be applied to other fungi", says Ulrich Kück, "such as *Penicillium citrinum* and *Aspergillus terreus* that produce cholesterol-lowering statins, or *Penicillium brevicompactum* and *Tolypocladium inflatum*, which produce immunosuppressives that are used in all organ transplantations". The researchers conducted the work in the Christian Doppler Laboratory "Biotechnology of Fungi" at the Ruhr-Universität with funding from the Christian Doppler Society (Vienna).

More information: J. Böhm, B. Hoff, C.M. O'Gorman, S. Wolfers, V. Klix, D. Binger, I. Zadra, H. Kürnsteiner, S. Pöggeler, P.S. Dyer, U. Kück (2013): Sexual reproduction and mating-type – mediated strain development in the penicillin-producing fungus *Penicillium chrysogenum*, *PNAS*, [DOI: 10.1073/pnas.1217943110](https://doi.org/10.1073/pnas.1217943110)

Provided by Ruhr-Universitaet-Bochum

APA citation: Molds are able to reproduce sexually, unlike we thought for 100 years (2013, January 8) retrieved 16 May 2021 from <https://phys.org/news/2013-01-molds-sexually-thought-years.html>

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