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Komagataeibacter xylinus

Komagataeibacter xylinus is a species of bacteria best known for its ability to produce cellulose.

Contents

History and taxonomy

The species was first described in 1886 by Adrian John Brown, who identified the bacteria while studying fermentation. Brown gave the species the name *Bacterium xylinum*. It has since been known by several other names, mainly *Acetobacter xylinum* and *Gluconacetobacter xylinus*.[2] It was given its current name, with the establishment of the new genus *Komagataeibacter*, in 2012.[2][3][4] It is the type species of the genus.[1]

Genome and metabolism

K. xylinus is a member of the acetic acid bacteria, a group of Gram-negative aerobic bacteria that produce acetic acid during fermentation. *K. xylinus* is unusual among the group in also producing cellulose. Bacterial cellulose (also sometimes known as nanocellulose) is involved in the formation of biofilms.[2] It is chemically identical to plant cellulose, but has distinct physical structure and properties.[5]

The genome of a cellulose-deficient strain of *K. xylinus* was sequenced in 2011,[6] and followed by the genomes of cellulose-producing strains in 2014[7] and 2018.[8] The first cellulose-producing strain had a genome consisting of one chromosome 3.4 megabase pairs and five plasmids, of which one is a "megaplasmid" of about 330 kilobase pairs.[7]

Key genes related to cellulose production occur in the four-gene operon *bcsABCD*, which codes for the four subunits of the cellulose synthase enzyme. All four genes are required for efficient cellulose production *in vivo*, although BcsA and BscB

Komagataeibacter xylinus	
Scientific classification	
Kingdom:	Bacteria
Phylum:	Proteobacteria
Class:	Alphaproteobacteria
Order:	Rhodospirillales
Family:	Acetobacteraceae
Genus:	*Komagataeibacter*
Species:	***K. xylinus***

Binomial name

Komagataeibacter xylinus
(Brown 1886) Yamada *et al*. 2013

Synonyms[1]

- "*Bacterium xylinum*" Brown 1886
- *Gluconoacetobacter xylinus* (Brown 1886) Yamada *et al* 1998
- *Gluconacetobacter xylinus* corrig. (Brown 1886) Yamada *et al*. 1998
- *Acetobacter xylinus* corrig. (Brown 1886) Yamada 1984
- *Acetobacter aceti* subsp. *xylinum* (Brown 1886) De Ley and Frateur 1974 (Approved Lists 1980)
- *Acetobacter xylinum* (Brown 1886) Yamada 1984
- *Acetobacter aceti* subsp. *xylinus* corrig. (Brown 1886) De Ley and Frateur 1974 (Approved Lists 1980

are sufficient *in vitro*. Several other genes in the *K. xylinus* genome are also involved in cellulose production and regulation, including a cellulase enzyme.[2]

- "*Komagatabacter xylinus*" (Brown 1886) Yamada *et al*. 2012

Uses and significance

K. xylinus was used for a long time as a model organism for the study of cellulose production in plants. It is also studied in its own right to explore bacterial biofilm production, cell-cell communication, and other topics of interest.[2] Production of bacterial cellulose for industrial uses has been the subject of extensive research, but is limited by productivity and scalability.[5][8]

Red *nata de coco* in syrup from the Philippines

Acetobacter xylinus is found to be the main microorganism in the culture of Kombucha.[9]

K. xylinus is also traditionally used in the Philippines for the production of jelly-like *nata de piña* and *nata de coco* desserts, made from pineapple juice and coconut water, respectively. The former has been produced since the 18th century.[10][11]

References

1. "Komagataeibacter" (https://lpsn.dsmz.de/genus/komagataeibacter). *List of prokaryotic names with standing in nomenclature*. Retrieved 5 July 2018.
2. Römling, Ute; Galperin, Michael Y. (September 2015). "Bacterial cellulose biosynthesis: diversity of operons, subunits, products, and functions" (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4676712). *Trends in Microbiology*. **23** (9): 545–557. doi:10.1016/j.tim.2015.05.005 (https://doi.org/10.1016%2Fj.tim.2015.05.005). PMC 4676712 (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4676712). PMID 26077867 (https://pubmed.ncbi.nlm.nih.gov/26077867).
3. Yamada, Yuzo; Yukphan, Pattaraporn; Vu, Huong Thi Lan; Muramatsu, Yuki; Ochaikul, Duangjai; Nakagawa, Yasuyoshi (12 June 2011). "Subdivision of the genus Gluconacetobacter Yamada, Hoshino and Ishikawa 1998: the proposal of Komagatabacter gen. nov., for strains accommodated to the Gluconacetobacter xylinus group in the α-Proteobacteria". *Annals of Microbiology*. **62** (2): 849–859. doi:10.1007/s13213-011-0288-4 (https://doi.org/10.1007%2Fs13213-011-0288-4).
4. Yamada, Yuzo; Yukphan, Pattaraporn; Lan Vu, Huong Thi; Muramatsu, Yuki; Ochaikul, Duangjai; Tanasupawat, Somboon; Nakagawa, Yasuyoshi (2012). "Description of Komagataeibacter gen. nov., with proposals of new combinations (Acetobacteraceae)" (https://doi.org/10.2323%2Fjgam.58.397). *The Journal of General and Applied Microbiology*. **58** (5): 397–404. doi:10.2323/jgam.58.397 (https://doi.org/10.2323%2Fjgam.58.397).
5. Klemm, Dieter; Kramer, Friederike; Moritz, Sebastian; Lindström, Tom; Ankerfors, Mikael; Gray, Derek; Dorris, Annie (6 June 2011). "Nanocelluloses: A New Family of Nature-Based Materials". *Angewandte Chemie International Edition*. **50** (24): 5438–5466. doi:10.1002/anie.201001273 (https://doi.org/10.1002%2Fanie.201001273). PMID 21598362 (https://pubmed.ncbi.nlm.nih.gov/21598362).
6. Ogino, H.; Azuma, Y.; Hosoyama, A.; Nakazawa, H.; Matsutani, M.; Hasegawa, A.; Otsuyama, K.-i.; Matsushita, K.; Fujita, N.; Shirai, M. (28 November 2011). "Complete Genome Sequence of NBRC 3288, a Unique Cellulose-Nonproducing Strain of Gluconacetobacter xylinus Isolated from Vinegar" (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3232855). *Journal of Bacteriology*. **193** (24): 6997–6998. doi:10.1128/JB.06158-11 (https://doi.org/10.1128%2FJB.06158-11). PMC 3232855 (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3232855). PMID 22123756 (https://pubmed.ncbi.nlm.nih.gov/22123756).

7. Kubiak, Katarzyna; Kurzawa, Marta; Jędrzejczak-Krzepkowska, Marzena; Ludwicka, Karolina; Krawczyk, Mariusz; Migdalski, Andrzej; Kacprzak, Magdalena M.; Loska, Damian; Krystynowicz, Alina; Bielecki, Stanisław (April 2014). "Complete genome sequence of Gluconacetobacter xylinus E25 strain—Valuable and effective producer of bacterial nanocellulose". *Journal of Biotechnology*. **176**: 18–19. doi:10.1016/j.jbiotec.2014.02.006 (https://doi.org/10.1016%2Fj.jbiotec.2014.02.006). PMID 24556328 (https://pubmed.ncbi.nlm.nih.gov/24556328).
8. Liu, Miao; Liu, Lingpu; Jia, Shiru; Li, Siqi; Zou, Yang; Zhong, Cheng (19 April 2018). "Complete genome analysis of Gluconacetobacter xylinus CGMCC 2955 for elucidating bacterial cellulose biosynthesis and metabolic regulation" (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5908849). *Scientific Reports*. **8** (1): 6266. doi:10.1038/s41598-018-24559-w (https://doi.org/10.1038%2Fs41598-018-24559-w). ISSN 2045-2322 (https://www.worldcat.org/issn/2045-2322). PMC 5908849 (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5908849). PMID 29674724 (https://pubmed.ncbi.nlm.nih.gov/29674724).
9. Jankovic, I., & Stojanovic, M. (1994). Microbial and chemical composition, growth, therapeutical and antimicrobial characteristics of tea fungus. Mikrobiologija (Yugoslavia).
10. Sutanto, Agus Tri (2012). "Pineapple Liquid Waste as Nata De Pina Raw Material" (https://www.semanticscholar.org/paper/Pineapple-Liquid-Waste-as-Nata-De-Pina-Raw-Material-Sutanto/a367ea50b8acaf48880ecff216f2a2ac3125ba20). *Makara, Teknologi*. **16** (1): 63–67.
11. Vergara, Benito S.; Idowu, Panna Melizah H.; Sumangil, Julia H. (1999). *Nata de Coco: A Filipino Delicacy* (http://scinet.dost.gov.ph/union/Downloads/nast_Vergara%20BS%20Nata%20De%20Coco_422.pdf) (PDF). National Academy of Sciences and Technology, Philippines. ISBN 9718538615.
