**Carlsberg Research Laboratory**
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# CARLSBERG RESEARCH LABORATORY

ANNUAL REPORT 2018

SCIENTIFIC STAFF AT CARLSBERG RESEARCH LABORATORY

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**Director of Research Support & Project Management**

Niels Lund-Johansen

**Commercial Director**

Gustav Hambraeus

## Raw Materials platform

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**Professor (Associated)**

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**Project Leaders**

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**Scientists and Postdocs**

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**PhD student**

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## Yeast & Fermentation platform

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## New Ingredients platform

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**Distinguished Professor (Associated)**

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Renil Manat

**Scientists and Postdocs**

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## Brewing Science & Technology platform

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**Project Leaders**

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**Senior Scientist**

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**Senior Brewer**

Finn Lok

**Technical Brewers**

Dimitrios Mouras

**Scientists and Postdocs**

Katarzyna Krucewicz, Lucia Marri, Raimon Pares Viader, Michela Della Negra, Julia R. Hafborsdottir, Juliana M. Stoica, Stefano Soprani, David Martinez, Ali Farsi, Yanyan Su, Rolf Ringborg, Matias Falk Bjerregaard

**PhD student**

Anders Bagger Sørensen

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PEER-REVIEWED PUBLICATIONS

**Achkar,N.P., Cho,S.K., Poulsen,C., Arce,A.L., Re,D.A., Giudicatti,A.J., Karayekov,E., Ryu,M.Y., Choi,S.W., Harholt,J., *et al.*** (2018) A Quick HYL1-Dependent Reactivation of MicroRNA Production Is Required for a Proper Developmental Response after Extended Periods of Light Deprivation. *Developmental Cell*, **46**, 236–247.

**Botticella,E., Sestili,F., Sparla,F., Moscatello,S., Marri,L., Cuesta-Seijo,J.A., Falini,G., Battistelli,A., Trost,P. and Lafiandra,D.** (2018) Combining mutations at genes encoding key enzymes involved in starch synthesis affects the amylose content, carbohydrate allocation and hardness in the wheat grain. *Plant Biotechnology Journal,* **16**, 1723–1734.

**Braumann,I., Urban,W., Preuβ,A., Dockter,C., Zakhrabekova,S. and Hansson,M.** (2018) Semi-dwarf barley (Hordeum vulgare L.) brh2 and ari-l mutants are deficient in a U-box E3 ubiquitin ligase. *Plant Growth Regulation*, **86**, 223–234.

**Braumann,I., Dockter,C., Beier,S., Himmelbach,A., Lok,F., Lundqvist,U., Skadhauge,B., Stein,N., Zakhrabekova,S., Zhou,R., *et al.*** (2018) Mutations in the gene of the Gα subunit of the heterotrimeric G protein are the cause for the brachytic1 semi-dwarf phenotype in barley and applicable for practical breeding. *Hereditas*, **155**, 10.

**da Costa,R.R., Hu,H., Pilgaard,B., Vreeburg,S.M.E., Schückel,J., Pedersen,K.S.K., Kracun,S.K., Busk,P.K., Harholt,J., Sapountzis,P., *et al.*** (2018) Enzyme Activities at Different Stages of Plant Biomass Decomposition in Three Species of Fungus-Growing Termites. *Applied and Environmental Microbiology,* **84**.

**Damgaard,P. de B., Marchi,N., Rasmussen,S., Peyrot,M., Renaud,G., Korneliussen,T., Moreno-Mayar,J.V., Pedersen,M.W., Goldberg,A., Usmanova,E., *et al.*** (2018) 137 ancient human genomes from across the Eurasian steppes. *Nature*, **557**, 369–374.

**De Porcellinis,A.J., Nørgaard,H., Brey,L.M.F., Erstad,S.M., Jones,P.R., Heazlewood,J.L. and Sakuragi,Y.** (2018) Overexpression of bifunctional fructose-1,6-bisphosphatase/sedoheptulose-1,7-bisphosphatase leads to enhanced photosynthesis and global reprogramming of carbon metabolism in Synechococcus sp. PCC 7002. *Metabolic engineering,* **47**, 170–183.

**Desai,P.R., Lengeler,K., Kapitan,M., JanΓμen,S.M., Alepuz,P., Jacobsen,I.D. and Ernst,J.F.** (2018) The 5′ Untranslated Region of the Transcript Promotes Its Translation To Regulate Hyphal Morphogenesis in. *mSphere*, **3**.

**Gutiérrez,A., Boekhout,T., Gojkovic,Z. and Katz,M.** (2018) Evaluation of non-Saccharomyces yeasts in the fermentation of wine, beer and cider for the development of new beverages. *Journal of the Institute of Brewing*, **124**, 389–402.

**Hesselbart,A., Junker,K. and Wendland,J.** (2018) Draft Genome Sequence of CBS 7830, a Predacious Yeast Belonging to the Saccharomycetales. *Genome Announcements*, **6**.

**Jensen,J.K., Busse-Wicher,M., Poulsen,C.P., Fangel,J.U., Smith,P.J., Yang,J.-Y., Peña,M.-J., Dinesen,M.H., Martens,H.J., Melkonian,M., *et al.*** (2018) Identification of an algal xylan synthase indicates that there is functional orthology between algal and plant cell wall biosynthesis. *New Phytologist,* **218**, 1049–1060.

**Junker,K., Bravo Ruiz,G., Lorenz,A., Walker,L., Gow,N.A.R. and Wendland,J.** (2018) The mycoparasitic yeast Saccharomycopsis schoenii predates and kills multi-drug resistant Candida auris. *Scientific reports*, **8**.

**Knoch,E., Sugawara,S., Mori,T., Poulsen,C., Fukushima,A., Harholt,J., Fujimoto,Y., Umemoto,N. and Saito,K.** (2018) Third DWF1 paralog in Solanaceae, sterol Δ^sup 24^-isomerase, branches withanolide biosynthesis from the general phytosterol pathway. *Proc. Natl. Acad. Sci. U. S. A.*, **115**.

**Louf,J.-F., Zheng,Y., Kumar,A., Bohr,T., Gundlach,C., Harholt,J., Poulsen,H.F. and Jensen,K.H.** (2018) Imbibition in plant seeds. *Physical Review,* **98**.

**Murozuka,E., Massange-Sánchez,J.A., Nielsen,K., Gregersen,P.L. and Braumann,I.** (2018) Genome wide characterization of barley NAC transcription factors enables the identification of grain-specific transcription factors exclusive for the Poaceae family of monocotyledonous plants. *PLoS One*, **13**.

**Nielsen,M.M., Ruzanski,C., Krucewicz,K., Striebeck,A., Cenci,U., Ball,S.G., Palcic,M.M. and Cuesta-Seijo,J.A.** (2018) Crystal Structures of the Catalytic Domain of Arabidopsis thaliana Starch Synthase IV, of Granule Bound Starch Synthase From CLg1 and of Granule Bound Starch Synthase I of Cyanophora paradoxa Illustrate Substrate Recognition in Starch Synthases. *Front. Plant Sci.*, **9**, 1138.

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**Silvestro,D., Villette,C., Delecolle,J., Olsen,C.E., Motawia,M.S., Geoffroy,P., Miesch,M., Jensen,P.E., Heintz,D. and Schaller,H.** (2018) Vitamin D-5 in Arabidopsis thaliana. *Scientific Reports*, **8**, 1–8.

**Trier,N., Izarzugaza,J., Chailyan,A., Marcatili,P. and Houen,G.** (2018) Human MHC-II with Shared Epitope Motifs Are Optimal Epstein-Barr Virus Glycoprotein 42 Ligands-Relation to Rheumatoid Arthritis. *International journal of molecular sciences*, **19**.

**Zhou,N., Katz,M., Knecht,W., Compagno,C. and Piškur,J.** (2018) Genome dynamics and evolution in yeasts: A long-term yeast-bacteria competition experiment. *PLoS One*, **13**, 1–16.

## CONFERENCE ABSTRACTS AND PRESENTATIONS

**Harholt, J.** Mixed Linkage Glucans are Ubiquitous in Higher Plants - Evidence for CslB as Mixed Linkage Glucan Synthases. VIII Cell wall research Conference. Asilomar, CA, USA (2018).

**Colomer, M.S., Funch, B., Jochen, F.** Influence of Brettanomyces claussenii and Brettanomyces bruxelles in bioflavoring of beer. International Specialized Symposium on Yeasts (ISSY), Bariloche, Argentina (2018).

## MASTER THESES

**Christensen, O.R.:** Towards solving the mystery: Regulation mechanisms of mixed-linkage glucan. MSc thesis, University of Copenhagen, August, 2018.

**MacGregor, G.:** Predictive screening for compounds of interest to the brewing industry in Humulus lupulus. MSc thesis, University of Copenhagen, August, 2018.

**Molia, E.:** Screening non-conventional yeasts for beer bioflavouring. MSc thesis, Aalborg University, August, 2018.

PUBLISHED PATENT APPLICATIONS AND GRANTED PATENTS

**Breddam, K., Skadhauge, B., Lok, F., Olsen. O., Bech, L.M., Knudsen, S.** Barley with reduced lipoxygenase activity. Patent. no.: AR074913 (Argentina).

**Donaldson, Iain., Vaag, P., Gojkovic, Z.** Method for producing beverages by acid removal. Patent no.: ZL 201380045309.6 (China), 116988 (Ukraine).

**Hambraeus, G., Sørensen, S.B., Breddam, K., Knudsen. S., Bech, L.M., Skadhauge, B., Olsen, O.** Barley and malt-derived beverages with low dimethyl sulfide level. Patent. no.: AR074430 (Argentina).

**Hambraeus, G., Sørensen, S.B., Breddam, K., Knudsen. S., Bech, L.M., Skadhauge, B., Olsen, O.** Beverage prepared from a barley plant with low dimethyl sulfide levels, wherein such plant carries nucleotide substitutions, deletions or insertions in the gene encoding enzyme MMT; malt composition; products derived from the plant, and procedure for generating barley plants having a total loss of functional MMT. Patent. no.: 56.827 (Chile).

**Hambraeus, G., Sørensen, S.B., Breddam, K., Knudsen. S., Bech, L.M., Skadhauge, B., Olsen, O.** Barley and malt-derived beverages with low DMS level. Patent no.: 029777 (Eurasia), 60174 (Thailand).

**MeldaL, M., Manat, R.** Polymer material, a container, a food storage material and a method for preparation of the polymer material. Patent no.: 293751 (India).

**MeldaL, M., Manat, R., Vesborg, S.** Coating of hydroxylated surfaces by gas phase grafting. Patent no.: 302751 (India).

**Møller, B., Mikkelsen, M., Jensen, M., Gojkovic, Z.** Beverages containing barley Beta-glucan. Publ. No.: CN 109068692 (China).

**Riis, P., Knudsen, S., Skadhauge, B., Bech, L.M., Olsen, O.** Energy saving brewing method**.** Publ. No.: 173417 (Thailand).

**Riis, P., Knudsen, S., Skadhauge, B., Bech, L.M., Olsen, O.** Energy saving brewing method Patent no.: AR081635B1 (Argentina).

**Rossignol, H., Manat. R., Vesborg, S.** Plant based material for injection molding. Publ. No.: CN 108473690 (China), 3380545 (Europe), - (India), 2018346667 (United States).

**Solodovnikova, N., Andersen, J. F., Sanchez, R. G., Gojkovic, Z.** Yeast for preparing alcoholic beverages. Publ. No.: CN 108064270 (China), 2018-500034 (Japan), US 2018/0163168 (United States).

**Vaag, P., Garde, A., Gojkovic, Z.** Flavour Stable Beverages. Patent no.: 2014375450 (Australia).

**Wendt, T., Thomsen, H.C., Striebeck, A., Rasmussen, M.W., Carciofi, M., Olsen, O., Knudsen, S., Skadhauge, S.** Predetermined nucleotide substitutions. Publ. No.: WO 2018/001884, - (Uruguay).

**Wendt, T., Krucewicz, K., Marri, L., Skadhauge, B., Lok, F., Knudsen, S., Olsen, O.** Refined Cereal-based Beverages. Publ. No.: AR108927A1 (Argentina), WO 2018/001882, - (Uruguay).