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Curriculum Vitae 2013

Positions: Professor, University of Copenhagen. Consultant Microbiologist, Department of Clinical Microbiology, Hvidovre Hospital, Hvidovre, Denmark since 1997.

Responsibilities: Head of MRSA Knowledge Center. Consultant for Molecular Biology, Virology and Chlamydia section. Head of Research and Development. Founder and Member of Board, QuantiBact A/S.

Academic degrees: Medical doctor, University of Copenhagen 1980, Specialist in Clinical Microbiology 1994, Business Economy, Copenhagen College of Business 1992, Doctor of Medical Science 1996.

Areas of Expertise: Expert in MRSA, Infection control, HIV and Chlamydia. Has consulted for UNICEF (HIV-testing), for Euro Health Group (Laboratory implementation of a HIV treatment program in Mombasa, Kenya), The Danish National Board of Health, The Danish Environmental Protection Agency, The Danish Medicines Agency, The Danish Cancer Society. A founder of QuantiBact A/S, a Biotech company based on a patent by Henrik Westh and Gorm Lisby. Chairmen of Advisory board SeqNet.org.

Major Research Focus: The MRSA KnowledgeCenter has been established to control MRSA in our Region. Our research has a practical approach looking at evolution, epidemiology, typing, carriage, characteristics of patients' illnesses and outcomes, infection-control and eradication therapies with the goal of keeping MRSA out of hospitals.

More than 120 scientific papers and more than 250 presentations at International congresses and meetings. 2300 citations and h-index 27

Advisor of PhD students

PhD, MD Margit Staum Kaltoft. Streptococcus pneumoniae in childhood. 2003.

MD, DMSc Kristian Schønning. Antibody neutralization ved HIV-1. 2003

PhD Cand scient Nuno Faria. Molecular epidemiology of methicillin-resistant Staphylococcus aureus: typing strategies and epidemiology trends 2009.

PhD, MD Sidsel Böcher. The influence of eradication of MRSA carriage for spread of MRSA. 2010

PhD Cand scient Teresa Conceicao. New methods for typing staphylococci. 2010.

PhD MD Mette Damkjær Bartels. Evolution of Community onset MRSA in Copenhagen. 2011

PhD MD Uffe Schneider. Properties of twisted intercalated nucleic acid (TINA). 2011.

PhD student Cand scient Ana Tavares. Oeiras Portugal. Community associated MRSA in Portugal. 2008-

PhD student MD Sissel Skovgaard. How biocides modulate the population of Staphylococcus epidermidis. Submitted May 2013

PhD student MD Maria Frølund. New causes of urethritis. 2010-

PhD student MD Katrine Hartung Hansen, ESBL 2011-

PhD student Cand scient Mara Baldry Antivirulence Therapy (Marie Curie PhD scholarship) 2013-

PhD student MD Mette Pinholdt. Battling antimicrobial resistance by reducing importance of Enterococcus resistome. 2013-

International collaborating partners

Professor Herminia de Lencastre ITQB, Portugal, Professor Alexander Tomasz, Rockefeller University, NY, USA. Alex Friedrich and Bert Niesters, Groningen, The Netherlands. Uli Nübel, Wernigerode, Germany, Francois Balloux, London, UK, Rory Bowden, Oxford, UK.

Publications

Substantial Decrease in Vancomycin-Resistant Enterococcus faecium Outbreak Duration and Number of Patients During the Danish COVID-19 Lockdown: A Prospective Observational Study

Gisselø, K. L., Rubin, I. M. C., Knudsen, M. S., From-Hansen, M., Stangerup, M., Kavalaris, C. P., Pinholt, M., Møllerup, S., Westh, H., Bartels, M. D. & Petersen, A. M., Jan 2022, In: Microbial drug resistance (Larchmont, N.Y.). 28, 1, p. 73-80 8 p.

Presence of SARS-CoV-2 in semen and the impact of COVID-19 on the male reproductive system

Hansen, C. B., Leineweber, T. D., Jørgensen, N., Schneider, U. V., Westh, H., Freiesleben, N. L. C., Nielsen, H. S. & Lauritsen, M. P., 20 Dec 2021, In: Ugeskrift for Læger. 183, 51

Danish Whole-Genome-Sequenced *Candida albicans* and *Candida glabrata* Samples Fit into Globally Prevalent Clades
Szarvas, J., Rebelo, A. R., Bortolaia, V., Leekitcharoenphon, P., Schrøder Hansen, D., Nielsen, H. L., Nørskov-Lauritsen, N., Kemp, M., Røder, B. L., Fridmodt-Møller, N., Søndergaard, T. S., Coia, J. E., Østergaard, C., Westh, H. & Aarestrup, F. M., 12 Nov 2021, In: *Journal of fungi* (Basel, Switzerland). 7, 11, 962.

Genomic analysis of 600 vancomycin-resistant *Enterococcus faecium* reveals a high prevalence of ST80 and spread of similar vanA regions via IS1216E and plasmid transfer in diverse genetic lineages in Ireland
Egan, S. A., Kavanagh, N. L., Shore, A. C., Møllerup, S., Samaniego Castruita, J. A., O'Connell, B., McManus, B. A., Brennan, G. I., Pinholt, M., Westh, H. & Coleman, D. C., 8 Nov 2021, (E-pub ahead of print) In: *The Journal of antimicrobial chemotherapy*.

A major outbreak of covid-19 at a residential care home

Andersen, C. Ø., Buch, I., Castruita, J. A. S., Jakobsen, N. G., Jensen, C. B., Westh, H., Marvig, R. L., Pedersen, M. S., Schønning, K. & Pinholt, M., 1 Oct 2021, In: *Danish Medical Journal*. 68, 10, A03210227.

Evaluation of the Hologic Panther Fusion MRSA Assay for the detection of MRSA in ESwab specimens obtained from nose, throat, and perineum

Bartels, M. D., Knudsen, D., Westh, H. & Schønning, K., Oct 2021, In: *European journal of clinical microbiology & infectious diseases* : official publication of the European Society of Clinical Microbiology. 40, 10, p. 2177-2183 7 p.

Investigation of the introduction and dissemination of vanB *Enterococcus faecium* in the Capital Region of Denmark and development of a rapid and accurate clone-specific vanB *E. faecium* PCR

Pinholt, M., Møllerup, S., Boye, K., Worning, P., Holzknicht, B. J., Nygaard, S., Nielsen, K. L., Hasman, H., Roer, L., Hammerum, A. M., Westh, H. & Schønning, K., Sep 2021, In: *The Journal of antimicrobial chemotherapy*. 76, 9, p. 2260-2267 8 p.

***Staphylococcus saprophyticus* Causing Infections in Humans Is Associated with High Resistance to Heavy Metals**

Lawal, O. U., Fraqueza, M. J., Worning, P., Bouchami, O., Bartels, M. D., Goncalves, L., Paixão, P., Goncalves, E., Toscano, C., Empel, J., Urbaś, M., Domínguez, M. A., Westh, H., de Lencastre, H. & Miragaia, M., 17 Jun 2021, In: *Antimicrobial Agents and Chemotherapy*. 65, 7, e0268520.

***Staphylococcus saprophyticus* From Clinical and Environmental Origins Have Distinct Biofilm Composition**

Lawal, O. U., Barata, M., Fraqueza, M. J., Worning, P., Bartels, M. D., Goncalves, L., Paixão, P., Goncalves, E., Toscano, C., Empel, J., Urbaś, M., Domínguez, M. A., Westh, H., de Lencastre, H. & Miragaia, M., 7 Jun 2021, In: *Frontiers in Microbiology*. 12, p. 1-13 13 p., 663768.

Rapid Open-Source SNP-Based Clustering Offers an Alternative to Core Genome MLST for Outbreak Tracing in a Hospital Setting

Szarvas, J., Bartels, M. D., Westh, H. & Lund, O., 1 Apr 2021, In: *Frontiers in Microbiology*. 12, p. 1-8 8 p., 636608.

The global dissemination of hospital clones of *Enterococcus faecium*

van Hal, S. J., Willems, R. J. L., Gouliouris, T., Ballard, S. A., Coque, T. M., Hammerum, A. M., Hegstad, K., Westh, H., Howden, B. P., Malhotra-Kumar, S., Werner, G., Yanagihara, K., Earl, A. M., Raven, K. E., Corander, J., Bowden, R. & Enterococcal Group, 30 Mar 2021, In: *Genome Medicine*. 13, 1, p. 1-12 12 p., 52.

Foodborne Origin and Local and Global Spread of *Staphylococcus saprophyticus* Causing Human Urinary Tract Infections

Lawal, O. U., Fraqueza, M. J., Bouchami, O., Worning, P., Bartels, M. D., Gonçalves, M. L., Paixão, P., Gonçalves, E., Toscano, C., Empel, J., Urbaś, M., Domínguez, M. A., Westh, H., de Lencastre, H. & Miragaia, M., Mar 2021, In: *Emerging Infectious Diseases*. 27, 3, p. 880-893 14 p.

Repeated introduction and spread of the MRSA clone t304/ST6 in Northern Europe

Bartels, M. D., Worning, P., Andersen, L. P., Bès, M., Enger, H., Ås, C. G., Hansen, T. A., Holzknicht, B. J., Larssen, K. W., Laurent, F., Mäkitalo, B., Pichon, B., Svartström, O. & Westh, H., Feb 2021, In: *Clinical Microbiology and Infection*. 27, 2, p. 284.e1-284.e5

Prevalence of MRSA nasal carriage among pregnant women in Copenhagen

Holm, M. K. A., Winther, T. N., Kammann, S., Rasmusson, M. S., Brooks, L., Westh, H. & Bartels, M. D., 29 Jan 2021, In: PLoS One. 16, 1, p. 1-6 6 p., e0246343.

Sex-associated Risk Factors for Co-infection with Chlamydia trachomatis and Neisseria gonorrhoea among Patients Presenting to a Sexually Transmitted Infection Clinic

Barati Sedeh, F., Thomsen, S. F., Larsen, H. K., Westh, H. & Salado-Rasmussen, K., 4 Jan 2021, In: Acta Dermato-Venereologica. 101, 1, p. adv00356 adv00356.

SARS-CoV-2 in first trimester pregnancy: a cohort study

la Cour Freiesleben, N., Egerup, P., Vauvert Römmelmayer Hviid, K., Rosenbek Severinsen, E., Kolte, A. M., Westergaard, D., Fich Olsen, L., Prætorius, L., Zedeler, A., Hellerung Christiansen, A-M., Reinhardt Nielsen, J., Bang, D., Berntsen, S., Ollé-López, J., Ingham, A., Bello-Rodríguez, J., Marie Storm, D., Ethelberg-Findsen, J., Hoffmann, E. R., Wilken-Jensen, C., Stener Jørgensen, F., Westh, H., Løvendahl Jørgensen, H. & Nielsen, H. S., 1 Jan 2021, In: Human reproduction (Oxford, England). 36, 1, p. 40-47 8 p.

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Clinical Manifestations in Children with Staphylococcal Bacteremia Positive for Panton-Valentine Leucocidin: A Nationwide Survey in a Low Methicillin-Resistance Setting

Bybeck Nielsen, A., Larsen, A. R., Petersen, A., Schønheyder, H. C., Westh, H., Benfield, T. & Nygaard, U., Sep 2020, In: The Pediatric infectious disease journal. 39, 9, p. 274-276 3 p.

Association between vancomycin-resistant Enterococcus faecium colonization and subsequent infection: a retrospective WGS study

Rubin, I. M. C., Pedersen, M. S., Møllerup, S., Kaya, H., Petersen, A. M., Westh, H. & Pinholt, M., 1 Jul 2020, In: The Journal of antimicrobial chemotherapy. 75, 7, p. 1712-1715 4 p.

Sensitivity, specificity, inclusivity and exclusivity of the updated Aptima Combo 2 assay, which provides detection coverage of the new diagnostic-escape Chlamydia trachomatis variants

Unemo, M., Hansen, M., Hadad, R., Puolakkainen, M., Westh, H., Rantakokko-Jalava, K., Thilesen, C., Cole, M. J., Boiko, I., Lan, P. T., Golparian, D., Ito, S. & Sundqvist, M., 16 Jun 2020, In: BMC Infectious Diseases. 20, 1, p. 1-6 6 p., 419.

A Chlamydia trachomatis 23S rRNA G1523A variant escaping detection in the Aptima Combo 2 assay (Hologic) was widespread across Denmark in July-September 2019

Hadad, R., Skov Jensen, J., Westh, H., Grønbaek, I., Jessen Schwartz, L., Nielsen, L., Müller Vang, T., Nielsen, R., Sandborg Weinreich, L., Skov, M. N., Olsen, M., Kjølseth Møller, J., Kolmos, B., Unemo, M. & Hoffmann, S., Jun 2020, In: APMIS - Journal of Pathology, Microbiology and Immunology. 128, 6, p. 440-444 5 p.

Core genome multi-locus sequence typing as an essential tool in a high-cost livestock-associated meticillin-resistant Staphylococcus aureus CC398 hospital outbreak

Slott Jensen, M. L., Skov, M. N., Kristiansen, H. P., Toft, A., Lundgaard, H., Gumpert, H., Westh, H., Holm, A., Kolmos, H. J. & Kemp, M., Apr 2020, In: The Journal of hospital infection. 104, 4, p. 574-581 8 p.

Aktuel kighostepidemi - hvad skal jeg vide?

Ignatiussen, M., Westh, H. & Bartels, M. D., Feb 2020, In: Månedsskrift for Almen Praksis. p. 889-893 5 p.

Evolution and Global Transmission of a Multidrug-Resistant, Community-Associated Methicillin-Resistant *Staphylococcus aureus* Lineage from the Indian Subcontinent

Steinig, E. J., Duchene, S., Robinson, D. A., Monecke, S., Yokoyama, M., Laabei, M., Slickers, P., Andersson, P., Williamson, D., Kearns, A., Goering, R. V., Dickson, E., Ehricht, R., Ip, M., O'Sullivan, M. V. N., Coombs, G. W., Petersen, A., Brennan, G., Shore, A. C., Coleman, D. C., Pantosti, A., de Lencastre, H., Westh, H., Kobayashi, N., Heffernan, H., Strommenger, B., Layer, F., Weber, S., Aamot, H. V., Skakni, L., Peacock, S. J., Sarovich, D., Harris, S., Parkhill, J., Massey, R. C., Holden, M. T. G., Bentley, S. D. & Tong, S. Y. C., 26 Nov 2019, In: mBio. 10, 6, p. 1-20 20 p., e01105-19.

Resistance to piperacillin/tazobactam in *Escherichia coli* resulting from extensive IS26-associated gene amplification of blaTEM-1

Hansen, K. H., Andreasen, M. R., Pedersen, M. S., Westh, H., Jelsbak, L. & Schønning, K., 1 Nov 2019, In: The Journal of antimicrobial chemotherapy. 74, 11, p. 3179-3183 5 p.

Trends and prediction of antimicrobial susceptibility in urinary bacteria isolated in European emergency departments: the EuroUTI 2010-2016 Study

Westh, H., Pedersen, M. & EuroUTI 2010-2016 Study Group , 1 Oct 2019, In: The Journal of antimicrobial chemotherapy. 74, 10, p. 3069-3076 8 p.

Implications of identifying the recently defined members of the *Staphylococcus aureus* complex *S. argenteus* and *S. schweitzeri*: A position paper of members of the ESCMID Study Group for staphylococci and Staphylococcal Diseases (ESGS)

Becker, K., Schaumburg, F., Kearns, A., Larsen, A. R., Lindsay, J. A., Skov, R. L. & Westh, H., Sep 2019, In: Clinical microbiology and infection : the official publication of the European Society of Clinical Microbiology and Infectious Diseases. 25, 9, p. 1064-1070 7 p.

Prevalence and treatment of group B streptococcus colonization based on risk factors versus intrapartum culture screening

Johansen, N. R., Kjærbye-Thygesen, A., Jønsson, S., Westh, H., Nilas, L. & Rørbye, C., Sep 2019, In: European journal of obstetrics, gynecology, and reproductive biology. 240, p. 178-181 4 p.

Surveillance of vancomycin-resistant enterococci reveals shift in dominating clones and national spread of a vancomycin-variable vanA *Enterococcus faecium* ST1421-CT1134 clone, Denmark, 2015 to March 2019

Hammerum, A. M., Justesen, U. S., Pinholt, M., Roer, L., Kaya, H., Worning, P., Nygaard, S., Kemp, M., Clausen, M. E., Nielsen, K. L., Samulionienė, J., Kjærsgaard, M., Østergaard, C., Coia, J., Søndergaard, T. S., Gaini, S., Schønning, K., Westh, H., Hasman, H. & Holzkecht, B. J., Aug 2019, In: Eurosurveillance. 24, 34

WGS of 1058 *Enterococcus faecium* from Copenhagen, Denmark, reveals rapid clonal expansion of vancomycin-resistant clone ST80 combined with widespread dissemination of a vanA-containing plasmid and acquisition of a heterogeneous accessory genome

Pinholt, M., Bayliss, S. C., Gumpert, H., Worning, P., Jensen, V. V. S., Pedersen, M., Feil, E. J. & Westh, H., Jul 2019, In: The Journal of antimicrobial chemotherapy. 74, 7, p. 1776-1785 10 p.

Ceftriaxone-resistant *Salmonella enterica* serotype Typhi in a pregnant traveller returning from Karachi, Pakistan to Denmark, 2019

Engsbro, A. L., Riis Jespersen, H. S., Goldschmidt, M. I., Møllerup, S., Worning, P., Pedersen, M. S., Westh, H. & Schneider, U. V., 23 May 2019, In: Eurosurveillance. 24, 21

Eradicating MRSA carriage: the impact of throat carriage and Panton-Valentine leukocidin genes on success rates

Bagge, K., Benfield, T., Westh, H. & Bartels, M. D., Apr 2019, In: European journal of clinical microbiology & infectious diseases : official publication of the European Society of Clinical Microbiology. 38, 4, p. 683-688 6 p.

Increased risk of *Staphylococcus aureus* bacteremia in hemodialysis-A nationwide study

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Evolution of the β -lactam-resistant *Streptococcus pneumoniae* PMEN3 clone over a 30year period in Barcelona, Spain

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European external quality assessments for identification, molecular typing and characterization of *Staphylococcus aureus*

Study Group on Staphylococci and Staphylococcal Infections (ESGS) of ESCMID, 1 Oct 2018, In: The Journal of antimicrobial chemotherapy. 73, 10, p. 2662-2666

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A Sporadic Four-Year Hospital Outbreak of a ST97-IVa MRSA With Half of the Patients First Identified in the Community

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Emergence of a vancomycin-variable *Enterococcus faecium* ST1421 strain containing a deletion in vanX

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Analytical performance of the Hologic Aptima HBV Quant Assay and the COBAS Ampliprep/COBAS TaqMan HBV test v2.0 for the quantification of HBV DNA in plasma samples

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Gonorrhoea

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Clinical and analytical evaluation of the new Aptima *Mycoplasma genitalium* assay, with data on *M. genitalium* prevalence and antimicrobial resistance in *M. genitalium* in Denmark, Norway and Sweden in 2016

Unemo, M., Salado-Rasmussen, K., Hansen, M., Olsen, A. O., Falk, M., Golparian, D., Aasterød, M., Ringlander, J., Steczko Nilsson, C., Sundqvist, M., Schønning, K., Moi, H., Westh, H. & Jensen, J. S., 1 May 2018, In: Clinical microbiology and infection : the official publication of the European Society of Clinical Microbiology and Infectious Diseases. 24, 5, p. 533-539

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Identification of a PVL-negative SCCmec-IVa sub-lineage of the methicillin-resistant *Staphylococcus aureus* CC80 lineage: Understanding the clonal origin of CA-MRSA

Edslev, S. M., Westh, H. T., Andersen, P. S., Skov, R., Kobayashi, N., Bartels, M. D., Vandenesch, F., Petersen, A., Worning, P., Larsen, A. R. & Stegger, M., Mar 2018, In: Clinical microbiology and infection : the official publication of the European Society of Clinical Microbiology and Infectious Diseases. 24, 3, p. 273-278

Use of a Regression Model to Study Host-Genomic Determinants of Phage Susceptibility in MRSA

Zschach, H., Larsen, M. V., Hasman, H., Westh, H., Nielsen, M., Międzybrodzki, R., Jończyk-Matysiak, E., Weber-Dąbrowska, B. & Górski, A., 1 Feb 2018, In: Antibiotics. 7, 1

Pelvic inflammatory disease risk following negative results from chlamydia nucleic acid amplification tests (NAATs) versus non-NAATs in Denmark: A retrospective cohort

Davies, B., Turner, K. M. E., Benfield, T., Frølund, M., Andersen, B., Westh, H., Ward, H. & Danish Chlamydia Study, 1 Jan 2018, In: PLOS Medicine. 15, 1

Gonorrhé

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Alotaibi, S. M. I., Ayibiekea, A., Pedersen, A. F., Jakobsen, L., Pinholt, M., Gumpert, H., Hammerum, A. M., Westh, H. & Ingmer, H., 14 Nov 2017, In: Journal of Medical Microbiology. p. 1744 1751 p.

Signatures of cytoplasmic proteins in the exoproteome distinguish community- and hospital-associated methicillin-resistant *Staphylococcus aureus* USA300 lineages

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Analytical and clinical performance of the Hologic Aptima HCV Quant Dx Assay for the quantification of HCV RNA in plasma samples

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Multidrug-resistant *Neisseria gonorrhoeae* infection with ceftriaxone resistance and intermediate resistance to azithromycin, Denmark, 2017

Terkelsen, D., Tolstrup, J., Johnsen, C. H., Lund, O., Larsen, H. K., Worning, P., Unemo, M. & Westh, H., Oct 2017, In: Eurosurveillance. 22, 42

Genetic characterization confirms sporadic occurrence of vancomycin-resistant *Enterococcus faecalis* in Copenhagen, Denmark

Holzknacht, B. J., Pinholt, M., Gumpert, H., Hammerum, A. M. & Westh, H., 1 Sep 2017, In: International Journal of Antimicrobial Agents. 50, 3, p. 501-502

Draft genome sequence of a *Kluyvera intermedia* isolate from a patient with a pancreatic abscess

Thele, R., Gumpert, H., Christensen, L. B., Worning, P., Schønning, K., Westh, H. & Arn Hansen, T., Sep 2017, In: Journal of Global Antimicrobial Resistance. 10, p. 1-2

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Genome-wide-analyses of *Listeria monocytogenes* from food-processing plants reveals clonal diversity and dates the emergence of persisting sequence types

Knudsen, G. M., Nielsen, J. B., Marvig, R. L., Ng, Y., Worning, P., Westh, H. & Gram, L., 1 Aug 2017, In: Environmental Microbiology. 9, 4, p. 428-440

Erratum to: Evaluating next-generation sequencing for direct clinical diagnostics in diarrhoeal disease

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