

## References

- Aanensen, D. M. and B. G. Spratt (2005). The multilocus sequence typing network: mlst.net. *Nucleic Acids Res* **33**(Web Server issue):W728-33.
- Achaz, G., *et al.* (2002). Origin and fate of repeats in bacteria. *Nucleic Acids Res* **30**(13):2987-94.
- Adams, W. G., *et al.* (1993). Decline of childhood *Haemophilus influenzae* type b (Hib) disease in the Hib vaccine era. *JAMA* **269**(2):221-6.
- Aguiar, S. I., *et al.* (2010). Serotypes 1, 7F and 19A became the leading causes of pediatric invasive pneumococcal infections in Portugal after 7 years of heptavalent conjugate vaccine use. *Vaccine* **28**(32):5167-73.
- Ahronheim, G. A., *et al.* (1979). Penicillin-insensitive pneumococci. Case report and review. *Am J Dis Child* **133**(2):187-91.
- Ajdic, D., *et al.* (2002). Genome sequence of *Streptococcus mutans* UA159, a cariogenic dental pathogen. *Proc Natl Acad Sci U S A* **99**(22):14434-9.
- Alloing, G., *et al.* (1998). Development of competence in *Streptococcus pneumoniae*: pheromone autoinduction and control of quorum sensing by the oligopeptide permease. *Mol Microbiol* **29**(1):75-83.
- Almirall, J., *et al.* (2000). Epidemiology of community-acquired pneumonia in adults: a population-based study. *Eur Respir J* **15**(4):757-63.
- Altschul, S. F., *et al.* (1997). Gapped BLAST and PSI-BLAST: a new generation of protein database search programs. *Nucleic Acids Res* **25**(17):3389-402.
- Ambur, O. H., *et al.* (2007). New functional identity for the DNA uptake sequence in transformation and its presence in transcriptional terminators. *J Bacteriol* **189**(5):2077-85.
- Anders, S. and W. Huber (2010). Differential expression analysis for sequence count data. *Genome Biol* **11**(10):R106.
- Angiuoli, S. V. and S. L. Salzberg (2011). Mugsy: fast multiple alignment of closely related whole genomes. *Bioinformatics* **27**(3):334-42.
- Aniansson, G., *et al.* (1992). Nasopharyngeal colonization during the first year of life. *J Infect Dis* **165 Suppl 1**:S38-42.
- Ardanuy, C., *et al.* (2009). Emergence of a multidrug-resistant clone (ST320) among invasive serotype 19A pneumococci in Spain. *J Antimicrob Chemother* **64**(3):507-10.
- Arrecubieta, C., *et al.* (1995). Sequence and transcriptional analysis of a DNA region involved in the production of capsular polysaccharide in *Streptococcus pneumoniae* type 3. *Gene* **167**(1-2):1-7.
- Arrecubieta, C., *et al.* (1994). Molecular characterization of *cap3A*, a gene from the operon required for the synthesis of the capsule of *Streptococcus pneumoniae* type 3: sequencing of mutations responsible for the unencapsulated phenotype and localization of the capsular cluster on the pneumococcal chromosome. *J Bacteriol* **176**(20):6375-83.
- Arthur, H. M. and R. G. Lloyd (1980). Hyper-recombination in *uvrD* mutants of *Escherichia coli* K-12. *Mol Gen Genet* **180**(1):185-91.
- Ash, R. and M. Solis-Cohen (1929). Contrasted behaviour of pneumococci toward quinin and optochin in relation to drug fastness. *J Infect Dis* **45**(6):457-462.
- Aspa, J., *et al.* (2006). Impact of initial antibiotic choice on mortality from pneumococcal pneumonia. *Eur Respir J* **27**(5):1010-9.

- Assefa, S., *et al.* (2009). ABACAS: algorithm-based automatic contiguation of assembled sequences. *Bioinformatics* **25**(15):1968-9.
- Auburtin, M., *et al.* (2002). Pneumococcal meningitis in the intensive care unit: prognostic factors of clinical outcome in a series of 80 cases. *Am J Respir Crit Care Med* **165**(5):713-7.
- Austrian, R. (1960). The Gram stain and the etiology of lobar pneumonia, an historical note. *Microbiol Mol Biol Rev* **24**(3):261-265.
- Austrian, R. (1978). The Jeremiah Metzger Lecture: Of gold and pneumococci: a history of pneumococcal vaccines in South Africa. *Trans Am Clin Climatol Assoc* **89**:141-61.
- Austrian, R. (2000). Pneumococcal otitis media and pneumococcal vaccines, a historical perspective. *Vaccine* **19 Suppl 1**:S71-7.
- Austrian, R., *et al.* (1976). Prevention of pneumococcal pneumonia by vaccination. *Trans Assoc Am Physicians* **89**:184-94.
- Austrian, R. and R. Rosenblum (1953). The relative efficacy of erythromycin (ilotycin) and of penicillin in the treatment of pneumococcal lobar pneumonia. *Am J Med Sci* **226**(5):487-90.
- Avadhanula, V., *et al.* (2006). Respiratory viruses augment the adhesion of bacterial pathogens to respiratory epithelium in a viral species- and cell type-dependent manner. *J Virol* **80**(4):1629-36.
- Avery, O., *et al.* (1944). Studies on the chemical nature of the substance inducing transformation of pneumococcal types. *J Exp Med* **79**(2):137-158.
- Avery, O. T. and R. Dubos (1931). The protective action of a specific enzyme against type III pneumococcus infection in mice. *J Exp Med* **54**(1):73-89.
- Avery, O. T. and W. F. Goebel (1931). Chemo-immunological studies on conjugated carbohydrate-proteins : V. The immunological specificity of an antigen prepared by combining the capsular polysaccharide of type III pneumococcus with foreign protein. *J Exp Med* **54**(3):437-47.
- Ayoubi, P., *et al.* (1991). Tn5253, the pneumococcal omega (*cat tet*) BM6001 element, is a composite structure of two conjugative transposons, Tn5251 and Tn5252. *J Bacteriol* **173**(5):1617-22.
- Bachelier, S., *et al.* (1999). Short palindromic repetitive DNA elements in enterobacteria: a survey. *Res Microbiol* **150**(9-10):627-39.
- Bagnoli, F., *et al.* (2008). A second pilus type in *Streptococcus pneumoniae* is prevalent in emerging serotypes and mediates adhesion to host cells. *J Bacteriol* **190**(15):5480-92.
- Bakir, M., *et al.* (2001). Asymptomatic carriage of *Neisseria meningitidis* and *Neisseria lactamica* in relation to *Streptococcus pneumoniae* and *Haemophilus influenzae* colonization in healthy children: apropos of 1400 children sampled. *Eur J Epidemiol* **17**(11):1015-8.
- Balganesh, T. S. and S. A. Lacks (1985). Heteroduplex DNA mismatch repair system of *Streptococcus pneumoniae*: cloning and expression of the *hexA* gene. *J Bacteriol* **162**(3):979-84.
- Ball, P. (1994). Bacterial resistance to fluoroquinolones: lessons to be learned. *Infection* **22 Suppl 2**:S140-7.
- Barbour, M. L., *et al.* (1995). The impact of conjugate vaccine on carriage of *Haemophilus influenzae* type b. *J Infect Dis* **171**(1):93-8.
- Barcus, V. A., *et al.* (1995). Genetics of high level penicillin resistance in clinical isolates of *Streptococcus pneumoniae*. *FEMS Microbiol Lett* **126**(3):299-303.

- Barnes, D. M., *et al.* (1995). Transmission of multidrug-resistant serotype 23F *Streptococcus pneumoniae* in group day care: evidence suggesting capsular transformation of the resistant strain *in vivo*. *J Infect Dis* **171**(4):890-6.
- Barocchi, M. A., *et al.* (2006). A pneumococcal pilus influences virulence and host inflammatory responses. *Proc Natl Acad Sci U S A* **103**(8):2857-62.
- Barrett-Connor, E. (1971). Bacterial infection and sickle cell anemia. An analysis of 250 infections in 166 patients and a review of the literature. *Medicine (Baltimore)* **50**(2):97-112.
- Beall, B., *et al.* (2006). Pre- and postvaccination clonal compositions of invasive pneumococcal serotypes for isolates collected in the United States in 1999, 2001, and 2002. *J Clin Microbiol* **44**(3):999-1017.
- Benjamini, Y. and Y. Hochberg (1995). Controlling the false discovery rate: a practical and powerful approach to multiple testing. *J R Statist Soc* **57**(1):289-300.
- Bentley, D. R., *et al.* (2008). Accurate whole human genome sequencing using reversible terminator chemistry. *Nature* **456**(7218):53-9.
- Bentley, S. D., *et al.* (2006). Genetic analysis of the capsular biosynthetic locus from all 90 pneumococcal serotypes. *PLoS Genet* **2**(3):e31.
- Bentley, S. D., *et al.* (2007). Meningococcal genetic variation mechanisms viewed through comparative analysis of serogroup C strain FAM18. *PLoS Genet* **3**(2):e23.
- Beres, S. B., *et al.* (2010). Molecular complexity of successive bacterial epidemics deconvoluted by comparative pathogenomics. *Proc Natl Acad Sci U S A* **107**(9):4371-6.
- Berge, M., *et al.* (2003). Transformation of *Streptococcus pneumoniae* relies on DprA- and RecA-dependent protection of incoming DNA single strands. *Mol Microbiol* **50**(2):527-36.
- Berk, S. L., *et al.* (1985). Type 8 pneumococcal pneumonia: an outbreak on an oncology ward. *South Med J* **78**(2):159-61.
- Berman, H. M. and P. R. Young (1981). The interaction of intercalating drugs with nucleic acids. *Annu Rev Biophys Bioeng* **10**:87-114.
- Bernhart, S. H., *et al.* (2008). RNAalifold: improved consensus structure prediction for RNA alignments. *BMC Bioinformatics* **9**:474.
- Bernheimer, H. P. and J. G. Tiraby (1976). Inhibition of phage infection by pneumococcus capsule. *Virology* **73**(1):308-9.
- Berriman, M. and K. Rutherford (2003). Viewing and annotating sequence data with Artemis. *Brief Bioinform* **4**(2):124-32.
- Berry, A. M., *et al.* (1989). Presence of a small plasmid in clinical isolates of *Streptococcus pneumoniae*. *FEMS Microbiol Lett* **53**(3):275-8.
- Berry, A. M. and J. C. Paton (2000). Additive attenuation of virulence of *Streptococcus pneumoniae* by mutation of the genes encoding pneumolysin and other putative pneumococcal virulence proteins. *Infect Immun* **68**(1):133-40.
- Bibb, M. J., *et al.* (1984). The relationship between base composition and codon usage in bacterial genes and its use for the simple and reliable identification of protein-coding sequences. *Gene* **30**(1-3):157-66.
- Bierne, H., *et al.* (1997). *uvrD* mutations enhance tandem repeat deletion in the *Escherichia coli* chromosome via SOS induction of the RecF recombination pathway. *Mol Microbiol* **26**(3):557-67.

- Bito, H., *et al.* (1994). Cloning, expression and tissue distribution of rat platelet-activating-factor-receptor cDNA. *Eur J Biochem* **221**(1):211-8.
- Block, S. L., *et al.* (2004). Community-wide vaccination with the heptavalent pneumococcal conjugate significantly alters the microbiology of acute otitis media. *Pediatr Infect Dis J* **23**(9):829-33.
- Blomberg, C., *et al.* (2009). Pattern of accessory regions and invasive disease potential in *Streptococcus pneumoniae*. *J Infect Dis* **199**(7):1032-42.
- Bluestone, C. and J. Klein (2007). *Otitis media in infants and children*. USA, People's Medical Publishing House.
- Bochner, B. R. (2009). Global phenotypic characterization of bacteria. *FEMS Microbiol Rev* **33**(1):191-205.
- Bogaert, D., *et al.* (2004a). *Streptococcus pneumoniae* colonisation: the key to pneumococcal disease. *Lancet Infect Dis* **4**(3):144-54.
- Bogaert, D., *et al.* (2001). Pneumococcal carriage in children in The Netherlands: a molecular epidemiological study. *J Clin Microbiol* **39**(9):3316-20.
- Bogaert, D., *et al.* (2005). Epidemiology of nasopharyngeal carriage of *Neisseria meningitidis* in healthy Dutch children. *Clin Infect Dis* **40**(6):899-902.
- Bogaert, D., *et al.* (2004b). Colonisation by *Streptococcus pneumoniae* and *Staphylococcus aureus* in healthy children. *Lancet* **363**(9424):1871-2.
- Bolan, G., *et al.* (1986). Pneumococcal vaccine efficacy in selected populations in the United States. *Ann Intern Med* **104**(1):1-6.
- Bonfield, J. K., *et al.* (1995). A new DNA sequence assembly program. *Nucleic Acids Res* **23**(24):4992-9.
- Brandt, J., *et al.* (2002). Invasive pneumococcal disease and hemolytic uremic syndrome. *Pediatrics* **110**(2 Pt 1):371-6.
- Bratcher, P. E., *et al.* (2010). Identification of natural pneumococcal isolates expressing serotype 6D by genetic, biochemical and serological characterization. *Microbiology* **156**(Pt 2):555-60.
- Briles, D. E., *et al.* (1992). Strong association between capsular type and virulence for mice among human isolates of *Streptococcus pneumoniae*. *Infect Immun* **60**(1):111-6.
- Brochet, M., *et al.* (2008). Shaping a bacterial genome by large chromosomal replacements, the evolutionary history of *Streptococcus agalactiae*. *Proc Natl Acad Sci U S A* **105**(41):15961-6.
- Brown, J. S., *et al.* (2001). A *Streptococcus pneumoniae* pathogenicity island encoding an ABC transporter involved in iron uptake and virulence. *Mol Microbiol* **40**(3):572-85.
- Brown, J. S., *et al.* (2004). A locus contained within a variable region of pneumococcal pathogenicity island 1 contributes to virulence in mice. *Infect Immun* **72**(3):1587-93.
- Brueggemann, A. B., *et al.* (2003). Clonal relationships between invasive and carriage *Streptococcus pneumoniae* and serotype- and clone-specific differences in invasive disease potential. *J Infect Dis* **187**(9):1424-32.
- Brueggemann, A. B., *et al.* (2007). Vaccine escape recombinants emerge after pneumococcal vaccination in the United States. *PLoS Pathog* **3**(11):e168.
- Brueggemann, A. B., *et al.* (2004). Temporal and geographic stability of the serogroup-specific invasive disease potential of *Streptococcus pneumoniae* in children. *J Infect Dis* **190**(7):1203-11.

- Brugger, S. D., *et al.* (2010). Multiple colonization with *S. pneumoniae* before and after introduction of the seven-valent conjugated pneumococcal polysaccharide vaccine. *PLoS One* **5**(7):e11638.
- Brundish, D. E. and J. Baddiley (1968). Pneumococcal C-substance, a ribitol teichoic acid containing choline phosphate. *Biochem J* **110**(3):573-82.
- Bryan, J. P., *et al.* (1990). Etiology and mortality of bacterial meningitis in northeastern Brazil. *Rev Infect Dis* **12**(1):128-35.
- Buchanan, R. and N. Gibbons, Eds. (1974). Bergey's Manual of Determinative Bacteriology. Baltimore, Williams & Wilkins Co.
- Burman, L. A., *et al.* (1985). Invasive pneumococcal infections: incidence, predisposing factors, and prognosis. *Rev Infect Dis* **7**(2):133-42.
- Burman, L. A., *et al.* (1991). Diagnosis of pneumonia by cultures, bacterial and viral antigen detection tests, and serology with special reference to antibodies against pneumococcal antigens. *J Infect Dis* **163**(5):1087-93.
- Buu-Hoi, A. and T. Horodniceanu (1980). Conjugative transfer of multiple antibiotic resistance markers in *Streptococcus pneumoniae*. *J Bacteriol* **143**(1):313-20.
- Byington, C. L., *et al.* (2006). Impact of the pneumococcal conjugate vaccine on pneumococcal parapneumonic empyema. *Pediatr Infect Dis J* **25**(3):250-4.
- Byington, C. L., *et al.* (2002). An epidemiological investigation of a sustained high rate of pediatric parapneumonic empyema: risk factors and microbiological associations. *Clin Infect Dis* **34**(4):434-40.
- Calverley, P. M., *et al.* (2007). Salmeterol and fluticasone propionate and survival in chronic obstructive pulmonary disease. *N Engl J Med* **356**(8):775-89.
- Camilli, R., *et al.* (2006). Zinc metalloproteinase genes in clinical isolates of *Streptococcus pneumoniae*: association of the full array with a clonal cluster comprising serotypes 8 and 11A. *Microbiology* **152**(Pt 2):313-21.
- Camou, T., *et al.* (1998). The apparent importation of penicillin-resistant capsular type 14 Spanish/French clone of *Streptococcus pneumoniae* into Uruguay in the early 1990s. *Microb Drug Resist* **4**(3):219-24.
- Campbell, E. A., *et al.* (1998). A competence regulon in *Streptococcus pneumoniae* revealed by genomic analysis. *Mol Microbiol* **27**(5):929-39.
- Canvin, J. R., *et al.* (1995). The role of pneumolysin and autolysin in the pathology of pneumonia and septicemia in mice infected with a type 2 pneumococcus. *J Infect Dis* **172**(1):119-23.
- Capdevila, O., *et al.* (2001). Pneumococcal peritonitis in adult patients: report of 64 cases with special reference to emergence of antibiotic resistance. *Arch Intern Med* **161**(14):1742-8.
- Cardozo, D. M., *et al.* (2008). Prevalence and risk factors for nasopharyngeal carriage of *Streptococcus pneumoniae* among adolescents. *J Med Microbiol* **57**(Pt 2):185-9.
- Carver, T., *et al.* (2008). Artemis and ACT: viewing, annotating and comparing sequences stored in a relational database. *Bioinformatics* **24**(23):2672-6.
- Carver, T. J., *et al.* (2005). ACT: the Artemis Comparison Tool. *Bioinformatics* **21**(16):3422-3.
- Casey, J. R. and M. E. Pichichero (2004). Changes in frequency and pathogens causing acute otitis media in 1995-2003. *Pediatr Infect Dis J* **23**(9):824-8.
- Castaneda, E., *et al.* (1998). Penicillin-resistant *Streptococcus pneumoniae* in Colombia: presence of international epidemic clones. Colombian pneumococcal study group. *Microb Drug Resist* **4**(3):233-9.

- Chen, C., *et al.* (2007). A glimpse of streptococcal toxic shock syndrome from comparative genomics of *S. suis* 2 Chinese isolates. *PLoS One* **2**(3):e315.
- Chen, F. M., *et al.* (1998). Geocoding and linking data from population-based surveillance and the US Census to evaluate the impact of median household income on the epidemiology of invasive *Streptococcus pneumoniae* infections. *Am J Epidemiol* **148**(12):1212-8.
- Chen, I., *et al.* (2005). The ins and outs of DNA transfer in bacteria. *Science* **310**(5753):1456-60.
- Chen, K. and A. W. Ravin (1966). Heterospecific transformation of pneumococcus and streptococcus. *J Mol Biol* **22**:123-134.
- Chen, Z., *et al.* (2008). Mechanism of homologous recombination from the RecA-ssDNA/dsDNA structures. *Nature* **453**(7194):489-4.
- Chilcote, R. R., *et al.* (1976). Septicemia and meningitis in children splenectomized for Hodgkin's disease. *N Engl J Med* **295**(15):798-800.
- Chotpitayasunondh, T. (1994). Bacterial meningitis in children: etiology and clinical features, an 11-year review of 618 cases. *Southeast Asian J Trop Med Public Health* **25**(1):107-15.
- Claverys, J. P., *et al.* (2000). Is the Ami-AliA/B oligopeptide permease of *Streptococcus pneumoniae* involved in sensing environmental conditions? *Res Microbiol* **151**(6):457-63.
- Claverys, J. P. and L. S. Havarstein (2002). Extracellular-peptide control of competence for genetic transformation in *Streptococcus pneumoniae*. *Front Biosci* **7**:d1798-814.
- Claverys, J. P., *et al.* (1980). Transformation of *Streptococcus pneumoniae* with *S. pneumoniae*-lambda phage hybrid DNA: induction of deletions. *Proc Natl Acad Sci U S A* **77**(6):3534-8.
- Claverys, J. P., *et al.* (2007). Competence-induced fratricide in streptococci. *Mol Microbiol* **64**(6):1423-33.
- Claverys, J. P., *et al.* (1981). Base specificity of mismatch repair in *Streptococcus pneumoniae*. *Nucleic Acids Res* **9**(10):2267-80.
- Claverys, J. P., *et al.* (1983). Mismatch repair in *Streptococcus pneumoniae*: relationship between base mismatches and transformation efficiencies. *Proc Natl Acad Sci U S A* **80**(19):5956-60.
- Claverys, J. P., *et al.* (2006). Induction of competence regulons as a general response to stress in Gram-positive bacteria. *Annu Rev Microbiol* **60**:451-75.
- Cloonan, N., *et al.* (2008). Stem cell transcriptome profiling via massive-scale mRNA sequencing. *Nat Methods* **5**(7):613-9.
- Cloonan, N. and S. M. Grimmond (2008). Transcriptome content and dynamics at single-nucleotide resolution. *Genome Biol* **9**(9):234.
- Cochetti, I., *et al.* (2008). *erm*(B)-carrying elements in tetracycline-resistant pneumococci and correspondence between Tn1545 and Tn6003. *Antimicrob Agents Chemother* **52**(4):1285-90.
- Cochetti, I., *et al.* (2007). New Tn916-related elements causing *erm*(B)-mediated erythromycin resistance in tetracycline-susceptible pneumococci. *J Antimicrob Chemother* **60**(1):127-31.
- Coffey, T. J., *et al.* (1993). Horizontal spread of an altered penicillin-binding protein 2B gene between *Streptococcus pneumoniae* and *Streptococcus oralis*. *FEMS Microbiol Lett* **110**(3):335-9.

- Coffey, T. J., *et al.* (1991). Horizontal transfer of multiple penicillin-binding protein genes, and capsular biosynthetic genes, in natural populations of *Streptococcus pneumoniae*. *Mol Microbiol* **5**(9):2255-60.
- Coffey, T. J., *et al.* (1998a). Recombinational exchanges at the capsular polysaccharide biosynthetic locus lead to frequent serotype changes among natural isolates of *Streptococcus pneumoniae*. *Mol Microbiol* **27**(1):73-83.
- Coffey, T. J., *et al.* (1998b). Serotype 19A variants of the Spanish serotype 23F multiresistant clone of *Streptococcus pneumoniae*. *Microb Drug Resist* **4**(1):51-5.
- Cohen, R., *et al.* (1997). Change in nasopharyngeal carriage of *Streptococcus pneumoniae* resulting from antibiotic therapy for acute otitis media in children. *Pediatr Infect Dis J* **16**(6):555-60.
- Coles, C. L., *et al.* (2001). Pneumococcal nasopharyngeal colonization in young South Indian infants. *Pediatr Infect Dis J* **20**(3):289-95.
- Collatz, E., *et al.* (1984). Characterization of high-level aminoglycoside resistance in a strain of *Streptococcus pneumoniae*. *J Gen Microbiol* **130**(7):1665-71.
- Collins, H. S., *et al.* (1948). Aureomycin in treatment of pneumococcal pneumonia and meningococemia. *Proc Soc Exp Biol Med* **69**(2):263-5.
- Connell, S. R., *et al.* (2003). Ribosomal protection proteins and their mechanism of tetracycline resistance. *Antimicrob Agents Chemother* **47**(12):3675-81.
- Corriere, J. N., Jr. and L. I. Lipshultz (1974). Pneumococcal nephritis. *Urology* **3**(5):557-61.
- Corso, A., *et al.* (1998). Molecular characterization of penicillin-resistant *Streptococcus pneumoniae* isolates causing respiratory disease in the United States. *Microb Drug Resist* **4**(4):325-37.
- Cortaza, G., *et al.* (1983). A plasmid in a drug-resistant clinical isolate of *Streptococcus pneumoniae*. *FEMS Microbiol Lett* **17**:55-57.
- Cortese, M. M., *et al.* (1992). High incidence rates of invasive pneumococcal disease in the White Mountain Apache population. *Arch Intern Med* **152**(11):2277-82.
- Courvalin, P., *et al.* (1985). Multiplicity of macrolide-lincosamide-streptogramin antibiotic resistance determinants. *J Antimicrob Chemother* **16** Suppl A:91-100.
- Cox, D. (1969). Some sampling problems in technology. New Developments in Survey Sampling. N. Johnson and H. Smith. New York, Wiley: 506-527.
- Cundell, D. R., *et al.* (1995a). *Streptococcus pneumoniae* anchor to activated human cells by the receptor for platelet-activating factor. *Nature* **377**(6548):435-8.
- Cundell, D. R., *et al.* (1995b). Relationship between colonial morphology and adherence of *Streptococcus pneumoniae*. *Infect Immun* **63**(3):757-61.
- Cvitkovitch, D. G., *et al.* (1997). Role of the citrate pathway in glutamate biosynthesis by *Streptococcus mutans*. *J Bacteriol* **179**(3):650-5.
- Cybulska, J., *et al.* (1970). Prevalence of types of *Diplococcus pneumoniae* and their susceptibility to 30 antibiotics. *Chemotherapy* **15**(5):304-16.
- Dagan, R. and K. P. Klugman (2008). Impact of conjugate pneumococcal vaccines on antibiotic resistance. *Lancet Infect Dis* **8**(12):785-95.
- Dagkessamanskaia, A., *et al.* (2004). Interconnection of competence, stress and CiaR regulons in *Streptococcus pneumoniae*: competence triggers stationary phase autolysis of *ciaR* mutant cells. *Mol Microbiol* **51**(4):1071-86.
- Danecek, P., *et al.* (2011). The variant call format and VCFtools. *Bioinformatics* **27**(15):2156-2158.

- Dang-Van, A., *et al.* (1978). Chloramphenicol resistance in *Streptococcus pneumoniae*: enzymatic acetylation and possible plasmid linkage. *Antimicrob Agents Chemother* **13**(4):577-83.
- Danner, D. B., *et al.* (1980). An eleven-base-pair sequence determines the specificity of DNA uptake in *Haemophilus* transformation. *Gene* **11**(3-4):311-8.
- Darling, A. E., *et al.* (2010). progressiveMauve: multiple genome alignment with gene gain, loss and rearrangement. *PLoS One* **5**(6):e11147.
- Dave, S., *et al.* (2004). Dual roles of PspC, a surface protein of *Streptococcus pneumoniae*, in binding human secretory IgA and factor H. *J Immunol* **173**(1):471-7.
- Dawid, S., *et al.* (2007). The *blp* bacteriocins of *Streptococcus pneumoniae* mediate intraspecies competition both *in vitro* and *in vivo*. *Infect Immun* **75**(1):443-51.
- De Gregorio, E., *et al.* (2002). The abundant class of nemis repeats provides RNA substrates for ribonuclease III in *Neisseriae*. *Biochim Biophys Acta* **1576**(1-2):39-44.
- De Gregorio, E., *et al.* (2005). Enterobacterial repetitive intergenic consensus sequence repeats in yersiniae: genomic organization and functional properties. *J Bacteriol* **187**(23):7945-54.
- de Hoon, M. J., *et al.* (2005). Prediction of transcriptional terminators in *Bacillus subtilis* and related species. *PLoS Comput Biol* **1**(3):e25.
- de Saizieu, A., *et al.* (2000). Microarray-based identification of a novel *Streptococcus pneumoniae* regulon controlled by an autoinduced peptide. *J Bacteriol* **182**(17):4696-703.
- de Visser, J. A. and S. F. Elena (2007). The evolution of sex: empirical insights into the roles of epistasis and drift. *Nat Rev Genet* **8**(2):139-49.
- Del Grosso, M., *et al.* (2006). The *mef(E)*-carrying genetic element (mega) of *Streptococcus pneumoniae*: insertion sites and association with other genetic elements. *Antimicrob Agents Chemother* **50**(10):3361-6.
- Del Grosso, M., *et al.* (2007). The macrolide resistance genes *erm(B)* and *mef(E)* are carried by Tn2010 in dual-gene *Streptococcus pneumoniae* isolates belonging to clonal complex CC271. *Antimicrob Agents Chemother* **51**(11):4184-6.
- Delcher, A. L., *et al.* (2007). Identifying bacterial genes and endosymbiont DNA with Glimmer. *Bioinformatics* **23**(6):673-9.
- Delilhas, N. (2008). Small mobile sequences in bacteria display diverse structure/function motifs. *Mol Microbiol* **67**(3):475-81.
- Denapaite, D., *et al.* (2010). The genome of *Streptococcus mitis* B6--what is a commensal? *PLoS One* **5**(2):e9426.
- Didelot, X. and D. Falush (2007). Inference of bacterial microevolution using multilocus sequence data. *Genetics* **175**(3):1251-66.
- Dillard, J. P., *et al.* (1995). Characterization of the cassette containing genes for type 3 capsular polysaccharide biosynthesis in *Streptococcus pneumoniae*. *J Exp Med* **181**(3):973-83.
- Ding, F., *et al.* (2009). Genome evolution driven by host adaptations results in a more virulent and antimicrobial-resistant *Streptococcus pneumoniae* serotype 14. *BMC Genomics* **10**:158.
- Dixon, J. M., *et al.* (1977). Detection and prevalence of pneumococci with increased resistance to penicillin. *Can Med Assoc J* **117**(10):1159-61.
- Dochez, A. and L. Gillespie (1913). A biologic classification of pneumococci by means of immunity reactions. *JAMA* **61**(10):727-732.

- Dochez, A. R. and O. T. Avery (1917). The elaboration of specific soluble substance by pneumococcus during growth. *J Exp Med* **26**(4):477-93.
- Doit, C., *et al.* (2010). Epidemiology of pediatric community-acquired bloodstream infections in a children hospital in Paris, France, 2001 to 2008. *Diagn Microbiol Infect Dis* **66**(3):332-5.
- Donaldson, S. S., *et al.* (1978). Bacterial infections in pediatric Hodgkin's disease: relationship to radiotherapy, chemotherapy and splenectomy. *Cancer* **41**(5):1949-58.
- Donati, C., *et al.* (2010). Structure and dynamics of the pan-genome of *Streptococcus pneumoniae* and closely related species. *Genome Biol* **11**(10):R107.
- Dopazo, J., *et al.* (2001). Annotated draft genomic sequence from a *Streptococcus pneumoniae* type 19F clinical isolate. *Microb Drug Resist* **7**(2):99-125.
- Douglas, R. M., *et al.* (1983). Antibody response to pneumococcal vaccination in children younger than five years of age. *J Infect Dis* **148**(1):131-7.
- Dowson, C. G., *et al.* (1993). Evolution of penicillin resistance in *Streptococcus pneumoniae*; the role of *Streptococcus mitis* in the formation of a low affinity PBP2B in *S. pneumoniae*. *Mol Microbiol* **9**(3):635-43.
- Dowson, C. G., *et al.* (1989). Horizontal transfer of penicillin-binding protein genes in penicillin-resistant clinical isolates of *Streptococcus pneumoniae*. *Proc Natl Acad Sci U S A* **86**(22):8842-6.
- Dowson, C. G., *et al.* (1990). Penicillin-resistant viridans streptococci have obtained altered penicillin-binding protein genes from penicillin-resistant strains of *Streptococcus pneumoniae*. *Proc Natl Acad Sci U S A* **87**(15):5858-62.
- Dowson, C. G., *et al.* (1994). Genetics of oxacillin resistance in clinical isolates of *Streptococcus pneumoniae* that are oxacillin resistant and penicillin susceptible. *Antimicrob Agents Chemother* **38**(1):49-53.
- Drummond, A. J., *et al.* (2006). Relaxed phylogenetics and dating with confidence. *PLoS Biol* **4**(5):e88.
- Drummond, A. J. and A. Rambaut (2007). BEAST: Bayesian evolutionary analysis by sampling trees. *BMC Evol Biol* **7**:214.
- Drummond, A. J., *et al.* (2005). Bayesian coalescent inference of past population dynamics from molecular sequences. *Mol Biol Evol* **22**(5):1185-92.
- Dublanchet, A. and R. Durieux (1979). Isolement d'une souche de *Streptococcus pneumoniae* multirésistante aux antibiotiques. *Nouv Presse Med* **8**(11):872.
- Dubnau, D. (1999). DNA uptake in bacteria. *Annu Rev Microbiol* **53**:217-44.
- Dubos, R. and O. T. Avery (1931). Decomposition of the capsular polysaccharide of pneumococcus type III by a bacterial enzyme. *J Exp Med* **54**(1):51-71.
- Dunais, B., *et al.* (2003). Influence of child care on nasopharyngeal carriage of *Streptococcus pneumoniae* and *Haemophilus influenzae*. *Pediatr Infect Dis J* **22**(7):589-92.
- Eastham, K. M., *et al.* (2004). Clinical features, aetiology and outcome of empyema in children in the north east of England. *Thorax* **59**(6):522-5.
- Echaniz-Aviles, G., *et al.* (1998). Predominance of the multiresistant 23F international clone of *Streptococcus pneumoniae* among isolates from Mexico. *Microb Drug Resist* **4**(3):241-6.
- Eddy, S. R. (2008). A probabilistic model of local sequence alignment that simplifies statistical significance estimation. *PLoS Comput Biol* **4**(5):e1000069.
- Edgar, R. C. (2004). MUSCLE: multiple sequence alignment with high accuracy and high throughput. *Nucleic Acids Res* **32**(5):1792-7.

- Ekwurzel, G., *et al.* (1938). Studies on immunizing substances in pneumococci. VIII. Report on field tests to determine the prophylactic value of a pneumococcus antigen. *Public Health Rep* **53**:1877-1893.
- El Garch, F., *et al.* (2010). Fluoroquinolones induce the expression of *patA* and *patB*, which encode ABC efflux pumps in *Streptococcus pneumoniae*. *J Antimicrob Chemother* **65**(10):2076-82.
- Eltringham, G., *et al.* (2003). Culture-negative childhood empyema is usually due to penicillin-sensitive *Streptococcus pneumoniae* capsular serotype 1. *J Clin Microbiol* **41**(1):521-2.
- Enright, A. J., *et al.* (2002). An efficient algorithm for large-scale detection of protein families. *Nucleic Acids Res* **30**(7):1575-84.
- Enright, M., *et al.* (1998). Molecular evolution of rifampicin resistance in *Streptococcus pneumoniae*. *Microb Drug Resist* **4**(1):65-70.
- Enright, M. C., *et al.* (1999). The three major Spanish clones of penicillin-resistant *Streptococcus pneumoniae* are the most common clones recovered in recent cases of meningitis in Spain. *J Clin Microbiol* **37**(10):3210-6.
- Enright, M. C. and B. G. Spratt (1998). A multilocus sequence typing scheme for *Streptococcus pneumoniae*: identification of clones associated with serious invasive disease. *Microbiology* **144** ( Pt 11):3049-60.
- Enright, M. C. and B. G. Spratt (1999). Extensive variation in the *ddl* gene of penicillin-resistant *Streptococcus pneumoniae* results from a hitchhiking effect driven by the penicillin-binding protein 2b gene. *Mol Biol Evol* **16**(12):1687-95.
- Ephrussi-Taylor, H., *et al.* (1965). Genetic recombination in DNA-induced transformation of pneumococcus. I. the problem of relative efficiency of transforming factors. *Genetics* **51**(3):455-75.
- Erill, I., *et al.* (2007). Aeons of distress: an evolutionary perspective on the bacterial SOS response. *FEMS Microbiol Rev* **31**(6):637-56.
- Ernst, P., *et al.* (2007). Inhaled corticosteroid use in chronic obstructive pulmonary disease and the risk of hospitalization for pneumonia. *Am J Respir Crit Care Med* **176**(2):162-6.
- Ertugrul, N., *et al.* (1997). BOX-polymerase chain reaction-based DNA analysis of nonserotypeable *Streptococcus pneumoniae* implicated in outbreaks of conjunctivitis. *J Infect Dis* **176**(5):1401-5.
- Espeli, O., *et al.* (2001). Transcription attenuation associated with bacterial repetitive extragenic BIME elements. *J Mol Biol* **314**(3):375-86.
- Evans, G. and W. Gaisford (1938). Treatment of pneumonia with 2-(*p*-aminobenzenesulphonamido)pyridine. *Lancet* **2**(22):14-19.
- Evans, W. and D. Hansman (1963). Tetracycline-resistant pneumococcus. *Lancet* **1**:451.
- Facklam, R. (2002). What happened to the streptococci: overview of taxonomic and nomenclature changes. *Clin Microbiol Rev* **15**(4):613-30.
- Fang, G. D., *et al.* (1990). New and emerging etiologies for community-acquired pneumonia with implications for therapy. A prospective multicenter study of 359 cases. *Medicine (Baltimore)* **69**(5):307-16.
- Feikin, D. R., *et al.* (2000). Mortality from invasive pneumococcal pneumonia in the era of antibiotic resistance, 1995-1997. *Am J Public Health* **90**(2):223-9.
- Feil, E. J., *et al.* (2001). Recombination within natural populations of pathogenic bacteria: short-term empirical estimates and long-term phylogenetic consequences. *Proc Natl Acad Sci U S A* **98**(1):182-7.

- Feil, E. J., *et al.* (2000). Estimating recombinational parameters in *Streptococcus pneumoniae* from multilocus sequence typing data. *Genetics* **154**(4):1439-50.
- Feinstein, S. I. and K. B. Low (1986). Hyper-recombining recipient strains in bacterial conjugation. *Genetics* **113**(1):13-33.
- Felsenstein, J. (1974). The evolutionary advantage of recombination. *Genetics* **78**(2):737-56.
- Felsenstein, J. (1989). PHYLIP - phylogeny inference package. *Cladistics* **5**:164-166.
- Felsenstein, J. and S. Yokoyama (1976). The evolutionary advantage of recombination. II Individual selection for recombination. *Genetics* **83**:845-859.
- Feng, J., *et al.* (2009). Genome sequencing of linezolid-resistant *Streptococcus pneumoniae* mutants reveals novel mechanisms of resistance. *Genome Res* **19**(7):1214-23.
- Fenoll, A., *et al.* (1991). Serotype distribution and antimicrobial resistance of *Streptococcus pneumoniae* isolates causing systemic infections in Spain, 1979-1989. *Rev Infect Dis* **13**(1):56-60.
- Fenoll, A., *et al.* (1994). Molecular basis of the optochin-sensitive phenotype of pneumococcus: characterization of the genes encoding the F0 complex of the *Streptococcus pneumoniae* and *Streptococcus oralis* H(+)-ATPases. *Mol Microbiol* **12**(4):587-98.
- Ferguson, A. D., *et al.* (1996). The clinical course and management of thoracic empyema. *QJM* **89**(4):285-9.
- Ferrandiz, M. J., *et al.* (2005). New mutations and horizontal transfer of *rpoB* among rifampin-resistant *Streptococcus pneumoniae* from four Spanish hospitals. *Antimicrob Agents Chemother* **49**(6):2237-45.
- Fiers, W., *et al.* (1976). Complete nucleotide sequence of bacteriophage MS2 RNA: primary and secondary structure of the replicase gene. *Nature* **260**(5551):500-7.
- Figueiredo, A. M., *et al.* (1995). Novel penicillin-resistant clones of *Streptococcus pneumoniae* in the Czech Republic and in Slovakia. *Microb Drug Resist* **1**(1):71-8.
- Filipe, S. R., *et al.* (2000). Distribution of the mosaic structured *murM* genes among natural populations of *Streptococcus pneumoniae*. *J Bacteriol* **182**(23):6798-805.
- Filipe, S. R. and A. Tomasz (2000). Inhibition of the expression of penicillin resistance in *Streptococcus pneumoniae* by inactivation of cell wall mucopeptide branching genes. *Proc Natl Acad Sci U S A* **97**(9):4891-6.
- Finland, M. and M. W. Barnes (1977). Changes in occurrence of capsular serotypes of *Streptococcus pneumoniae* at Boston City Hospital during selected years between 1935 and 1974. *J Clin Microbiol* **5**(2):154-66.
- Finland, M., *et al.* (1976). Susceptibility of pneumococci and *Haemophilus influenzae* to antibacterial agents. *Antimicrob Agents Chemother* **9**(2):274-87.
- Fisher, R. (1930). *The genetical theory of natural selection*. Oxford, Oxford University Press.
- Fitch, D. H. and M. Goodman (1991). Phylogenetic scanning: a computer-assisted algorithm for mapping gene conversions and other recombinational events. *Comput Appl Biosci* **7**(2):207-15.
- Fitzmaurice, W. P., *et al.* (1984). Characterization of recognition sites on bacteriophage HP1c1 DNA which interact with the DNA uptake system of *Haemophilus influenzae* Rd. *Gene* **31**(1-3):187-96.

- Flamaing, J., *et al.* (2010). Pneumococcal colonization in older persons in a nonoutbreak setting. *J Am Geriatr Soc* **58**(2):396-8.
- Flannery, B., *et al.* (2006). Changes in invasive Pneumococcal disease among HIV-infected adults living in the era of childhood pneumococcal immunization. *Ann Intern Med* **144**(1):1-9.
- Fleischmann, R. D., *et al.* (1995). Whole-genome random sequencing and assembly of *Haemophilus influenzae* Rd. *Science* **269**(5223):496-512.
- Foa, P. and G. Bordoni-Uffreduzzi (1888). Über die Aetiologie der "Meningitis cerebrospinalis epidemica". *Ztschr f Hyg u Infektionskr* **4**(1):67.
- Foss Abrahamsen, A., *et al.* (1997). Systemic pneumococcal disease after staging splenectomy for Hodgkin's disease 1969-1980 without pneumococcal vaccine protection: a follow-up study 1994. *Eur J Haematol* **58**(2):73-7.
- Fox, M. S. and M. K. Allen (1964). On the mechanism of deoxyribonucleate integration in pneumococcal transformation. *Proc Natl Acad Sci U S A* **52**:412-9.
- Francis, T. and W. S. Tillett (1930). Cutaneous reactions in pneumonia. the development of antibodies following the intradermal injection of type-specific polysaccharide. *J Exp Med* **52**(4):573-85.
- Fränkel, A. (1884). Über die genuine Pneumonie. *Verhandlungen des Congresses für Innere Medizin, Dritter Congress* **3**:17-31.
- Fränkel, A. (1886). Weitere Beiträge zur Lehre von den Mikroccoccen der genuine fibrinösen Pneumonie. *Ztschr f klin Med* **11**:437.
- Frankel, R. E., *et al.* (1996). Invasive pneumococcal disease: clinical features, serotypes, and antimicrobial resistance patterns in cases involving patients with and without human immunodeficiency virus infection. *Clin Infect Dis* **23**(3):577-84.
- Fraser, C., *et al.* (2007). Recombination and the nature of bacterial speciation. *Science* **315**(5811):476-80.
- Friedländer, C. (1882). Über die Schizomyceten bei der acuten fibrinösen Pneumonie. *Virchows Arch f Path Anat* **87**(2):319.
- Friedländer, C. (1883). Die Mikrokokken der Pneumonie. *Fortschr Med* **1**(22):715-733.
- Friedländer, C. (1886). Weitere Arbeiten über die Schizomyceten der Pneumonie und der Meningitis. *Fortschr d Med* **4**(21):702.
- Gamaléia, N. (1888). Sur l'étiologie de la pneumonie fibrineuse chez l'homme. *Ann Inst Pasteur* **2**(8):440-459.
- Garau, J., *et al.* (1981). Chloramphenicol-resistant pneumococci. *Lancet* **2**(8238):147-8.
- Garcia, E., *et al.* (1988). Molecular evolution of lytic enzymes of *Streptococcus pneumoniae* and its bacteriophages. *Proc Natl Acad Sci U S A* **85**(3):914-8.
- Garcia-Bustos, J. and A. Tomasz (1990). A biological price of antibiotic resistance: major changes in the peptidoglycan structure of penicillin-resistant pneumococci. *Proc Natl Acad Sci U S A* **87**(14):5415-9.
- Garcia-Bustos, J. F., *et al.* (1988). Altered peptidoglycan structure in a pneumococcal transformant resistant to penicillin. *J Bacteriol* **170**(5):2143-7.
- Garvey, M. I., *et al.* (2010). Overexpression of *patA* and *patB*, which encode ABC transporters, is associated with fluoroquinolone resistance in clinical isolates of *Streptococcus pneumoniae*. *Antimicrob Agents Chemother* **55**(1):190-6.
- Garvey, M. I. and L. J. Piddock (2008). The efflux pump inhibitor reserpine selects multidrug-resistant *Streptococcus pneumoniae* strains that overexpress the

- ABC transporters PatA and PatB. *Antimicrob Agents Chemother* **52**(5):1677-85.
- Gasc, A. M., *et al.* (1987). Mismatch repair during pneumococcal transformation of small deletions produced by site-directed mutagenesis. *Mol Gen Genet* **210**(2):369-72.
- Gasc, A. M. and A. M. Sicard (1986). Frame-shift mutants induced by quinacrine are recognized by the mismatch repair system in *Streptococcus pneumoniae*. *Mol Gen Genet* **203**(2):269-73.
- Gasc, A. M., *et al.* (1989). Repair of single- and multiple-substitution mismatches during recombination in *Streptococcus pneumoniae*. *Genetics* **121**(1):29-36.
- Gay, K. and D. S. Stephens (2001). Structure and dissemination of a chromosomal insertion element encoding macrolide efflux in *Streptococcus pneumoniae*. *J Infect Dis* **184**(1):56-65.
- George, R. H., *et al.* (1981). Multiresistant pneumococci. *Lancet* **2**(8249):751-2.
- Gianfaldoni, C., *et al.* (2007). *Streptococcus pneumoniae* pilus subunits protect mice against lethal challenge. *Infect Immun* **75**(2):1059-62.
- Gill, M. J., *et al.* (1999). Identification of an efflux pump gene, *pmrA*, associated with fluoroquinolone resistance in *Streptococcus pneumoniae*. *Antimicrob Agents Chemother* **43**(1):187-9.
- Gilson, E., *et al.* (1991). Palindromic units are part of a new bacterial interspersed mosaic element (BIME). *Nucleic Acids Res* **19**(7):1375-83.
- Gindreau, E., *et al.* (2000). MM1, a temperate bacteriophage of the type 23F Spanish/USA multiresistant epidemic clone of *Streptococcus pneumoniae*: structural analysis of the site-specific integration system. *J Virol* **74**(17):7803-13.
- Gladstone, R. A., *et al.* (2011). Continued control of pneumococcal disease in the UK - the impact of vaccination. *J Med Microbiol* **60**(Pt 1):1-8.
- Goebel, W. F. and O. T. Avery (1931). Chemo-immunological studies on conjugated carbohydrate-proteins : iv. the synthesis of thep-aminobenzyl ether of the soluble specific substance of type III pneumococcus and its coupling with protein. *J Exp Med* **54**(3):431-6.
- Goldsmith, C. E., *et al.* (1998). Increased incidence of ciprofloxacin resistance in penicillin-resistant pneumococci in Northern Ireland. *J Antimicrob Chemother* **41**(3):420-1.
- Goldstein, F. W. and J. F. Acar (1996). Antimicrobial resistance among lower respiratory tract isolates of *Streptococcus pneumoniae*: results of a 1992-93 western Europe and USA collaborative surveillance study. The Alexander Project Collaborative Group. *J Antimicrob Chemother* **38 Suppl A**:71-84.
- Goodman, S. D. and J. J. Scocca (1988). Identification and arrangement of the DNA sequence recognized in specific transformation of *Neisseria gonorrhoeae*. *Proc Natl Acad Sci U S A* **85**(18):6982-6.
- Gordon, M. A., *et al.* (2001). Bacteraemia and mortality among adult medical admissions in Malawi--predominance of non-typhi salmonellae and *Streptococcus pneumoniae*. *J Infect* **42**(1):44-9.
- Gram, C. (1884). Über die isolierte Färbung der Schizomyceten in Schnitt- und Trockenpräparaten. *Fortschr d Med* **2**:185-189.
- Gransden, W. R., *et al.* (1985). Pneumococcal bacteraemia: 325 episodes diagnosed at St Thomas's Hospital. *Br Med J (Clin Res Ed)* **290**(6467):505-8.

- Grassly, N. C. and E. C. Holmes (1997). A likelihood method for the detection of selection and recombination using nucleotide sequences. *Mol Biol Evol* **14**(3):239-47.
- Gratten, M., *et al.* (1986). Colonisation of *Haemophilus influenzae* and *Streptococcus pneumoniae* in the upper respiratory tract of neonates in Papua New Guinea: primary acquisition, duration of carriage, and relationship to carriage in mothers. *Biol Neonate* **50**(2):114-20.
- Gratten, M., *et al.* (1989). Multiple colonization of the upper respiratory tract of Papua New Guinea children with *Haemophilus influenzae* and *Streptococcus pneumoniae*. *Southeast Asian J Trop Med Public Health* **20**(4):501-9.
- Gratten, M., *et al.* (1993). An outbreak of serotype 1 *Streptococcus pneumoniae* infection in central Australia. *Med J Aust* **158**(5):340-2.
- Gratten, M., *et al.* (1980). High prevalence of penicillin-insensitive pneumococci in Port Moresby, Papua New Guinea. *Lancet* **2**(8187):192-5.
- Gray, B. M., *et al.* (1980). Epidemiologic studies of *Streptococcus pneumoniae* in infants: acquisition, carriage, and infection during the first 24 months of life. *J Infect Dis* **142**(6):923-33.
- Gray, B. M., *et al.* (1982). Epidemiologic studies of *Streptococcus pneumoniae* in infants. The effects of season and age on pneumococcal acquisition and carriage in the first 24 months of life. *Am J Epidemiol* **116**(4):692-703.
- Greenberg, D., *et al.* (2006). The contribution of smoking and exposure to tobacco smoke to *Streptococcus pneumoniae* and *Haemophilus influenzae* carriage in children and their mothers. *Clin Infect Dis* **42**(7):897-903.
- Griffith, F. (1928). The significance of pneumococcal types. *J Hygiene* **27**:113-159.
- Guell, M., *et al.* (2009). Transcriptome complexity in a genome-reduced bacterium. *Science* **326**(5957):1268-71.
- Guenzi, E., *et al.* (1994). A two-component signal-transducing system is involved in competence and penicillin susceptibility in laboratory mutants of *Streptococcus pneumoniae*. *Mol Microbiol* **12**(3):505-15.
- Guevara, M., *et al.* (2009). Changing epidemiology of invasive pneumococcal disease following increased coverage with the heptavalent conjugate vaccine in Navarre, Spain. *Clin Microbiol Infect* **15**(11):1013-9.
- Guiral, S., *et al.* (2005). Competence-programmed predation of noncompetent cells in the human pathogen *Streptococcus pneumoniae*: genetic requirements. *Proc Natl Acad Sci U S A* **102**(24):8710-5.
- Gundel, M. and F. Schwarz (1932). Studien über die Bakterien flora der Oberen Atmungswege Neugeborener unter besonderer Berücksichtigung ihrer Bedeutung für das Pneumoniaeproblem. *Z Hyg Infekt* **1932**(113):411-436.
- Gurney, T., Jr. and M. S. Fox (1968). Physical and genetic hybrids formed in bacterial transformation. *J Mol Biol* **32**(1):83-100.
- Gutierrez-Preciado, A., *et al.* (2007). Comparison of tryptophan biosynthetic operon regulation in different Gram-positive bacterial species. *Trends Genet* **23**(9):422-6.
- Haber, L. T., *et al.* (1988). Nucleotide sequence of the *Salmonella typhimurium mutS* gene required for mismatch repair: homology of MutS and HexA of *Streptococcus pneumoniae*. *J Bacteriol* **170**(1):197-202.
- Hakenbeck, R., *et al.* (1991a). Antigenic variation of penicillin-binding proteins from penicillin-resistant clinical strains of *Streptococcus pneumoniae*. *J Infect Dis* **164**(2):313-9.

- Hakenbeck, R., *et al.* (1991b). Variability of penicillin-binding proteins from penicillin-sensitive *Streptococcus pneumoniae*. *J Infect Dis* **164**(2):307-12.
- Hakenbeck, R., *et al.* (1986). Antibodies against the benzylpenicilloyl moiety as a probe for penicillin-binding proteins. *Eur J Biochem* **157**(1):101-6.
- Hakenbeck, R., *et al.* (1980). Multiple changes of penicillin-binding proteins in penicillin-resistant clinical isolates of *Streptococcus pneumoniae*. *Antimicrob Agents Chemother* **17**(3):364-71.
- Hamburger, M., *et al.* (1943). The occurrence of sulfonamide-resistant pneumococci in clinical practice. *J Infect Dis* **73**(1):12-30.
- Hanage, W. P., *et al.* (2006). Sequences, sequence clusters and bacterial species. *Philos Trans R Soc Lond B Biol Sci* **361**(1475):1917-27.
- Hanna, J. N., *et al.* (2008). Invasive pneumococcal disease in Indigenous people in north Queensland: an update, 2005-2007. *Med J Aust* **189**(1):43-6.
- Hansman, D. and M. Bullen (1967). A resistant pneumococcus. *Lancet* **2**:264-265.
- Hansman, D., *et al.* (1971). Increased resistance to penicillin of pneumococci isolated from man. *N Engl J Med* **284**(4):175-7.
- Harboe, Z. B., *et al.* (2009). Pneumococcal serotypes and mortality following invasive pneumococcal disease: a population-based cohort study. *PLoS Med* **6**(5):e1000081.
- Hardie, W., *et al.* (1996). Pneumococcal pleural empyemas in children. *Clin Infect Dis* **22**(6):1057-63.
- Hare, K. M., *et al.* (2008). Random colony selection versus colony morphology for detection of multiple pneumococcal serotypes in nasopharyngeal swabs. *Pediatr Infect Dis J* **27**(2):178-80.
- Harris, H. (1966). Enzyme polymorphisms in man. *Proc R Soc Lond B Biol Sci* **164**(995):298-310.
- Harris, S. R., *et al.* (2010). Evolution of MRSA during hospital transmission and intercontinental spread. *Science* **327**(5964):469-74.
- Hava, D. L. and A. Camilli (2002). Large-scale identification of serotype 4 *Streptococcus pneumoniae* virulence factors. *Mol Microbiol* **45**(5):1389-406.
- Havarstein, L. S. (2010). Increasing competence in the genus *Streptococcus*. *Mol Microbiol* **78**(3):541-4.
- Havarstein, L. S., *et al.* (1995). An unmodified heptadecapeptide pheromone induces competence for genetic transformation in *Streptococcus pneumoniae*. *Proc Natl Acad Sci U S A* **92**(24):11140-4.
- Havarstein, L. S., *et al.* (2006). New insights into the pneumococcal fratricide: relationship to clumping and identification of a novel immunity factor. *Mol Microbiol* **59**(4):1297-307.
- He, M., *et al.* (2010). Evolutionary dynamics of *Clostridium difficile* over short and long time scales. *Proc Natl Acad Sci U S A* **107**(16):7527-32.
- He, Y., *et al.* (2008). The antisense transcriptomes of human cells. *Science* **322**(5909):1855-7.
- Heidelberger, M. and O. T. Avery (1923). The soluble specific substance of pneumococcus. *J Exp Med* **38**(1):73-9.
- Heidelberger, M. and W. Goebel (1927). The soluble specific substance of pneumococcus. *J Biol Chem* **74**:613-618.
- Hein, J. (1993). A heuristic method to reconstruct the history of sequences subject to recombination. *J Mol Evol* **36**(4):396-405.

- Hendrickson, D. J., *et al.* (2008). Five-fold increase in pediatric parapneumonic empyema since introduction of pneumococcal conjugate vaccine. *Pediatr Infect Dis J* **27**(11):1030-2.
- Henriques, B., *et al.* (2000). Molecular epidemiology of *Streptococcus pneumoniae* causing invasive disease in 5 countries. *J Infect Dis* **182**(3):833-9.
- Henriques Normark, B., *et al.* (2001). Clinical isolates of *Streptococcus pneumoniae* that exhibit tolerance of vancomycin. *Clin Infect Dis* **32**(4):552-8.
- Hermans, P. W., *et al.* (1997). Penicillin-resistant *Streptococcus pneumoniae* in the Netherlands: results of a 1-year molecular epidemiologic survey. *J Infect Dis* **175**(6):1413-22.
- Hernandez, D., *et al.* (2008). *De novo* bacterial genome sequencing: millions of very short reads assembled on a desktop computer. *Genome Res* **18**(5):802-9.
- Hicks, L. A., *et al.* (2007). Incidence of pneumococcal disease due to non-pneumococcal conjugate vaccine (PCV7) serotypes in the United States during the era of widespread PCV7 vaccination, 1998-2004. *J Infect Dis* **196**(9):1346-54.
- Hill, P. C., *et al.* (2008). Nasopharyngeal carriage of *Streptococcus pneumoniae* in Gambian infants: a longitudinal study. *Clin Infect Dis* **46**(6):807-14.
- Hill, W. and A. Robertson (1966). The effect of linkage on limits to artificial selection. *Genetical Res* **8**:269-294.
- Hiller, N. L., *et al.* (2007). Comparative genomic analyses of seventeen *Streptococcus pneumoniae* strains: insights into the pneumococcal supragenome. *J Bacteriol* **189**(22):8186-95.
- Hinds, J., *et al.* (2002a). Glass slide microarrays for bacterial genomes. *Methods Microbiol* **33**:83-99.
- Hinds, J., *et al.* (2002b). Microarray design for bacterial genomes. *Methods Microbiol* **33**:67-82.
- Hirst, R. A., *et al.* (2004). The role of pneumolysin in pneumococcal pneumonia and meningitis. *Clin Exp Immunol* **138**(2):195-201.
- Hoelzer, M. A. and R. E. Michod (1991). DNA repair and the evolution of transformation in *Bacillus subtilis*. III. Sex with damaged DNA. *Genetics* **128**(2):215-23.
- Hofacker, I. L. (2009). RNA secondary structure analysis using the Vienna RNA package. *Curr Protoc Bioinformatics* **Chapter 12**:Unit12 2.
- Hoge, C. W., *et al.* (1994). An epidemic of pneumococcal disease in an overcrowded, inadequately ventilated jail. *N Engl J Med* **331**(10):643-8.
- Hogg, J. S., *et al.* (2007). Characterization and modeling of the *Haemophilus influenzae* core and supragenomes based on the complete genomic sequences of Rd and 12 clinical nontypeable strains. *Genome Biol* **8**(6):R103.
- Holden, M. T., *et al.* (2009a). Rapid evolution of virulence and drug resistance in the emerging zoonotic pathogen *Streptococcus suis*. *PLoS One* **4**(7):e6072.
- Holden, M. T., *et al.* (2009b). Genomic evidence for the evolution of *Streptococcus equi*: host restriction, increased virulence, and genetic exchange with human pathogens. *PLoS Pathog* **5**(3):e1000346.
- Holt, K. E., *et al.* (2008). High-throughput sequencing provides insights into genome variation and evolution in *Salmonella* Typhi. *Nat Genet* **40**(8):987-93.
- Hoskins, J., *et al.* (2001). Genome of the bacterium *Streptococcus pneumoniae* strain R6. *J Bacteriol* **183**(19):5709-17.
- Howard, L. V. and H. Gooder (1974). Specificity of the autolysin of *Streptococcus (Diplococcus) pneumoniae*. *J Bacteriol* **117**(2):796-804.

- Howe, J. G. and T. S. Wilson (1972). Co-trimoxazole-resistant pneumococci. *Lancet* **2**(7769):184-5.
- Hsieh, Y. C., *et al.* (2006). Serotype competence and penicillin resistance in *Streptococcus pneumoniae*. *Emerg Infect Dis* **12**(11):1709-14.
- Hsu, K., *et al.* (2005). Population-based surveillance for childhood invasive pneumococcal disease in the era of conjugate vaccine. *Pediatr Infect Dis J* **24**(1):17-23.
- Huang, S. S., *et al.* (2004). Community-level predictors of pneumococcal carriage and resistance in young children. *Am J Epidemiol* **159**(7):645-54.
- Huang, S. S., *et al.* (2005). Post-PCV7 changes in colonizing pneumococcal serotypes in 16 Massachusetts communities, 2001 and 2004. *Pediatrics* **116**(3):e408-13.
- Huebner, R. E., *et al.* (2000). Lack of utility of serotyping multiple colonies for detection of simultaneous nasopharyngeal carriage of different pneumococcal serotypes. *Pediatr Infect Dis J* **19**(10):1017-20.
- Hughes, D. T. (1969). Single-blind comparative trial of trimethoprim-sulphamethoxazole and ampicillin in the treatment of exacerbations of chronic bronchitis. *Br Med J* **4**(5681):470-3.
- Hulton, C. S., *et al.* (1991). ERIC sequences: a novel family of repetitive elements in the genomes of *Escherichia coli*, *Salmonella typhimurium* and other enterobacteria. *Mol Microbiol* **5**(4):825-34.
- Humbert, O., *et al.* (1995). Homeologous recombination and mismatch repair during transformation in *Streptococcus pneumoniae*: saturation of the Hex mismatch repair system. *Proc Natl Acad Sci U S A* **92**(20):9052-6.
- Husmeier, D. (2005). Discriminating between rate heterogeneity and interspecific recombination in DNA sequence alignments with phylogenetic factorial hidden Markov models. *Bioinformatics* **21 Suppl 2**:ii166-72.
- Hyams, C., *et al.* (2010a). The *Streptococcus pneumoniae* capsule inhibits complement activity and neutrophil phagocytosis by multiple mechanisms. *Infect Immun* **78**(2):704-15.
- Hyams, C., *et al.* (2010b). *Streptococcus pneumoniae* resistance to complement-mediated immunity is dependent on the capsular serotype. *Infect Immun* **78**(2):716-25.
- Inostroza, J., *et al.* (2001). Influence of patient age on *Streptococcus pneumoniae* serotypes causing invasive disease. *Clin Diagn Lab Immunol* **8**(3):556-9.
- Inverarity, D. (2009). Genomic diversity in naturally transformable *Streptococcus pneumoniae*. Division of Infection and Immunity. Glasgow, University of Glasgow. **PhD**.
- Isozumi, R., *et al.* (2008). Molecular characteristics of serotype 3 *Streptococcus pneumoniae* isolates among community-acquired pneumonia patients in Japan. *J Infect Chemother* **14**(3):258-61.
- Iyer, V. N. and A. W. Ravin (1962). Integration and expression of different lengths of DNA during the transformation of pneumococcus to erythromycin resistance. *Genetics* **47**(10):1355-68.
- Jabes, D., *et al.* (1989). Penicillin-binding protein families: evidence for the clonal nature of penicillin resistance in clinical isolates of pneumococci. *J Infect Dis* **159**(1):16-25.
- Jacobs, M. R., *et al.* (1978). Emergence of multiply resistant pneumococci. *N Engl J Med* **299**(14):735-40.
- Jacobs, N. M. (1991). Pneumococcal osteomyelitis and arthritis in children. A hospital series and literature review. *Am J Dis Child* **145**(1):70-4.

- Jacoby, P., *et al.* (2007). Modelling the co-occurrence of *Streptococcus pneumoniae* with other bacterial and viral pathogens in the upper respiratory tract. *Vaccine* **25**(13):2458-64.
- Janoff, E. N., *et al.* (1993). *Streptococcus pneumoniae* colonization, bacteremia, and immune response among persons with human immunodeficiency virus infection. *J Infect Dis* **167**(1):49-56.
- Janoir, C., *et al.* (1996). High-level fluoroquinolone resistance in *Streptococcus pneumoniae* requires mutations in *parC* and *gyrA*. *Antimicrob Agents Chemother* **40**(12):2760-4.
- Janulczyk, R., *et al.* (2000). Hic, a novel surface protein of *Streptococcus pneumoniae* that interferes with complement function. *J Biol Chem* **275**(47):37257-63.
- Jennings, H. J., *et al.* (1980). Structure of the complex polysaccharide C-substance from *Streptococcus pneumoniae* type 1. *Biochemistry* **19**(20):4712-9.
- Johnsborg, O., *et al.* (2007). Natural genetic transformation: prevalence, mechanisms and function. *Res Microbiol* **158**(10):767-78.
- Johnson, A. P., *et al.* (2007). Morbidity and mortality of pneumococcal meningitis and serotypes of causative strains prior to introduction of the 7-valent conjugant pneumococcal vaccine in England. *J Infect* **55**(5):394-9.
- Juhn, Y. J., *et al.* (2008). Increased risk of serious pneumococcal disease in patients with asthma. *J Allergy Clin Immunol* **122**(4):719-23.
- Kadioglu, A., *et al.* (2008). The role of *Streptococcus pneumoniae* virulence factors in host respiratory colonization and disease. *Nat Rev Microbiol* **6**(4):288-301.
- Kalin, M., *et al.* (2000). Prospective study of prognostic factors in community-acquired bacteremic pneumococcal disease in 5 countries. *J Infect Dis* **182**(3):840-7.
- Kaltoft, M. S., *et al.* (2008). An easy method for detection of nasopharyngeal carriage of multiple *Streptococcus pneumoniae* serotypes. *J Microbiol Methods* **75**(3):540-4.
- Kane, M. D., *et al.* (2000). Assessment of the sensitivity and specificity of oligonucleotide (50mer) microarrays. *Nucleic Acids Res* **28**(22):4552-7.
- Kaplan, S. L., *et al.* (2004). Decrease of invasive pneumococcal infections in children among 8 children's hospitals in the United States after the introduction of the 7-valent pneumococcal conjugate vaccine. *Pediatrics* **113**(3 Pt 1):443-9.
- Karlsson, C., *et al.* (1999). The pneumococcal common antigen C-polysaccharide occurs in different forms. Mono-substituted or di-substituted with phosphocholine. *Eur J Biochem* **265**(3):1091-7.
- Kashket, E. (1987). Bioenergetics of lactic acid bacteria: cytoplasmic pH and osmotolerance. *FEMS Microbiol Rev* **46**:233-244.
- Kastenbauer, S. and H. W. Pfister (2003). Pneumococcal meningitis in adults: spectrum of complications and prognostic factors in a series of 87 cases. *Brain* **126**(Pt 5):1015-25.
- Kawamura, Y., *et al.* (1995). Determination of 16S rRNA sequences of *Streptococcus mitis* and *Streptococcus gordonii* and phylogenetic relationships among members of the genus *Streptococcus*. *Int J Syst Bacteriol* **45**(2):406-8.
- Keefer, C., *et al.* (1943). Penicillin in the treatment of infections. *JAMA* **122**(18):1217-1224.
- Keith, E. R., *et al.* (2006). Characteristics of *Streptococcus pseudopneumoniae* isolated from purulent sputum samples. *J Clin Microbiol* **44**(3):923-7.

- Kellner, J. D., *et al.* (1998). The use of *Streptococcus pneumoniae* nasopharyngeal isolates from healthy children to predict features of invasive disease. *Pediatr Infect Dis J* **17**(4):279-86.
- Kelly, T., *et al.* (1994). Effect of genetic switching of capsular type on virulence of *Streptococcus pneumoniae*. *Infect Immun* **62**(5):1813-9.
- Kemp, K. (1979). A review of selected federal vaccine and immunization policies, based on case studies of pneumococcal vaccine, Office of Technology Assessment.
- Kidgell, C., *et al.* (2002). *Salmonella typhi*, the causative agent of typhoid fever, is approximately 50,000 years old. *Infect Genet Evol* **2**(1):39-45.
- Kilian, M., *et al.* (2008). Evolution of *Streptococcus pneumoniae* and its close commensal relatives. *PLoS One* **3**(7):e2683.
- Kim, J. O. and J. N. Weiser (1998). Association of intrastrain phase variation in quantity of capsular polysaccharide and teichoic acid with the virulence of *Streptococcus pneumoniae*. *J Infect Dis* **177**(2):368-77.
- Kislak, J. W. (1967). Type 6 pneumococcus resistant to erythromycin and lincomycin. *N Engl J Med* **276**(15):852.
- Kislak, J. W., *et al.* (1965). Susceptibility of pneumococci to nine antibiotics. *Am J Med Sci* **250**(3):261-8.
- Klein, J. O. (1994). Otitis media. *Clin Infect Dis* **19**(5):823-33.
- Klein, J. O. (2000). The burden of otitis media. *Vaccine* **19 Suppl 1**:S2-8.
- Klugman, K. (1998). Pneumococcal molecular epidemiology network. *ASM News* **64**(7):371.
- Klugman, K. P. (2002). The successful clone: the vector of dissemination of resistance in *Streptococcus pneumoniae*. *J Antimicrob Chemother* **50 Suppl S2**:1-5.
- Klugman, K. P. and H. Koornhof (1988a). Bacteremic pneumonia caused by penicillin-resistant pneumococci. *N Engl J Med* **318**(2):123-4.
- Klugman, K. P. and H. J. Koornhof (1988b). Drug resistance patterns and serogroups or serotypes of pneumococcal isolates from cerebrospinal fluid or blood, 1979-1986. *J Infect Dis* **158**(5):956-64.
- Knutsen, E., *et al.* (2006). BOX elements modulate gene expression in *Streptococcus pneumoniae*: impact on the fine-tuning of competence development. *J Bacteriol* **188**(23):8307-12.
- Koch, R. (1893). Über den augenblicklichen Stand der bakteriologischen Choleradiagnose. *Z Hyg Infekt* **14**:319-333.
- Koedel, U., *et al.* (2002). Pathogenesis and pathophysiology of pneumococcal meningitis. *Lancet Infect Dis* **2**(12):721-36.
- Koeuth, T., *et al.* (1995). Differential subsequence conservation of interspersed repetitive *Streptococcus pneumoniae* BOX elements in diverse bacteria. *Genome Res* **5**(4):408-18.
- Koivula, I., *et al.* (1994). Risk factors for pneumonia in the elderly. *Am J Med* **96**(4):313-20.
- Kreutzer, D. A. and J. M. Essigmann (1998). Oxidized, deaminated cytosines are a source of C --> T transitions in vivo. *Proc Natl Acad Sci U S A* **95**(7):3578-82.
- Kuhn, H. and M. D. Frank-Kamenetskii (2005). Template-independent ligation of single-stranded DNA by T4 DNA ligase. *FEBS J* **272**(23):5991-6000.
- Kulldorf, M. (1997). A spatial scan statistic. *Comm Stat Theory Meth* **26**(6):1481-1496.

- Kyaw, M. H., *et al.* (2006). Effect of introduction of the pneumococcal conjugate vaccine on drug-resistant *Streptococcus pneumoniae*. *N Engl J Med* **354**(14):1455-63.
- Kyaw, M. H., *et al.* (2005). The influence of chronic illnesses on the incidence of invasive pneumococcal disease in adults. *J Infect Dis* **192**(3):377-86.
- Lacks, S. (1966). Integration efficiency and genetic recombination in pneumococcal transformation. *Genetics* **53**(1):207-35.
- Lacks, S. (1970). Mutants of *Diplococcus pneumoniae* that lack deoxyribonucleases and other activities possibly pertinent to genetic transformation. *J Bacteriol* **101**(2):373-83.
- Lacks, S. and M. Neuberger (1975). Membrane location of a deoxyribonuclease implicated in the genetic transformation of *Diplococcus pneumoniae*. *J Bacteriol* **124**(3):1321-9.
- Lacks, S. A., *et al.* (1982). Identification of base mismatches recognized by the heteroduplex-DNA-repair system of *Streptococcus pneumoniae*. *Cell* **31**(2 Pt 1):327-36.
- Laible, G. and R. Hakenbeck (1991). Five independent combinations of mutations can result in low-affinity penicillin-binding protein 2x of *Streptococcus pneumoniae*. *J Bacteriol* **173**(21):6986-90.
- Laible, G., *et al.* (1989). Nucleotide sequences of the *pbpX* genes encoding the penicillin-binding proteins 2x from *Streptococcus pneumoniae* R6 and a cefotaxime-resistant mutant, C506. *Mol Microbiol* **3**(10):1337-48.
- Lancereaux, E. and J. Besançon (1886). Étude sur quelques cas de pneumonie observés à l'hôpital de la Pitié au printemps de l'année 1886. *Arch gen de med* **7**(18):257.
- Lanie, J. A., *et al.* (2007). Genome sequence of Avery's virulent serotype 2 strain D39 of *Streptococcus pneumoniae* and comparison with that of unencapsulated laboratory strain R6. *J Bacteriol* **189**(1):38-51.
- Latorre, C., *et al.* (1985). Antibiotic resistance and serotypes of 100 *Streptococcus pneumoniae* strains isolated in a children's hospital in Barcelona, Spain. *Antimicrob Agents Chemother* **28**(2):357-9.
- Lau, G. W., *et al.* (2001). A functional genomic analysis of type 3 *Streptococcus pneumoniae* virulence. *Mol Microbiol* **40**(3):555-71.
- Lawrence, E. M., *et al.* (1983). Pneumococcal vaccine in normal children. Primary and secondary vaccination. *Am J Dis Child* **137**(9):846-50.
- Le Hello, S., *et al.* (2010). Invasive serotype 1 *Streptococcus pneumoniae* outbreaks in the South Pacific from 2000 to 2007. *J Clin Microbiol* **48**(8):2968-71.
- Lefevre, J. C., *et al.* (1989). Conversion of deletions during recombination in pneumococcal transformation. *Genetics* **123**(3):455-64.
- Leimkugel, J., *et al.* (2005). An outbreak of serotype 1 *Streptococcus pneumoniae* meningitis in northern Ghana with features that are characteristic of *Neisseria meningitidis* meningitis epidemics. *J Infect Dis* **192**(2):192-9.
- Lepoutre, A., *et al.* (2008). Impact of infant pneumococcal vaccination on invasive pneumococcal diseases in France, 2001-2006. *Euro Surveill* **13**(35).
- Lexau, C. A., *et al.* (2005). Changing epidemiology of invasive pneumococcal disease among older adults in the era of pediatric pneumococcal conjugate vaccine. *JAMA* **294**(16):2043-51.
- Leyden, H. v. (1882). Über infectiöse Pneumonie. *Deutsch Med Wochenschr* **9**:52-54.
- Li, H. and R. Durbin (2010). Fast and accurate long-read alignment with Burrows-Wheeler transform. *Bioinformatics* **26**(5):589-95.

- Li, H., *et al.* (2009). The Sequence Alignment/Map format and SAMtools. *Bioinformatics* **25**(16):2078-9.
- Li, L., *et al.* (2003). OrthoMCL: identification of ortholog groups for eukaryotic genomes. *Genome Res* **13**(9):2178-89.
- Lin, P. L., *et al.* (2003). Incidence of invasive pneumococcal disease in children 3 to 36 months of age at a tertiary care pediatric center 2 years after licensure of the pneumococcal conjugate vaccine. *Pediatrics* **111**(4 Pt 1):896-9.
- Linares, J., *et al.* (1983). Antibiotic resistance and serotypes of *Streptococcus pneumoniae* from patients with community-acquired pneumococcal disease. *Antimicrob Agents Chemother* **23**(4):545-7.
- Lipsitch, M. (1997). Vaccination against colonizing bacteria with multiple serotypes. *Proc Natl Acad Sci U S A* **94**(12):6571-6.
- Lipsitch, M. (1999). Bacterial vaccines and serotype replacement: lessons from *Haemophilus influenzae* and prospects for *Streptococcus pneumoniae*. *Emerg Infect Dis* **5**(3):336-45.
- Lipsky, B. A., *et al.* (1986). Risk factors for acquiring pneumococcal infections. *Arch Intern Med* **146**(11):2179-85.
- Lister, R., *et al.* (2008). Highly integrated single-base resolution maps of the epigenome in *Arabidopsis*. *Cell* **133**(3):523-36.
- Llull, D., *et al.* (1999). A single gene (*tts*) located outside the cap locus directs the formation of *Streptococcus pneumoniae* type 37 capsular polysaccharide. Type 37 pneumococci are natural, genetically binary strains. *J Exp Med* **190**(2):241-51.
- Loeffler, J. M. and V. A. Fischetti (2006). Lysogeny of *Streptococcus pneumoniae* with MM1 phage: improved adherence and other phenotypic changes. *Infect Immun* **74**(8):4486-95.
- Long, P. and E. Bliss (1937). The use of para amino benzene sulphonamide (Sulphanilamide) or its derivatives in the treatment of infections due To beta hemolytic streptococci, pneumococci and meningococci. *South Med J* **30**(5):479-487.
- Lopez, R. and E. Garcia (2004). Recent trends on the molecular biology of pneumococcal capsules, lytic enzymes, and bacteriophage. *FEMS Microbiol Rev* **28**(5):553-80.
- Lopez, R., *et al.* (1982). Choline-containing bacteriophage receptors in *Streptococcus pneumoniae*. *J Bacteriol* **151**(3):1581-90.
- Lopez, R., *et al.* (1992). Structural analysis and biological significance of the cell wall lytic enzymes of *Streptococcus pneumoniae* and its bacteriophage. *FEMS Microbiol Lett* **79**(1-3):439-47.
- Lowell, F., *et al.* (1940). Observations on the susceptibility of pneumococci to sulfapyridine, sulfathiazole and sulfamethylthiazole. *Ann Intern Med* **14**(6):1001-1023.
- Lowenburg, H. (1929). Pneumococcic empyema. *JAMA* **93**(2):106-107.
- Lujan, M., *et al.* (2004). Prospective observational study of bacteremic pneumococcal pneumonia: Effect of discordant therapy on mortality. *Crit Care Med* **32**(3):625-31.
- Lund, E. (1960). Laboratory diagnosis of pneumococcus infections. *Bull Wld Hlth Org* **23**:5-13.
- Luotonen, J. (1982). *Streptococcus pneumoniae* and *Haemophilus influenzae* in nasal cultures during acute otitis media. *Acta Otolaryngol* **93**(3-4):295-9.

- Lux, T., *et al.* (2007). Diversity of bacteriocins and activity spectrum in *Streptococcus pneumoniae*. *J Bacteriol* **189**(21):7741-51.
- Lysenko, E. S., *et al.* (2005). The role of innate immune responses in the outcome of interspecies competition for colonization of mucosal surfaces. *PLoS Pathog* **1**(1):e1.
- MacFadyen, L. P., *et al.* (2001). Competence development by *Haemophilus influenzae* is regulated by the availability of nucleic acid precursors. *Mol Microbiol* **40**(3):700-7.
- Macfarlane, J. (1994). An overview of community acquired pneumonia with lessons learned from the British Thoracic Society Study. *Semin Respir Infect* **9**(3):153-65.
- Macleod, C. M., *et al.* (1945). Prevention of pneumococcal pneumonia by immunization with specific capsular polysaccharides. *J Exp Med* **82**(6):445-65.
- Madhi, S. A., *et al.* (2007). Long-term effect of pneumococcal conjugate vaccine on nasopharyngeal colonization by *Streptococcus pneumoniae*--and associated interactions with *Staphylococcus aureus* and *Haemophilus influenzae* colonization--in HIV-Infected and HIV-uninfected children. *J Infect Dis* **196**(11):1662-6.
- Mahjoub-Messai, F., *et al.* (2009). Population snapshot of *Streptococcus pneumoniae* serotype 19A isolates before and after introduction of seven-valent pneumococcal vaccination for French children. *J Clin Microbiol* **47**(3):837-40.
- Maiden, M. C., *et al.* (1998). Multilocus sequence typing: a portable approach to the identification of clones within populations of pathogenic microorganisms. *Proc Natl Acad Sci U S A* **95**(6):3140-5.
- Majewski, J. and F. M. Cohan (1998). The effect of mismatch repair and heteroduplex formation on sexual isolation in *Bacillus*. *Genetics* **148**(1):13-8.
- Majewski, J., *et al.* (2000). Barriers to genetic exchange between bacterial species: *Streptococcus pneumoniae* transformation. *J Bacteriol* **182**(4):1016-23.
- Makela, P. H., *et al.* (1981). A study of the pneumococcal vaccine in prevention of clinically acute attacks of recurrent otitis media. *Rev Infect Dis* **3** Suppl:S124-32.
- Maki, D. G., *et al.* (1980). Penicillin susceptibility of *Streptococcus pneumoniae* in 1978. Screening for resistance by disk testing. *Am J Clin Pathol* **73**(2):177-82.
- Mangalam, H. (2002). The Bio\* toolkits--a brief overview. *Brief Bioinform* **3**(3):296-302.
- Mankovich, J. A., *et al.* (1989). Nucleotide sequence of the *Salmonella typhimurium mutL* gene required for mismatch repair: homology of MutL to HexB of *Streptococcus pneumoniae* and to PMS1 of the yeast *Saccharomyces cerevisiae*. *J Bacteriol* **171**(10):5325-31.
- Margulies, M., *et al.* (2005). Genome sequencing in microfabricated high-density picolitre reactors. *Nature* **437**(7057):376-80.
- Marioni, J. C., *et al.* (2008). RNA-seq: an assessment of technical reproducibility and comparison with gene expression arrays. *Genome Res* **18**(9):1509-17.
- Markiewicz, Z. and A. Tomasz (1989). Variation in penicillin-binding protein patterns of penicillin-resistant clinical isolates of pneumococci. *J Clin Microbiol* **27**(3):405-10.
- Marrer, E., *et al.* (2006). Involvement of the putative ATP-dependent efflux proteins PatA and PatB in fluoroquinolone resistance of a multidrug-resistant mutant of *Streptococcus pneumoniae*. *Antimicrob Agents Chemother* **50**(2):685-93.

- Marrie, T. J. (1992). Bacteraemic pneumococcal pneumonia: a continuously evolving disease. *J Infect* **24**(3):247-55.
- Martens, P., *et al.* (2004). Serotype-specific mortality from invasive *Streptococcus pneumoniae* disease revisited. *BMC Infect Dis* **4**:21.
- Martin, A. C., *et al.* (1996). Analysis of the complete nucleotide sequence and functional organization of the genome of *Streptococcus pneumoniae* bacteriophage Cp-1. *J Virol* **70**(6):3678-87.
- Martin, B., *et al.* (1992). A highly conserved repeated DNA element located in the chromosome of *Streptococcus pneumoniae*. *Nucleic Acids Res* **20**(13):3479-83.
- Martin, M., *et al.* (2003). An outbreak of conjunctivitis due to atypical *Streptococcus pneumoniae*. *N Engl J Med* **348**(12):1112-21.
- Maron, A., *et al.* (1991). Extremely high incidence of antibiotic resistance in clinical isolates of *Streptococcus pneumoniae* in Hungary. *J Infect Dis* **163**(3):542-8.
- Matthews, L. W., *et al.* (1963). Studies on pulmonary secretions. I. The over-all chemical composition of pulmonary secretions from patients with cystic fibrosis, bronchiectasis, and laryngectomy. *Am Rev Respir Dis* **88**:199-204.
- Maynard, C. (1915). Pneumonia inoculation experiment no. III. *Med J S Afr* **11**:36-38.
- Maynard, G. (1913). An enquiry into the etiology, manifestations and prevention of pneumonia amongst natives on the Rand recruited from tropical areas. *Public South Afr Inst Med Res* **1**:1-101.
- Maynard Smith, J. (1964). Group selection and kin selection. *Nature* **201**(4924):1145-1147.
- Maynard Smith, J. (1978). *The evolution of sex*. Cambridge, Cambridge University Press.
- Maynard Smith, J. (1992). Analyzing the mosaic structure of genes. *J Mol Evol* **34**(2):126-9.
- Maynard Smith, J. (1999). The detection and measurement of recombination from sequence data. *Genetics* **153**(2):1021-7.
- Maynard Smith, J. and N. H. Smith (1998). Detecting recombination from gene trees. *Mol Biol Evol* **15**(5):590-9.
- Mazzone, M., *et al.* (2001). Whole-genome organization and functional properties of miniature DNA insertion sequences conserved in pathogenic *Neisseriae*. *Gene* **278**(1-2):211-22.
- McClelland, M., *et al.* (1987). Restriction endonucleases for pulsed field mapping of bacterial genomes. *Nucleic Acids Res* **15**(15):5985-6005.
- McCool, T. L., *et al.* (2002). The immune response to pneumococcal proteins during experimental human carriage. *J Exp Med* **195**(3):359-65.
- McCullers, J. A., *et al.* (2000). Isolation and characterization of vancomycin-tolerant *Streptococcus pneumoniae* from the cerebrospinal fluid of a patient who developed recrudescence meningitis. *J Infect Dis* **181**(1):369-73.
- McDonnell, M., *et al.* (1975). "Diphlophage": a bacteriophage of *Diplococcus pneumoniae*. *Virology* **63**(2):577-82.
- McDougal, L. K., *et al.* (1998). Detection of Tn917-like sequences within a Tn916-like conjugative transposon (Tn3872) in erythromycin-resistant isolates of *Streptococcus pneumoniae*. *Antimicrob Agents Chemother* **42**(9):2312-8.
- McEllistrem, M. C., *et al.* (2003). Epidemiology of acute otitis media caused by *Streptococcus pneumoniae* before and after licensure of the 7-valent pneumococcal protein conjugate vaccine. *J Infect Dis* **188**(11):1679-84.

- McGee, L. and K. Klugman. (2011). "Pneumococcal Molecular Epidemiology Network." 2011, from <http://www.sph.emory.edu/PMEN/>.
- McGee, L., *et al.* (2001). Nomenclature of major antimicrobial-resistant clones of *Streptococcus pneumoniae* defined by the pneumococcal molecular epidemiology network. *J Clin Microbiol* **39**(7):2565-71.
- McGuire, G. and F. Wright (2000). TOPAL 2.0: improved detection of mosaic sequences within multiple alignments. *Bioinformatics* **16**(2):130-4.
- McGuire, G., *et al.* (1997). A graphical method for detecting recombination in phylogenetic data sets. *Mol Biol Evol* **14**(11):1125-31.
- McGuire, G., *et al.* (2000). A Bayesian model for detecting past recombination events in DNA multiple alignments. *J Comput Biol* **7**(1-2):159-70.
- McKee, C. and C. Houck (1943). Induced resistance to penicillin of cultures of staphylococci, pneumococci and streptococci. *Proc Soc Exp Biol Med* **53**:33-34.
- McNally, L. M., *et al.* (2006). Lack of association between the nasopharyngeal carriage of *Streptococcus pneumoniae* and *Staphylococcus aureus* in HIV-1-infected South African children. *J Infect Dis* **194**(3):385-90.
- Mehtar, S., *et al.* (1990). Clinical evaluation of oral ciprofloxacin in serious infection: an open study. *Eur J Int Med* **1**(383-390):383.
- Mejean, V. and J. P. Claverys (1984). Use of a cloned DNA fragment to analyze the fate of donor DNA in transformation of *Streptococcus pneumoniae*. *J Bacteriol* **158**(3):1175-8.
- Mejean, V. and J. P. Claverys (1988). Polarity of DNA entry in transformation of *Streptococcus pneumoniae*. *Mol Gen Genet* **213**(2-3):444-8.
- Mercat, A., *et al.* (1991). An outbreak of pneumococcal pneumonia in two men's shelters. *Chest* **99**(1):147-51.
- Messina, A. F., *et al.* (2007). Impact of the pneumococcal conjugate vaccine on serotype distribution and antimicrobial resistance of invasive *Streptococcus pneumoniae* isolates in Dallas, TX, children from 1999 through 2005. *Pediatr Infect Dis J* **26**(6):461-7.
- Metzker, M. L. (2005). Emerging technologies in DNA sequencing. *Genome Res* **15**(12):1767-76.
- Metzker, M. L. (2010). Sequencing technologies - the next generation. *Nat Rev Genet* **11**(1):31-46.
- Michel, J. B., *et al.* (2010). Quantitative analysis of culture using millions of digitized books. *Science* **331**(6014):176-82.
- Michod, R. E., *et al.* (2008). Adaptive value of sex in microbial pathogens. *Infect Genet Evol* **8**(3):267-85.
- Milkman, R. and M. M. Bridges (1993). Molecular evolution of the *Escherichia coli* chromosome. IV. Sequence comparisons. *Genetics* **133**(3):455-68.
- Millar, E. V., *et al.* (2006). Effect of community-wide conjugate pneumococcal vaccine use in infancy on nasopharyngeal carriage through 3 years of age: a cross-sectional study in a high-risk population. *Clin Infect Dis* **43**(1):8-15.
- Mingoia, M., *et al.* (2007). Composite structure of *Streptococcus pneumoniae* containing the erythromycin efflux resistance gene *mefI* and the chloramphenicol resistance gene *catQ*. *Antimicrob Agents Chemother* **51**(11):3983-7.
- Mitchell, T. J., *et al.* (1991). Complement activation and antibody binding by pneumolysin via a region of the toxin homologous to a human acute-phase protein. *Mol Microbiol* **5**(8):1883-8.

- Moller, P. and H. Wallin (1998). Adduct formation, mutagenesis and nucleotide excision repair of DNA damage produced by reactive oxygen species and lipid peroxidation product. *Mutat Res* **410**(3):271-90.
- Moore, H. and A. Chesney (1917). A study of ethylhydrocuprein (optochin) in the treatment of acute lobar pneumonia. *Arch Intern Med* **19**(4):611-682.
- Moore, M. R., *et al.* (2008). Population snapshot of emergent *Streptococcus pneumoniae* serotype 19A in the United States, 2005. *J Infect Dis* **197**(7):1016-27.
- Moore, M. R., *et al.* (2004). Impact of a conjugate vaccine on community-wide carriage of nonsusceptible *Streptococcus pneumoniae* in Alaska. *J Infect Dis* **190**(11):2031-8.
- Morel, P., *et al.* (1993). Antipairing and strand transferase activities of *E. coli* helicase II (UvrD). *Nucleic Acids Res* **21**(14):3205-9.
- Moreno, F., *et al.* (1995). The clinical and molecular epidemiology of bacteremias at a university hospital caused by pneumococci not susceptible to penicillin. *J Infect Dis* **172**(2):427-32.
- Morgenroth, J. and M. Kaufmann (1912). Arzneifestigkeit bei Bakterien (Pneumokokken). *Z. Immunitaetsforsch* **15**:610-624.
- Morrison, D. A. and W. R. Guild (1972). Transformation and deoxyribonucleic acid size: extent of degradation on entry varies with size of donor. *J Bacteriol* **112**(3):1157-68.
- Morse, H. G. and L. S. Lerman (1969). A genetic analysis by transformation of a group of uracil-requiring mutants of *Diplococcus pneumoniae*. *Genetics* **61**(1):41-60.
- Mortazavi, A., *et al.* (2008). Mapping and quantifying mammalian transcriptomes by RNA-Seq. *Nat Methods* **5**(7):621-8.
- Mortier-Barriere, I., *et al.* (2007). A key presynaptic role in transformation for a widespread bacterial protein: DprA conveys incoming ssDNA to RecA. *Cell* **130**(5):824-36.
- Moscato, M., *et al.* (2010). Vancomycin tolerance in clinical and laboratory *Streptococcus pneumoniae* isolates depends on reduced enzyme activity of the major LytA autolysin or cooperation between CiaH histidine kinase and capsular polysaccharide. *Mol Microbiol*.
- Mosser, J. L. and A. Tomasz (1970). Choline-containing teichoic acid as a structural component of pneumococcal cell wall and its role in sensitivity to lysis by an autolytic enzyme. *J Biol Chem* **245**(2):287-98.
- Moxon, E. R. and K. A. Vaughn (1981). The type b capsular polysaccharide as a virulence determinant of *Haemophilus influenzae*: studies using clinical isolates and laboratory transformants. *J Infect Dis* **143**(4):517-24.
- Muller, H. (1932). Some genetic aspects of sex. *Am Nat* **66**(703):118-138.
- Muller, H. J. (1964). The relation of recombination to mutational advance. *Mutat Res* **106**:2-9.
- Munoz, R., *et al.* (1991). Intercontinental spread of a multiresistant clone of serotype 23F *Streptococcus pneumoniae*. *J Infect Dis* **164**(2):302-6.
- Munoz, R. and A. G. De La Campa (1996). ParC subunit of DNA topoisomerase IV of *Streptococcus pneumoniae* is a primary target of fluoroquinolones and cooperates with DNA gyrase A subunit in forming resistance phenotype. *Antimicrob Agents Chemother* **40**(10):2252-7.
- Munoz, R., *et al.* (1992). Genetics of resistance to third-generation cephalosporins in clinical isolates of *Streptococcus pneumoniae*. *Mol Microbiol* **6**(17):2461-5.

- Munoz, R., *et al.* (1999). Construction of a new *Streptococcus pneumoniae*-*Escherichia coli* shuttle vector based on the replicon of an indigenous pneumococcal cryptic plasmid. *Int Microbiol* **2**(1):23-8.
- Munoz-Almagro, C., *et al.* (2008). Emergence of invasive pneumococcal disease caused by nonvaccine serotypes in the era of 7-valent conjugate vaccine. *Clin Infect Dis* **46**(2):174-82.
- Munoz-Najar, U. and M. N. Vijayakumar (1999). An operon that confers UV resistance by evoking the SOS mutagenic response in streptococcal conjugative transposon Tn5252. *J Bacteriol* **181**(9):2782-8.
- Murdoch, J. M., *et al.* (1964). Clinical trial of cephaloridine (ceporin), a new broad-spectrum antibiotic derived from cephalosporin C. *Br Med J* **2**(5419):1238-40.
- Nagalakshmi, U., *et al.* (2008). The transcriptional landscape of the yeast genome defined by RNA sequencing. *Science* **320**(5881):1344-9.
- Nandoskar, M., *et al.* (1986). Inhibition of human monocyte respiratory burst, degranulation, phospholipid methylation and bactericidal activity by pneumolysin. *Immunology* **59**(4):515-20.
- Netter (1886). De l'endocardite vegetante-ulcereuse d'origine pneumonique. *Arch de physiol norm et path* **8**(2):106-161.
- Netter (1887). De la méningite due au pneumocoque (avec ou sans pneumonie). *Arch gen de med* **7**(19):257-77.
- Neufeld, F. (1900). Über eine spezifische bakteriolytische Wirkung der Galle. *Z Hyg Infekt* **34**:454-464.
- Neufeld, F. (1902). Über die Agglutination der Pneumokokken und über die Theorieen der Agglutination *Z Hyg Infekt* **40**:54-72.
- Neufeld, F. and L. Händel (1910). Weitere Untersuchungen über Pneumokokken-Heilsera. III. Mitteilung. Über Vorkommen and Bedeutung atypischer Varietäten des Pneumokokkes. *Arbeiten aus dem kaiserlichen Gesundheitsamte* **34**:293-304.
- Neuhaus, F. C. and J. Baddiley (2003). A continuum of anionic charge: structures and functions of D-alanyl-teichoic acids in gram-positive bacteria. *Microbiol Mol Biol Rev* **67**(4):686-723.
- Niederman, M. S., *et al.* (2001). Guidelines for the management of adults with community-acquired pneumonia. Diagnosis, assessment of severity, antimicrobial therapy, and prevention. *Am J Respir Crit Care Med* **163**(7):1730-54.
- Ning, Z., *et al.* (2001). SSAHA: a fast search method for large DNA databases. *Genome Res* **11**(10):1725-9.
- Nizet, V. (2002). Streptococcal beta-hemolysins: genetics and role in disease pathogenesis. *Trends Microbiol* **10**(12):575-80.
- Novak, R., *et al.* (1999). Emergence of vancomycin tolerance in *Streptococcus pneumoniae*. *Nature* **399**(6736):590-3.
- Nuorti, J. P., *et al.* (1998). An outbreak of multidrug-resistant pneumococcal pneumonia and bacteremia among unvaccinated nursing home residents. *N Engl J Med* **338**(26):1861-8.
- Nuorti, J. P., *et al.* (2000a). Cigarette smoking and invasive pneumococcal disease. Active Bacterial Core Surveillance Team. *N Engl J Med* **342**(10):681-9.
- Nuorti, J. P., *et al.* (2000b). Epidemiologic relation between HIV and invasive pneumococcal disease in San Francisco County, California. *Ann Intern Med* **132**(3):182-90.

- O'Brien, K. L., *et al.* (2009). Burden of disease caused by *Streptococcus pneumoniae* in children younger than 5 years: global estimates. *Lancet* **374**(9693):893-902.
- Obert, C., *et al.* (2006). Identification of a candidate *Streptococcus pneumoniae* core genome and regions of diversity correlated with invasive pneumococcal disease. *Infect Immun* **74**(8):4766-77.
- Obregon, V., *et al.* (2003). Genome organization and molecular analysis of the temperate bacteriophage MM1 of *Streptococcus pneumoniae*. *J Bacteriol* **185**(7):2362-8.
- Obregon, V., *et al.* (2002). Molecular peculiarities of the *lytA* gene isolated from clinical pneumococcal strains that are bile insoluble. *J Clin Microbiol* **40**(7):2545-54.
- Ochman, H., *et al.* (1999). Calibrating bacterial evolution. *Proc Natl Acad Sci U S A* **96**(22):12638-43.
- Ogata, H., *et al.* (2002). Protein coding palindromes are a unique but recurrent feature in *Rickettsia*. *Genome Res* **12**(5):808-16.
- Ogata, H., *et al.* (2000). Selfish DNA in protein-coding genes of *Rickettsia*. *Science* **290**(5490):347-50.
- Oggioni, M. R. and J. P. Claverys (1999). Repeated extragenic sequences in prokaryotic genomes: a proposal for the origin and dynamics of the RUP element in *Streptococcus pneumoniae*. *Microbiology* **145** ( Pt 10):2647-53.
- Oggioni, M. R., *et al.* (1999). Characterization of cryptic plasmids pDP1 and pSMB1 of *Streptococcus pneumoniae*. *Plasmid* **41**(1):70-2.
- Oggioni, M. R., *et al.* (2003). Pneumococcal zinc metalloproteinase ZmpC cleaves human matrix metalloproteinase 9 and is a virulence factor in experimental pneumonia. *Mol Microbiol* **49**(3):795-805.
- Ojo, K. K., *et al.* (2006). The presence of a conjugative Gram-positive Tn2009 in Gram-negative commensal bacteria. *J Antimicrob Chemother* **57**(6):1065-9.
- Oliver, H. F., *et al.* (2009). Deep RNA sequencing of *L. monocytogenes* reveals overlapping and extensive stationary phase and sigma B-dependent transcriptomes, including multiple highly transcribed noncoding RNAs. *BMC Genomics* **10**:641.
- Orihuela, C. J., *et al.* (2004). Microarray analysis of pneumococcal gene expression during invasive disease. *Infect Immun* **72**(10):5582-96.
- Ortiz, P. J. (1970). Dihydrofolate and dihydropteroate synthesis by partially purified enzymes from wild-type and sulfonamide-resistant pneumococcus. *Biochemistry* **9**(2):355-61.
- Otto, T. D., *et al.* (2010). Iterative Correction of Reference Nucleotides (iCORN) using second generation sequencing technology. *Bioinformatics* **26**(14):1704-7.
- Pai, R., *et al.* (2006). Sequential multiplex PCR approach for determining capsular serotypes of *Streptococcus pneumoniae* isolates. *J Clin Microbiol* **44**(1):124-31.
- Pai, R., *et al.* (2005). Postvaccine genetic structure of *Streptococcus pneumoniae* serotype 19A from children in the United States. *J Infect Dis* **192**(11):1988-95.
- Pallares, R., *et al.* (1995). Resistance to penicillin and cephalosporin and mortality from severe pneumococcal pneumonia in Barcelona, Spain. *N Engl J Med* **333**(8):474-80.
- Pankuch, G. A., *et al.* (1995). Activity of CP99,219 compared with DU-6859a, ciprofloxacin, ofloxacin, levofloxacin, lomefloxacin, tosufloxacin,

- sparfloxacin and grepafloxacin against penicillin-susceptible and -resistant pneumococci. *J Antimicrob Chemother* **35**(1):230-2.
- Park, I. H., *et al.* (2007). Genetic basis for the new pneumococcal serotype, 6C. *Infect Immun* **75**(9):4482-9.
- Park, S. Y., *et al.* (2008). Impact of conjugate vaccine on transmission of antimicrobial-resistant *Streptococcus pneumoniae* among Alaskan children. *Pediatr Infect Dis J* **27**(4):335-40.
- Parkhill, J. (2002). Annotation of microbial genomes. *Methods in Microbiology* **33**:3-26.
- Parkhill, J., *et al.* (2000). Complete DNA sequence of a serogroup A strain of *Neisseria meningitidis* Z2491. *Nature* **404**(6777):502-6.
- Parry, C. M., *et al.* (2000). Nasal carriage in Vietnamese children of *Streptococcus pneumoniae* resistant to multiple antimicrobial agents. *Antimicrob Agents Chemother* **44**(3):484-8.
- Passalacqua, K. D., *et al.* (2009). Structure and complexity of a bacterial transcriptome. *J Bacteriol* **191**(10):3203-11.
- Pasta, F. and M. A. Sicard (1996). Exclusion of long heterologous insertions and deletions from the pairing synapsis in pneumococcal transformation. *Microbiology* **142** ( Pt 3):695-705.
- Pasteur, L. (1881). Sur une maladie nouvelle, provoquée par la salive d'un enfant mort de la rage. *C R Acad Sci (Paris)* **92**:159-165.
- Pastor, P., *et al.* (1998). Invasive pneumococcal disease in Dallas County, Texas: results from population-based surveillance in 1995. *Clin Infect Dis* **26**(3):590-5.
- Paterson, G. K., *et al.* (2008). PclA, a pneumococcal collagen-like protein with selected strain distribution, contributes to adherence and invasion of host cells. *FEMS Microbiol Lett* **285**(2):170-6.
- Paulsen, I. T., *et al.* (2000). Microbial genome analyses: comparative transport capabilities in eighteen prokaryotes. *J Mol Biol* **301**(1):75-100.
- Pearce, B. J., *et al.* (2002). Construction of new unencapsulated (rough) strains of *Streptococcus pneumoniae*. *Res Microbiol* **153**(4):243-7.
- Peltola, H. (2000). Worldwide *Haemophilus influenzae* type b disease at the beginning of the 21st century: global analysis of the disease burden 25 years after the use of the polysaccharide vaccine and a decade after the advent of conjugates. *Clin Microbiol Rev* **13**(2):302-17.
- Peltola, V. T. and J. A. McCullers (2004). Respiratory viruses predisposing to bacterial infections: role of neuraminidase. *Pediatr Infect Dis J* **23**(1 Suppl):S87-97.
- Pelton, S. I., *et al.* (2007). Emergence of 19A as virulent and multidrug resistant *Pneumococcus* in Massachusetts following universal immunization of infants with pneumococcal conjugate vaccine. *Pediatr Infect Dis J* **26**(6):468-72.
- Perez-Trallero, E., *et al.* (1990). Therapeutic failure and selection of resistance to quinolones in a case of pneumococcal pneumonia treated with ciprofloxacin. *Eur J Clin Microbiol Infect Dis* **9**(12):905-6.
- Perez-Trallero, E., *et al.* (2003). Fluoroquinolone and macrolide treatment failure in pneumococcal pneumonia and selection of multidrug-resistant isolates. *Emerg Infect Dis* **9**(9):1159-62.
- Perichon, B., *et al.* (1997). Characterization of a mutation in the *parE* gene that confers fluoroquinolone resistance in *Streptococcus pneumoniae*. *Antimicrob Agents Chemother* **41**(5):1166-7.

- Pericone, C. D., *et al.* (2000). Inhibitory and bactericidal effects of hydrogen peroxide production by *Streptococcus pneumoniae* on other inhabitants of the upper respiratory tract. *Infect Immun* **68**(7):3990-7.
- Perkins, T. T., *et al.* (2009). A strand-specific RNA-Seq analysis of the transcriptome of the typhoid bacillus *Salmonella typhi*. *PLoS Genet* **5**(7):e1000569.
- Pestova, E. V., *et al.* (1996). Regulation of competence for genetic transformation in *Streptococcus pneumoniae* by an auto-induced peptide pheromone and a two-component regulatory system. *Mol Microbiol* **21**(4):853-62.
- Pestova, E. V. and D. A. Morrison (1998). Isolation and characterization of three *Streptococcus pneumoniae* transformation-specific loci by use of a *lacZ* reporter insertion vector. *J Bacteriol* **180**(10):2701-10.
- Peterson, S., *et al.* (2000). Gene expression analysis of the *Streptococcus pneumoniae* competence regulons by use of DNA microarrays. *J Bacteriol* **182**(21):6192-202.
- Peterson, S. N., *et al.* (2004). Identification of competence pheromone responsive genes in *Streptococcus pneumoniae* by use of DNA microarrays. *Mol Microbiol* **51**(4):1051-70.
- Petranovic, M., *et al.* (2001). Genetic evidence that the elevated levels of *Escherichia coli* helicase II antagonize recombinational DNA repair. *Biochimie* **83**(11-12):1041-7.
- Petrosillo, N., *et al.* (2002). Prevalence, determinants, and molecular epidemiology of *Streptococcus pneumoniae* isolates colonizing the nasopharynx of healthy children in Rome. *Eur J Clin Microbiol Infect Dis* **21**(3):181-8.
- Pikis, A., *et al.* (2001). Optochin resistance in *Streptococcus pneumoniae*: mechanism, significance, and clinical implications. *J Infect Dis* **184**(5):582-90.
- Pikis, A., *et al.* (1998). A conservative amino acid mutation in the chromosome-encoded dihydrofolate reductase confers trimethoprim resistance in *Streptococcus pneumoniae*. *J Infect Dis* **178**(3):700-6.
- Pletz, M. W., *et al.* (2004). Levofloxacin-resistant invasive *Streptococcus pneumoniae* in the United States: evidence for clonal spread and the impact of conjugate pneumococcal vaccine. *Antimicrob Agents Chemother* **48**(9):3491-7.
- Poehling, K. A., *et al.* (2006). Invasive pneumococcal disease among infants before and after introduction of pneumococcal conjugate vaccine. *JAMA* **295**(14):1668-74.
- Polack, F. P., *et al.* (2000). Colonization by *Streptococcus pneumoniae* in human immunodeficiency virus-infected children. *Pediatr Infect Dis J* **19**(7):608-12.
- Polissi, A., *et al.* (1998). Large-scale identification of virulence genes from *Streptococcus pneumoniae*. *Infect Immun* **66**(12):5620-9.
- Ponstingl, H. (2011). "SMALT." from [www.sanger.ac.uk/resources/software/smalt/](http://www.sanger.ac.uk/resources/software/smalt/).
- Poolman, B. (1993). Energy transduction in lactic acid bacteria. *FEMS Microbiol Rev* **12**(1-3):125-47.
- Posada, D., *et al.* (2002). Recombination in evolutionary genomics. *Annu Rev Genet* **36**:75-97.
- Powars, D., *et al.* (1981). Pneumococcal septicemia in children with sickle cell anemia. Changing trend of survival. *JAMA* **245**(18):1839-42.
- Powel, K. (2004). Changing interest among physicians toward pneumococcal vaccination throughout the twentieth century. *J Hist Med Allied Sci* **59**(4):555-587.

- Poyart-Salmeron, C., *et al.* (1991). Nucleotide sequences specific for Tn1545-like conjugative transposons in pneumococci and staphylococci resistant to tetracycline. *Antimicrob Agents Chemother* **35**(8):1657-60.
- Pozzi, G., *et al.* (1996). Competence for genetic transformation in encapsulated strains of *Streptococcus pneumoniae*: two allelic variants of the peptide pheromone. *J Bacteriol* **178**(20):6087-90.
- Prats, H., *et al.* (1985). The *hexB* mismatch repair gene of *Streptococcus pneumoniae*: characterisation, cloning and identification of the product. *Mol Gen Genet* **200**(3):482-9.
- Price, A. L., *et al.* (2005). *De novo* identification of repeat families in large genomes. *Bioinformatics* **21 Suppl 1**:i351-8.
- Priebe, S. D., *et al.* (1988). Nucleotide sequence of the *hexA* gene for DNA mismatch repair in *Streptococcus pneumoniae* and homology of *hexA* to *mutS* of *Escherichia coli* and *Salmonella typhimurium*. *J Bacteriol* **170**(1):190-6.
- Principi, N., *et al.* (1999). Risk factors for carriage of respiratory pathogens in the nasopharynx of healthy children. Ascanius Project Collaborative Group. *Pediatr Infect Dis J* **18**(6):517-23.
- Provvedi, R., *et al.* (1996). Characterization of conjugative transposon Tn5251 of *Streptococcus pneumoniae*. *FEMS Microbiol Lett* **135**(2-3):231-6.
- Prudhomme, M., *et al.* (2006). Antibiotic stress induces genetic transformability in the human pathogen *Streptococcus pneumoniae*. *Science* **313**(5783):89-92.
- Prudhomme, M., *et al.* (1989). Nucleotide sequence of the *Streptococcus pneumoniae hexB* mismatch repair gene: homology of HexB to MutL of *Salmonella typhimurium* and to PMS1 of *Saccharomyces cerevisiae*. *J Bacteriol* **171**(10):5332-8.
- Quick, R. E., *et al.* (1993). Underutilization of pneumococcal vaccine in nursing home in Washington State: report of a serotype-specific outbreak and a survey. *Am J Med* **94**(2):149-52.
- Quin, L. R., *et al.* (2005). *In vivo* binding of complement regulator factor H by *Streptococcus pneumoniae*. *J Infect Dis* **192**(11):1996-2003.
- R Development Core Team (2011). *R: a language and environment for statistical computing*. Vienna, R Foundation for Statistical Computing.
- Radetsky, M. S., *et al.* (1981). Multiply resistant pneumococcus causing meningitis: its epidemiology within a day-care centre. *Lancet* **2**(8250):771-3.
- Ramirez, M., *et al.* (1999). A high incidence of prophage carriage among natural isolates of *Streptococcus pneumoniae*. *J Bacteriol* **181**(12):3618-25.
- Rane, L. and Y. Subbarow (1940). Nutritional Requirements of the Pneumococcus: I. Growth Factors for Types I, II, V, VII, VIII. *J Bacteriol* **40**(5):695-704.
- Rauhut, R. and G. Klug (1999). mRNA degradation in bacteria. *FEMS Microbiol Rev* **23**(3):353-70.
- Ravitch, M. M. and R. Fein (1961). The changing picture of pneumonia and empyema in infants and children. A review of the experience at the Harriet Lane Home from 1934 through 1958. *JAMA* **175**:1039-44.
- Raymond, J., *et al.* (2000). Sequential colonization by *Streptococcus pneumoniae* of healthy children living in an orphanage. *J Infect Dis* **181**(6):1983-8.
- Reber, W. (1917). Some phases of modern ocular therapeutics. *Br J Ophthalmol* **1**(5):294-309.
- Redfield, R. J. (1988). Evolution of bacterial transformation: is sex with dead cells ever better than no sex at all? *Genetics* **119**(1):213-21.

- Redfield, R. J. (1993a). Evolution of natural transformation: testing the DNA repair hypothesis in *Bacillus subtilis* and *Haemophilus influenzae*. *Genetics* **133**(4):755-61.
- Redfield, R. J. (1993b). Genes for breakfast: the have-your-cake-and-eat-it-too of bacterial transformation. *J Hered* **84**(5):400-4.
- Regev-Yochay, G., et al. (2004a). Association between carriage of *Streptococcus pneumoniae* and *Staphylococcus aureus* in Children. *JAMA* **292**(6):716-20.
- Regev-Yochay, G., et al. (2009). The pneumococcal pilus predicts the absence of *Staphylococcus aureus* co-colonization in pneumococcal carriers. *Clin Infect Dis* **48**(6):760-3.
- Regev-Yochay, G., et al. (2004b). Nasopharyngeal carriage of *Streptococcus pneumoniae* by adults and children in community and family settings. *Clin Infect Dis* **38**(5):632-9.
- Regev-Yochay, G., et al. (2006). Interference between *Streptococcus pneumoniae* and *Staphylococcus aureus*: *In vitro* hydrogen peroxide-mediated killing by *Streptococcus pneumoniae*. *J Bacteriol* **188**(13):4996-5001.
- Rehrauer, W. M., et al. (1998). Modulation of RecA nucleoprotein function by the mutagenic UmuD'C protein complex. *J Biol Chem* **273**(49):32384-7.
- Reichmann, P. and R. Hakenbeck (2000). Allelic variation in a peptide-inducible two-component system of *Streptococcus pneumoniae*. *FEMS Microbiol Lett* **190**(2):231-6.
- Reinert, R. R., et al. (2005a). Antimicrobial susceptibility of *Streptococcus pneumoniae* in eight European countries from 2001 to 2003. *Antimicrob Agents Chemother* **49**(7):2903-13.
- Reinert, R. R., et al. (2005b). Molecular epidemiology of macrolide-resistant *Streptococcus pneumoniae* isolates in Europe. *J Clin Microbiol* **43**(3):1294-300.
- Reis, J. N., et al. (2008). Transmission of *Streptococcus pneumoniae* in an urban slum community. *J Infect* **57**(3):204-13.
- Rennels, M. B., et al. (1998). Safety and immunogenicity of heptavalent pneumococcal vaccine conjugated to CRM197 in United States infants. *Pediatrics* **101**(4 Pt 1):604-11.
- Rice, P., et al. (2000). EMBOSS: the European Molecular Biology Open Software Suite. *Trends Genet* **16**(6):276-7.
- Ridda, I., et al. (2010). Lack of pneumococcal carriage in the hospitalised elderly. *Vaccine* **28**(23):3902-4.
- Riley, H. D., Jr. (1950). Pneumococcal meningitis with hyperglycemia and development of subdural effusion; successful treatment with chloramphenicol. *J Pediatr* **37**(6):909-16.
- Ring, A., et al. (1998). Pneumococcal trafficking across the blood-brain barrier. Molecular analysis of a novel bidirectional pathway. *J Clin Invest* **102**(2):347-60.
- Roberts, A. P. and P. Mullany (2009). A modular master on the move: the Tn916 family of mobile genetic elements. *Trends Microbiol* **17**(6):251-8.
- Roberts, M. S. and F. M. Cohan (1993). The effect of DNA sequence divergence on sexual isolation in *Bacillus*. *Genetics* **134**(2):401-8.
- Robertson, G. T., et al. (2005). Use of an efflux-deficient *Streptococcus pneumoniae* strain panel to identify ABC-class multidrug transporters involved in intrinsic resistance to antimicrobial agents. *Antimicrob Agents Chemother* **49**(11):4781-3.

- Robinson, K. A., *et al.* (2001). Epidemiology of invasive *Streptococcus pneumoniae* infections in the United States, 1995-1998: Opportunities for prevention in the conjugate vaccine era. *JAMA* **285**(13):1729-35.
- Rocha, E. P. (2008). The organization of the bacterial genome. *Annu Rev Genet* **42**:211-33.
- Rodenburg, G. D., *et al.* (2010). Effects of pneumococcal conjugate vaccine 2 years after its introduction, the Netherlands. *Emerg Infect Dis* **16**(5):816-23.
- Rodriguez-Barradas, M. C., *et al.* (1997). Colonization by *Streptococcus pneumoniae* among human immunodeficiency virus-infected adults: prevalence of antibiotic resistance, impact of immunization, and characterization by polymerase chain reaction with BOX primers of isolates from persistent *S. pneumoniae* carriers. *J Infect Dis* **175**(3):590-7.
- Romero, P., *et al.* (2009). Development of a prophage typing system and analysis of prophage carriage in *Streptococcus pneumoniae*. *Appl Environ Microbiol* **75**(6):1642-9.
- Romero, P., *et al.* (2007). Isolation and characterization of a new plasmid pSpnP1 from a multidrug-resistant clone of *Streptococcus pneumoniae*. *Plasmid* **58**(1):51-60.
- Ross, R. (1939). Acquired tolerance of pneumococcus to M. + B. *Lancet* **1**:1207-1208.
- Ruckinger, S., *et al.* (2009a). Reduction in the incidence of invasive pneumococcal disease after general vaccination with 7-valent pneumococcal conjugate vaccine in Germany. *Vaccine* **27**(31):4136-41.
- Ruckinger, S., *et al.* (2009b). Association of serotype of *Streptococcus pneumoniae* with risk of severe and fatal outcome. *Pediatr Infect Dis J* **28**(2):118-22.
- Rudolph, K. M., *et al.* (2000). Serotype distribution and antimicrobial resistance patterns of invasive isolates of *Streptococcus pneumoniae*: Alaska, 1991-1998. *J Infect Dis* **182**(2):490-6.
- Ruiz, M., *et al.* (1999). Etiology of community-acquired pneumonia: impact of age, comorbidity, and severity. *Am J Respir Crit Care Med* **160**(2):397-405.
- Sa-Leao, R., *et al.* (2009). Changes in pneumococcal serotypes and antibiotypes carried by vaccinated and unvaccinated day-care centre attendees in Portugal, a country with widespread use of the seven-valent pneumococcal conjugate vaccine. *Clin Microbiol Infect* **15**(11):1002-7.
- Saah, A. J., *et al.* (1980). Relative resistance to penicillin in the pneumococcus. A prevalence and case-control study. *JAMA* **243**(18):1924-7.
- Sabri, M., *et al.* (2011). Genome annotation and intraviral interactome for the *Streptococcus pneumoniae* virulent phage Dp-1. *J Bacteriol* **193**(2):551-62.
- Saha, S. K., *et al.* (2009). Surveillance for invasive *Streptococcus pneumoniae* disease among hospitalized children in Bangladesh: antimicrobial susceptibility and serotype distribution. *Clin Infect Dis* **48 Suppl 2**:S75-81.
- Salmon, D. E. (1884). Discrediting American science. *Science* **4**(86):303-5.
- Saluja, S. K. and J. N. Weiser (1995). The genetic basis of colony opacity in *Streptococcus pneumoniae*: evidence for the effect of box elements on the frequency of phenotypic variation. *Mol Microbiol* **16**(2):215-27.
- Sanchez, C. J., *et al.* (2010). The pneumococcal serine-rich repeat protein is an intra-species bacterial adhesin that promotes bacterial aggregation *in vivo* and in biofilms. *PLoS Pathog* **6**(8).

- Sanchez-Pescador, R., *et al.* (1988). Homology of the TetM with translational elongation factors: implications for potential modes of *tetM*-conferred tetracycline resistance. *Nucleic Acids Res* **16**(3):1218.
- Sandgren, A., *et al.* (2004). Effect of clonal and serotype-specific properties on the invasive capacity of *Streptococcus pneumoniae*. *J Infect Dis* **189**(5):785-96.
- Sanger, F., *et al.* (1977). DNA sequencing with chain-terminating inhibitors. *Proc Natl Acad Sci U S A* **74**(12):5463-7.
- Sawyer, S. (1989). Statistical tests for detecting gene conversion. *Mol Biol Evol* **6**(5):526-38.
- Schmidt, L. and C. Sesler (1943). Development of resistance to penicillin by pneumococci. *Proc Soc Exp Biol Med* **52**:353-357.
- Schuchat, A., *et al.* (1997). Bacterial meningitis in the United States in 1995. Active Surveillance Team. *N Engl J Med* **337**(14):970-6.
- Schuster, C., *et al.* (1998). Small cryptic plasmids of *Streptococcus pneumoniae* belong to the pC194/pUB110 family of rolling circle plasmids. *FEMS Microbiol Lett* **164**(2):427-31.
- Schuster-Bockler, B., *et al.* (2004). HMM Logos for visualization of protein families. *BMC Bioinformatics* **5**:7.
- Schwartz, D. C. and C. R. Cantor (1984). Separation of yeast chromosome-sized DNAs by pulsed field gradient gel electrophoresis. *Cell* **37**(1):67-75.
- Scott, J. A., *et al.* (1996). Serogroup-specific epidemiology of *Streptococcus pneumoniae*: associations with age, sex, and geography in 7,000 episodes of invasive disease. *Clin Infect Dis* **22**(6):973-81.
- Sebert, M. E., *et al.* (2005). Pneumococcal HtrA protease mediates inhibition of competence by the CiaRH two-component signaling system. *J Bacteriol* **187**(12):3969-79.
- Selander, R. K., *et al.* (1986). Methods of multilocus enzyme electrophoresis for bacterial population genetics and systematics. *Appl Environ Microbiol* **51**(5):873-84.
- Sell, S. H., *et al.* (1981). Clinical studies of pneumococcal vaccines in infants. I. Reactogenicity and immunogenicity of two polyvalent polysaccharide vaccines. *Rev Infect Dis* **3 Suppl**:S97-107.
- Senger, E. (1886). Bakteriologische Untersuchungen über die Pneumonie und pneumonische Metastasen. *Arch exper Path u Pharmacol* **20**:389.
- Seo, H. S., *et al.* (2008). A new model of pneumococcal lipoteichoic acid structure resolves biochemical, biosynthetic, and serologic inconsistencies of the current model. *J Bacteriol* **190**(7):2379-87.
- Seral, C., *et al.* (2001). Distribution of resistance genes *tet*(M), *aph3'*-III, *catp*C194 and the integrase gene of Tn1545 in clinical *Streptococcus pneumoniae* harbouring *erm*(B) and *mef*(A) genes in Spain. *J Antimicrob Chemother* **47**(6):863-6.
- Serino, L. and M. Virji (2000). Phosphorylcholine decoration of lipopolysaccharide differentiates commensal *Neisseriae* from pathogenic strains: identification of *licA*-type genes in commensal *Neisseriae*. *Mol Microbiol* **35**(6):1550-9.
- Shakhnovich, E. A., *et al.* (2002). Neuraminidase expressed by *Streptococcus pneumoniae* desialylates the lipopolysaccharide of *Neisseria meningitidis* and *Haemophilus influenzae*: a paradigm for interbacterial competition among pathogens of the human respiratory tract. *Infect Immun* **70**(12):7161-4.

- Shaper, M., *et al.* (2004). PspA protects *Streptococcus pneumoniae* from killing by apolactoferrin, and antibody to PspA enhances killing of pneumococci by apolactoferrin. *Infect Immun* **72**(9):5031-40.
- Shapiro, E. D., *et al.* (1991). The protective efficacy of polyvalent pneumococcal polysaccharide vaccine. *N Engl J Med* **325**(21):1453-60.
- Shapiro, E. D. and J. D. Clemens (1984). A controlled evaluation of the protective efficacy of pneumococcal vaccine for patients at high risk of serious pneumococcal infections. *Ann Intern Med* **101**(3):325-30.
- Sharma, C. M., *et al.* (2010). The primary transcriptome of the major human pathogen *Helicobacter pylori*. *Nature* **464**(7286):250-5.
- Shaw, J. H. and D. B. Clewell (1985). Complete nucleotide sequence of macrolide-lincosamide-streptogramin B-resistance transposon Tn917 in *Streptococcus faecalis*. *J Bacteriol* **164**(2):782-96.
- Sheehan, M. M., *et al.* (1997). The lytic enzyme of the pneumococcal phage Dp-1: a chimeric lysin of intergeneric origin. *Mol Microbiol* **25**(4):717-25.
- Shi, Z. Y., *et al.* (1998). Identification of three major clones of multiply antibiotic-resistant *Streptococcus pneumoniae* in Taiwanese hospitals by multilocus sequence typing. *J Clin Microbiol* **36**(12):3514-9.
- Shivshankar, P., *et al.* (2009). The *Streptococcus pneumoniae* adhesin PsrP binds to Keratin 10 on lung cells. *Mol Microbiol* **73**(4):663-79.
- Shoemaker, N. B., *et al.* (1979). Organization and transfer of heterologous chloramphenicol and tetracycline resistance genes in pneumococcus. *J Bacteriol* **139**(2):432-41.
- Shoemaker, N. B., *et al.* (1980). DNase-resistant transfer of chromosomal *cat* and *tet* insertions by filter mating in Pneumococcus. *Plasmid* **3**(1):80-7.
- Sibold, C., *et al.* (1994). Mosaic *pbpX* genes of major clones of penicillin-resistant *Streptococcus pneumoniae* have evolved from *pbpX* genes of a penicillin-sensitive *Streptococcus oralis*. *Mol Microbiol* **12**(6):1013-23.
- Sibold, C., *et al.* (1991). Novel plasmids in clinical strains of *Streptococcus pneumoniae*. *FEMS Microbiol Lett* **61**(1):91-5.
- Sibold, C., *et al.* (1992). Genetic relationships of penicillin-susceptible and -resistant *Streptococcus pneumoniae* strains isolated on different continents. *Infect Immun* **60**(10):4119-26.
- Siegman-Igra, Y., *et al.* (2002). Reappraisal of community-acquired bacteremia: a proposal of a new classification for the spectrum of acquisition of bacteremia. *Clin Infect Dis* **34**(11):1431-9.
- Siguier, P., *et al.* (2006). ISfinder: the reference centre for bacterial insertion sequences. *Nucleic Acids Res* **34**(Database issue):D32-6.
- Sims, R. V., *et al.* (1988). The clinical effectiveness of pneumococcal vaccine in the elderly. *Ann Intern Med* **108**(5):653-7.
- Singleton, R. J., *et al.* (2007). Invasive pneumococcal disease caused by nonvaccine serotypes among Alaska native children with high levels of 7-valent pneumococcal conjugate vaccine coverage. *JAMA* **297**(16):1784-92.
- Sirotnak, F. M., *et al.* (1969). Increased dihydrofolate reductase synthesis in *Diplococcus pneumoniae* following translatable alteration of the structural gene. II. Individual and dual effects on the properties and rate of synthesis of the enzyme. *Genetics* **61**(2):313-26.
- Slamti, L. and D. Lereclus (2002). A cell-cell signaling peptide activates the PlcR virulence regulon in bacteria of the *Bacillus cereus* group. *EMBO J* **21**(17):4550-9.

- Sleeman, K. L., *et al.* (2006). Capsular serotype-specific attack rates and duration of carriage of *Streptococcus pneumoniae* in a population of children. *J Infect Dis* **194**(5):682-8.
- Sloyer, J. L., Jr., *et al.* (1981). Efficacy of pneumococcal polysaccharide vaccine in preventing acute otitis media in infants in Huntsville, Alabama. *Rev Infect Dis* **3 Suppl**:S119-23.
- Smith, A. M. and K. P. Klugman (2001). Alterations in MurM, a cell wall mucopeptide branching enzyme, increase high-level penicillin and cephalosporin resistance in *Streptococcus pneumoniae*. *Antimicrob Agents Chemother* **45**(8):2393-6.
- Smith, C. B., *et al.* (1976). Interactions between viruses and bacteria in patients with chronic bronchitis. *J Infect Dis* **134**(6):552-61.
- Smith, H. O., *et al.* (1999). DNA uptake signal sequences in naturally transformable bacteria. *Res Microbiol* **150**(9-10):603-16.
- Smith, M. D. and W. R. Guild (1979). A plasmid in *Streptococcus pneumoniae*. *J Bacteriol* **137**(2):735-9.
- Smith, T., *et al.* (1993). Acquisition and invasiveness of different serotypes of *Streptococcus pneumoniae* in young children. *Epidemiol Infect* **111**(1):27-39.
- Smyth, G. (2004). Linear models and empirical Bayes methods for assessing differential expression in microarray experiments. *Statistical Applications Genet Mol Biol* **3**(1):3.
- Sneath, P., *et al.* (1975). Detecting evolutionary incompatibilities from protein sequences. *Syst Zool* **24**(3):311-322.
- Snyder, L. A., *et al.* (2009). Comparative analysis of two *Neisseria gonorrhoeae* genome sequences reveals evidence of mobilization of Corraia Repeat Enclosed Elements and their role in regulation. *BMC Genomics* **10**:70.
- Sommer, S., *et al.* (1993). The appearance of the UmuD'C protein complex in *Escherichia coli* switches repair from homologous recombination to SOS mutagenesis. *Mol Microbiol* **10**(5):963-71.
- Sorek, R., *et al.* (2007). Genome-wide experimental determination of barriers to horizontal gene transfer. *Science* **318**(5855):1449-52.
- Spratt, B. G. (1975). Distinct penicillin binding proteins involved in the division, elongation, and shape of *Escherichia coli* K12. *Proc Natl Acad Sci U S A* **72**(8):2999-3003.
- Spratt, B. G. and B. M. Greenwood (2000). Prevention of pneumococcal disease by vaccination: does serotype replacement matter? *Lancet* **356**(9237):1210-1.
- Spratt, B. G. and A. B. Pardee (1975). Penicillin-binding proteins and cell shape in *E. coli*. *Nature* **254**(5500):516-7.
- Spratt, B. G., *et al.* (1989). Recruitment of a penicillin-binding protein gene from *Neisseria flavescens* during the emergence of penicillin resistance in *Neisseria meningitidis*. *Proc Natl Acad Sci U S A* **86**(22):8988-92.
- Stamatakis, A., *et al.* (2005). RAxML-III: a fast program for maximum likelihood-based inference of large phylogenetic trees. *Bioinformatics* **21**(4):456-63.
- Stein, K. E. (1992). Thymus-independent and thymus-dependent responses to polysaccharide antigens. *J Infect Dis* **165 Suppl 1**:S49-52.
- Stephens, D. S., *et al.* (2005). Incidence of macrolide resistance in *Streptococcus pneumoniae* after introduction of the pneumococcal conjugate vaccine: population-based assessment. *Lancet* **365**(9462):855-63.
- Stephens, J. C. (1985). Statistical methods of DNA sequence analysis: detection of intragenic recombination or gene conversion. *Mol Biol Evol* **2**(6):539-56.

- Sternberg, G. M. (1881). A fatal form of septicemia in the rabbit produced by subcutaneous injection of human saliva. *Natl Board of Health Bull* **3**(87):108.
- Sternberg, G. M. (1882). Induced septicaemia in the rabbit. *Am J Med Sci* **84**(167):69-76.
- Sternberg, G. M. (1885). The pneumonia-coccus of Friedlander (*Micrococcus Pasteuri*, Sternberg). *Am J Med Sci* **179**:106-122.
- Stool, S. E. and M. J. Field (1989). The impact of otitis media. *Pediatr Infect Dis J* **8**(1 Suppl):S11-4.
- Sutcliffe, J., *et al.* (1996). *Streptococcus pneumoniae* and *Streptococcus pyogenes* resistant to macrolides but sensitive to clindamycin: a common resistance pattern mediated by an efflux system. *Antimicrob Agents Chemother* **40**(8):1817-24.
- Syrjanen, R. K., *et al.* (2001). Nasopharyngeal carriage of *Streptococcus pneumoniae* in Finnish children younger than 2 years old. *J Infect Dis* **184**(4):451-9.
- Szklarczyk, D., *et al.* (2011). The STRING database in 2011: functional interaction networks of proteins, globally integrated and scored. *Nucleic Acids Res* **39**(Database issue):D561-8.
- Takala, A. K., *et al.* (1995). Risk factors for primary invasive pneumococcal disease among children in Finland. *JAMA* **273**(11):859-64.
- Talamon, C. (1883). Coccus de la pneumonie. *Bull Soc Anat Paris* **58**:475-481.
- Talbot, T. R., *et al.* (2005). Asthma as a risk factor for invasive pneumococcal disease. *N Engl J Med* **352**(20):2082-90.
- Talbot, T. R., *et al.* (2004). Reduction in high rates of antibiotic-nonsusceptible invasive pneumococcal disease in Tennessee after introduction of the pneumococcal conjugate vaccine. *Clin Infect Dis* **39**(5):641-8.
- Taniai, H., *et al.* (2008). Concerted action of lactate oxidase and pyruvate oxidase in aerobic growth of *Streptococcus pneumoniae*: role of lactate as an energy source. *J Bacteriol* **190**(10):3572-9.
- Tankovic, J., *et al.* (1996). Contribution of mutations in *gyrA* and *parC* genes to fluoroquinolone resistance of mutants of *Streptococcus pneumoniae* obtained *in vivo* and *in vitro*. *Antimicrob Agents Chemother* **40**(11):2505-10.
- Tarasi, A., *et al.* (1997). Spread of the serotype 23F multidrug-resistant *Streptococcus pneumoniae* clone to South Korea. *Microb Drug Resist* **3**(1):105-9.
- Tarasi, A., *et al.* (1995). Penicillin-resistant and multidrug-resistant *Streptococcus pneumoniae* in a pediatric hospital in Zagreb, Croatia. *Microb Drug Resist* **1**(2):169-76.
- Taylor, S. N. and C. V. Sanders (1999). Unusual manifestations of invasive pneumococcal infection. *Am J Med* **107**(1A):12S-27S.
- Teele, D. W., *et al.* (1981). Use of pneumococcal vaccine for prevention of recurrent acute otitis media in infants in Boston. The Greater Boston Collaborative Otitis Media Study Group. *Rev Infect Dis* **3** Suppl:S113-8.
- Tempest, B., *et al.* (1974). Distribution of the sensitivities to penicillin of types of *Diplococcus pneumoniae* in an American Indian population. *J Infect Dis* **130**(1):67-9.
- Tettelin, H., *et al.* (2005). Genome analysis of multiple pathogenic isolates of *Streptococcus agalactiae*: implications for the microbial "pan-genome". *Proc Natl Acad Sci U S A* **102**(39):13950-5.
- Tettelin, H., *et al.* (2001). Complete genome sequence of a virulent isolate of *Streptococcus pneumoniae*. *Science* **293**(5529):498-506.

- Thornsberry, C., *et al.* (1999). Survey of susceptibilities of *Streptococcus pneumoniae*, *Haemophilus influenzae*, and *Moraxella catarrhalis* isolates to 26 antimicrobial agents: a prospective U.S. study. *Antimicrob Agents Chemother* **43**(11):2612-23.
- Thornton, G. F. and V. T. Andriole (1966). Laboratory and clinical studies of a new antibiotic, cephaloridine, in the treatment of gram-positive infections. *Yale J Biol Med* **39**(1):9-20.
- Thys, J. P., *et al.* (1989). Quinolones in the treatment of lower respiratory tract infections. *Rev Infect Dis* **11 Suppl 5**:S1212-9.
- Tilley, S. J., *et al.* (2005). Structural basis of pore formation by the bacterial toxin pneumolysin. *Cell* **121**(2):247-56.
- Tiraby, J. G. and M. S. Fox (1973). Marker discrimination in transformation and mutation of pneumococcus. *Proc Natl Acad Sci U S A* **70**(12):3541-5.
- Tiraby, J. G., *et al.* (1975). Pneumococcal bacteriophages. *Virology* **68**(2):566-9.
- Tomasz, A. (1966). Model for the mechanism controlling the expression of competent state in Pneumococcus cultures. *J Bacteriol* **91**(3):1050-61.
- Tomasz, A., *et al.* (1998). Molecular epidemiologic characterization of penicillin-resistant *Streptococcus pneumoniae* invasive pediatric isolates recovered in six Latin-American countries: an overview. PAHO/Rockefeller University Workshop. Pan American Health Organization. *Microb Drug Resist* **4**(3):195-207.
- Tomasz, A. and J. L. Mosser (1966). On the nature of the pneumococcal activator substance. *Proc Natl Acad Sci U S A* **55**(1):58-66.
- Torzillo, P. J., *et al.* (1995). Invasive pneumococcal disease in central Australia. *Med J Aust* **162**(4):182-6.
- Trotman, J., *et al.* (1995). Invasive pneumococcal disease in central Australia. *Clin Infect Dis* **20**(6):1553-6.
- Trzcinski, K., *et al.* (2004). Single-step capsular transformation and acquisition of penicillin resistance in *Streptococcus pneumoniae*. *J Bacteriol* **186**(11):3447-52.
- Tsai, I. J., *et al.* (2010). Improving draft assemblies by iterative mapping and assembly of short reads to eliminate gaps. *Genome Biol* **11**(4):R41.
- Tu, A. H., *et al.* (1999). Pneumococcal surface protein A inhibits complement activation by *Streptococcus pneumoniae*. *Infect Immun* **67**(9):4720-4.
- Tuomanen, E., *et al.*, Eds. (2004). The pneumococcus. Washington, DC, ASM Press.
- Turner, P., *et al.* (2011). Improved detection of nasopharyngeal co-colonization by multiple pneumococcal serotypes using latex agglutination or molecular serotyping by microarray. *J Clin Microbiol*.
- Tzianabos, A. O. (2000). Polysaccharide immunomodulators as therapeutic agents: structural aspects and biologic function. *Clin Microbiol Rev* **13**(4):523-33.
- Valles, J., *et al.* (2003). Community-acquired bloodstream infection in critically ill adult patients: impact of shock and inappropriate antibiotic therapy on survival. *Chest* **123**(5):1615-24.
- Valouev, A., *et al.* (2008). A high-resolution, nucleosome position map of *C. elegans* reveals a lack of universal sequence-dictated positioning. *Genome Res* **18**(7):1051-63.
- van Belkum, A., *et al.* (1996). Novel BOX repeat PCR assay for high-resolution typing of *Streptococcus pneumoniae* strains. *J Clin Microbiol* **34**(5):1176-9.

- van der Meer, J. T., *et al.* (1991). Distribution, antibiotic susceptibility and tolerance of bacterial isolates in culture-positive cases of endocarditis in The Netherlands. *Eur J Clin Microbiol Infect Dis* **10**(9):728-34.
- Veaute, X., *et al.* (2005). UvrD helicase, unlike Rep helicase, dismantles RecA nucleoprotein filaments in *Escherichia coli*. *EMBO J* **24**(1):180-9.
- Vernikos, G. S. and J. Parkhill (2006). Interpolated variable order motifs for identification of horizontally acquired DNA: revisiting the *Salmonella* pathogenicity islands. *Bioinformatics* **22**(18):2196-203.
- Vijayakumar, M. N., *et al.* (1986). Structure of a conjugative element in *Streptococcus pneumoniae*. *J Bacteriol* **166**(3):978-84.
- Vos, M. (2009). Why do bacteria engage in homologous recombination? *Trends Microbiol* **17**(6):226-32.
- Vos, M. and X. Didelot (2009). A comparison of homologous recombination rates in bacteria and archaea. *ISME J* **3**(2):199-208.
- Vulic, M., *et al.* (1997). Molecular keys to speciation: DNA polymorphism and the control of genetic exchange in enterobacteria. *Proc Natl Acad Sci U S A* **94**(18):9763-7.
- Waite, R. D., *et al.* (2003). Spontaneous sequence duplications within capsule genes *cap8E* and *tts* control phase variation in *Streptococcus pneumoniae* serotypes 8 and 37. *Microbiology* **149**(Pt 2):497-504.
- Waite, R. D., *et al.* (2001). Spontaneous sequence duplication within an open reading frame of the pneumococcal type 3 capsule locus causes high-frequency phase variation. *Mol Microbiol* **42**(5):1223-32.
- Walker, J. A., *et al.* (1987). Molecular cloning, characterization, and complete nucleotide sequence of the gene for pneumolysin, the sulfhydryl-activated toxin of *Streptococcus pneumoniae*. *Infect Immun* **55**(5):1184-9.
- Wani, J. H., *et al.* (1996). Identification, cloning, and sequencing of the immunoglobulin A1 protease gene of *Streptococcus pneumoniae*. *Infect Immun* **64**(10):3967-74.
- Wannamaker, L. and J. Matsen, Eds. (1972). Streptococci and streptococcal diseases. New York, Academic Press Inc.
- Ward, J. (1981). Antibiotic-resistant *Streptococcus pneumoniae*: clinical and epidemiologic aspects. *Rev Infect Dis* **3**(2):254-66.
- Warren, M. J. and M. P. Jennings (2003). Identification and characterization of *pptA*: a gene involved in the phase-variable expression of phosphorylcholine on pili of *Neisseria meningitidis*. *Infect Immun* **71**(12):6892-8.
- Watson, D. A., *et al.* (1993). A brief history of the pneumococcus in biomedical research: a panoply of scientific discovery. *Clin Infect Dis* **17**(5):913-24.
- Watson, K., *et al.* (2006). Upper respiratory tract bacterial carriage in Aboriginal and non-Aboriginal children in a semi-arid area of Western Australia. *Pediatr Infect Dis J* **25**(9):782-90.
- Weichselbaum, A. (1886). Über die Aetiologie der acuten Lungen- und Rippenfellentzündungen. *Med Jhrbchr* **1**:483-554.
- Weiller, G. F. (1998). Phylogenetic profiles: a graphical method for detecting genetic recombinations in homologous sequences. *Mol Biol Evol* **15**(3):326-35.
- Weinberger, D. M., *et al.* (2011). Serotype replacement in disease after pneumococcal vaccination. *Lancet*.
- Weisblum, B. (1967). Pneumococcus resistant to erythromycin and lincomycin. *Lancet* **1**(7494):843-4.

- Weiser, J. N., *et al.* (1994). Phase variation in pneumococcal opacity: relationship between colonial morphology and nasopharyngeal colonization. *Infect Immun* **62**(6):2582-9.
- Weiser, J. N., *et al.* (1998). The phosphorylcholine epitope undergoes phase variation on a 43-kilodalton protein in *Pseudomonas aeruginosa* and on pili of *Neisseria meningitidis* and *Neisseria gonorrhoeae*. *Infect Immun* **66**(9):4263-7.
- Weiser, J. N., *et al.* (1997). Decoration of lipopolysaccharide with phosphorylcholine: a phase-variable characteristic of *Haemophilus influenzae*. *Infect Immun* **65**(3):943-50.
- Weisfelt, M., *et al.* (2006). Clinical features, complications, and outcome in adults with pneumococcal meningitis: a prospective case series. *Lancet Neurol* **5**(2):123-9.
- Whatmore, A. M. and C. G. Dowson (1999). The autolysin-encoding gene (*lytA*) of *Streptococcus pneumoniae* displays restricted allelic variation despite localized recombination events with genes of pneumococcal bacteriophage encoding cell wall lytic enzymes. *Infect Immun* **67**(9):4551-6.
- Whitby, L. (1938). Chemotherapy of pneumococcal and other infections with 2-(*p*-aminobenzenesulphonamido) pyridine. *Lancet* **1**:1210-1212.
- White, B., *et al.* (1938). *The biology of pneumococcus*. New York, The Commonwealth Fund.
- Whiting, G. C. and S. H. Gillespie (1996). Incorporation of choline into *Streptococcus pneumoniae* cell wall antigens: evidence for choline kinase activity. *FEMS Microbiol Lett* **138**(2-3):141-5.
- Whitney, C. G., *et al.* (2003). Decline in invasive pneumococcal disease after the introduction of protein-polysaccharide conjugate vaccine. *N Engl J Med* **348**(18):1737-46.
- WHO (2003). Pneumococcal vaccines. *Wkly Epidemiol Rec* **78**:100-19.
- Widdowson, C. A., *et al.* (2000). Acquisition of chloramphenicol resistance by the linearization and integration of the entire staphylococcal plasmid pC194 into the chromosome of *Streptococcus pneumoniae*. *Antimicrob Agents Chemother* **44**(2):393-5.
- Wijnands, W. J., *et al.* (1986). Enoxacin in lower respiratory tract infections. *J Antimicrob Chemother* **18**(6):719-27.
- Wilhelm, B. T., *et al.* (2008). Dynamic repertoire of a eukaryotic transcriptome surveyed at single-nucleotide resolution. *Nature* **453**(7199):1239-43.
- Willey, J. M. and W. A. van der Donk (2007). Lantibiotics: peptides of diverse structure and function. *Annu Rev Microbiol* **61**:477-501.
- Williams, E. W., *et al.* (1981). *Streptococcus pneumoniae* resistant to penicillin and chloramphenicol in the U.K. *Lancet* **2**(8248):699.
- Williams, G. (1966). *Adaptation and natural selection*. Princeton, Princeton University Press.
- Williamson, R., *et al.* (1980). *In vivo* interaction of beta-lactam antibiotics with the penicillin-binding proteins of *Streptococcus pneumoniae*. *Antimicrob Agents Chemother* **18**(4):629-37.
- Wolf, B. and R. D. Hotchkiss (1963). Genetically modified folic acid synthesizing enzymes of pneumococcus. *Biochemistry* **2**:145-50.
- Wood, B. and W. Holzappel, Eds. (1995). The Genera of Lactic Acid Bacteria. Glasgow, Blackie Academic and Professional.

- Wright, A., *et al.* (1914). Observations on prophylactic inoculation against pneumococcus infections, and on the results which have been achieved by it. *Lancet* **183**(4714):1-10.
- Xu, P., *et al.* (2007). Genome of the opportunistic pathogen *Streptococcus sanguinis*. *J Bacteriol* **189**(8):3166-75.
- Yamada, T. and J. Carlsson (1973). Phosphoenolpyruvate carboxylase and ammonium metabolism in oral streptococci. *Arch Oral Biol* **18**(7):799-812.
- Yang, Z. (2007). PAML 4: phylogenetic analysis by maximum likelihood. *Mol Biol Evol* **24**(8):1586-91.
- Yesilkaya, H., *et al.* (2000). Role of manganese-containing superoxide dismutase in oxidative stress and virulence of *Streptococcus pneumoniae*. *Infect Immun* **68**(5):2819-26.
- Yildirim, I., *et al.* (2010). Serotype specific invasive capacity and persistent reduction in invasive pneumococcal disease. *Vaccine* **29**(2):283-8.
- Yoder-Himes, D. R., *et al.* (2009). Mapping the *Burkholderia cenocepacia* niche response via high-throughput sequencing. *Proc Natl Acad Sci U S A* **106**(10):3976-81.
- Zaufal, E. (1887). Mikroorganismen im Secrete der Otitis media acuta. *Prag Med Wchnschr* **12**(27):225-227.
- Zerbino, D. R. and E. Birney (2008). Velvet: algorithms for *de novo* short read assembly using de Bruijn graphs. *Genome Res* **18**(5):821-9.
- Zhang, J. R., *et al.* (2000). The polymeric immunoglobulin receptor translocates pneumococci across human nasopharyngeal epithelial cells. *Cell* **102**(6):827-37.
- Zhou, F., *et al.* (2008). Nezha, a novel active miniature inverted-repeat transposable element in cyanobacteria. *Biochem Biophys Res Commun* **365**(4):790-4.
- Zighelboim, S. and A. Tomasz (1980). Penicillin-binding proteins of multiply antibiotic-resistant South African strains of *Streptococcus pneumoniae*. *Antimicrob Agents Chemother* **17**(3):434-42.