



**Abstracts  
of the  
Tenth International Pathogenic Neisseria  
Conference**

**September 8-13, 1996  
Baltimore, Maryland, USA**

**Compiled and edited by:**

Wendell D. Zollinger  
Carl E. Frasch  
Carolyn D. Deal

*Cover designed by Betty Hebb, Design Section, Medical Arts and Photography, National Institutes of Health, Bethesda, MD, USA*

## **The Tenth International Pathogenic Neisseria Conference**

### **Conference Organizing Committee**

Dr. Carl Frasch, Chair, Center for Biologics, Food and Drug Administration, Bethesda,  
MD, USA  
Dr. Carolyn Deal, National Institute of Allergy and Infectious Diseases, Bethesda, MD, USA  
Dr. Wendell Zollinger, Walter Reed Army Institute of Research, Washington, DC, USA

### **Scientific Program Committee**

Dr. Michael Apicella, University of Iowa, Iowa City, IA, USA  
Dr. Janne Cannon, University of North Carolina, Chapel Hill, NC, USA  
Dr. Myron Cohen, University of North Carolina, Chapel Hill, NC, USA  
Dr. Martin Maiden, National Institute of Biological Standards and Control, Potters Bar, UK  
Dr. Peter Paradiso, Wyeth Lederle Vaccines and Pediatrics, Rochester, NY, USA  
Dr. Richard Rest, Allegheny University of the Health Sciences, Philadelphia, PA, USA  
Dr. Dominique Schulz, Pasteur Merieux Serum & Vaccins, Marcy L'Etoile, FRANCE  
Dr. Daniel Stein, University of Maryland, College Park, MD, USA  
Dr. Edmund Tramont, University of Maryland Biotechnology Center, Baltimore, MD,  
USA  
Dr. Jay Wenger, Centers for Disease Control, Atlanta, GA, USA  
Dr. Johnathan Zenilman, Johns Hopkins University, Baltimore, MD, USA

### **Meeting Sponsors:**

Centers for Disease Control and Prevention  
Center for Biologics Evaluation and Research, FDA  
National Institute of Allergy and Infectious Diseases, NIH  
US Army Medical Research and Materiel Command  
Bayer Corporation  
Biocine S.p.A.  
Connaught Laboratories, Inc.  
Merck & Co., Inc.  
Pasteur Merieux  
Pfizer, Inc.  
Roche Laboratories  
Wyeth Lederle Vaccines and Pediatrics



## Preface

The emphasis of the Tenth International Pathogenic Neisseria Conference is the public health impact of the pathogenic *Neisseria* in both developed and developing countries, and how basic and applied research are contributing to the diagnosis, treatment, and prevention of diseases caused by these bacteria. This is the major international conference in the field attracting over 300 scientists and public health officials from over 30 countries. The first conference in the series was held in San Francisco in 1978, and dealt primarily with *Neisseria gonorrhoeae*. The conferences have been held every two years since then, alternating between Europe and North America, and have resulted in the fruitful interaction of physicians, basic scientists, public health officers, and epidemiologists. The ninth conference was held in September 1994 in Winchester, England, and over 320 individuals attended.

A goal of these conferences has been to bring together investigators, from universities, governments and the biologics industry, who are involved with or are interested in *N. gonorrhoeae* and *N. meningitidis* and the diseases they cause. Over two million cases of gonococcal disease occur in the United States and Europe each year. Pelvic inflammatory disease in women exceeded \$5 billion in health care costs in the U.S. in 1993 and is the leading cause of ectopic pregnancy and tubal infertility in much of Africa. *N. meningitidis* causes outbreaks or epidemics in many countries causing major problems within the public health system. It is therefore of major importance to understand the mechanisms by which these pathogenic *Neisseria* are able to invade and evade the host immune system. These conferences have resulted in dissemination of important new findings concerning the pathogenic mechanisms and epidemiological surveillance of these organisms, and will provide the information to improve control through immunization. Furthermore, developments in our understanding of how the pathogenic *Neisseria* express, through up-regulation, an array of new surface proteins for acquisition of iron from human iron binding proteins, and for *in vivo* survival has contributed greatly to our understanding of other invasive bacterial pathogens.

These conferences have clearly demonstrated the application of molecular biology and immunology to the analysis of gonococcal and meningococcal physiology, structure, pathogenicity and epidemiology, and have presented new developments in vaccines against gonococcal and meningococcal disease. The Tenth International Pathogenic Neisseria Conference extends these observations and provides the latest information about studies now in progress to control and prevent the morbidity and mortality associated with these organisms. Lectures and posters were submitted in nine broad areas, including over 40 oral presentations and 220 posters.

Carl E. Frasch Ph.D.  
Chairman,  
Conference Organizing Committee



## Table of Contents

### Gonococcal Infection, Immunity, and Resistance

Is there protective immunity to gonococcal disease? (Review) PA Rice, S Gulati, DP McQuillen and S Ram .....	3
Absence of protective immunity from repeat infections by gonococci expressing the same Por protein TM Alcorn, KK Fox, RH Davis, et al. ....	9
Infectivity of gonococcal mutants in the human challenge model JG Cannon, MS Cohen, SF Isbey, et al. ....	11
Does an experimental gonococcal infection protect human volunteers from subsequent reinfection? H Schneider, J Lindstrom, KA Schmidt, et al. ....	13
Neisserial porins activate naive resting B lymphocytes, inducing proliferation and immunoglobulin secretion LM Wetzler and C Snapper .....	14
Selection for Opa <sup>+</sup> phenotypes of <i>Neisseria gonorrhoeae</i> in normal human serum (Poster 1) MP Bos, D Hogan and RJ Belland .....	17
In-vitro effects of contraceptive microbicides on <i>Neisseria gonorrhoeae</i> infection (Poster 2) MD Cooper, R Kirkpatrick, RA Anderson, DP Waller, and LJD Zaneveld	19
Epidemiological survey of plasmid mediated tetracycline resistance gonococci in Argentina (April 1993 - April 1996) (Poster 3) S Fiorito, P Galarza, M Sparo, et al. ....	22
Oral inoculation with live attenuated <i>Neisseria gonorrhoeae</i> induces a vaginal IgA response (Poster 4) HM Harper, JA Harrison and R Demarco de Hormaeche .....	24
Production of inflammatory cytokines by human macrophages and polymorphonuclear cells in response to <i>in vitro</i> stimulation with <i>Neisseria gonorrhoeae</i> (Poster 5) HM Harper, AL Padmore, WD Smith, MK Taylor and R Demarco de Hormaeche	27
Infection with <i>Neisseria gonorrhoeae</i> induces acute systemic, but not local, immune and inflammatory responses: effects of concomitant infection with <i>Trichomonas vaginalis</i> and/or <i>Chlamydia trachomatis</i> (Poster 6) SR Hedges, C Blalock, L Kallman, et al. ....	30

Effects of <i>Neisseria gonorrhoeae</i> urethritis on the concentration of HIV-1 in seminal plasma (Poster 7)	
IF Hoffman, C Costello Daly, P Kazembe, et al. ....	32
<i>In vivo</i> induction of TNF $\alpha$ by <i>Neisseria gonorrhoeae</i> (Poster 8)	
R Demarco de Hormaeche, LM Chamberlain and P Mastroeni ...	34
A strategy for constructing mutant strains of <i>Neisseria gonorrhoeae</i> containing no new antibiotic resistance markers using a two gene cassette with selectable and counterselectable markers, and its use in constructing a <i>pgm</i> mutant for use in human challenge trials (Poster 9)	
DM Johnston, SF Isbey, T Snodgrass, et al. ....	37
Isolation of the outer membrane of <i>Neisseria gonorrhoeae</i> (Poster 10)	
RC Judd, CE Tilly, J Smith and DS Manning .....	39
Generation of polyclonal and monoclonal antiserum to a specific epitope of the MtrC protein of <i>Neisseria gonorrhoeae</i> (Poster 11)	
DC Marchion, KG Messer, DS Manning, WM Shafer, and RC Judd	41
Replication origins of $\beta$ -lactamase-producing plasmids of <i>Neisseria gonorrhoeae</i> (Poster 12)	
F Pagotto, and JR Dillon .....	42
Characterization of an 85 kDa outer membrane protein of <i>Neisseria gonorrhoeae</i> having homology with the D15 surface protective antigen of <i>Haemophilus influenzae</i> (Poster 13)	
DK Reschke, DS Manning and RC Judd .....	44
Recombinant CTB-linked mucosal immunogens for inducing antibodies in secretions (Poster 14)	
) MW Russell, G Hajishengallis, H-Y Wu et al. ....	45
Opacity protein expression by organisms recovered from volunteers infected with transparent <i>Neisseria gonorrhoeae</i> MS11mkC (Poster 15)	
KA Schmidt, CD Deal, J Lindstrom et al. ....	47
Characterization of <i>Neisseria gonorrhoeae</i> strains isolated from a conjunctivitis outbreak (Poster 16)	
J Sosa; A Llop, R Llanes; I Martínez and F Sotolongo .....	49
Antimicrobial susceptibility of 42 <i>Neisseria gonorrhoeae</i> strains isolated in 1995 in Cuba (Poster 17)	
R Llanes, J Sosa, I Martínez, et al. ....	52



In vitro induction of inflammatory cytokines by <i>Neisseria gonorrhoeae</i> and by gonococcal antigens (Poster 18) LL Van De Verg, KA Schmidt, ES Drazek, et al. ....	55
Differential antibody and cytokine responses in male volunteers experimentally infected with <i>Neisseria gonorrhoeae</i> MS11mkC (Poster 19) RL Warren, LL Van De Verg, KA Schmidt et al. ....	56
Cellular immune response to <i>Neisseria gonorrhoeae</i> proteins in patients with urogenital gonorrhea (Poster 20) SD Simpson, Y Ho, TK Means, and LM Wetzler .....	57
Intracellular <i>Neisseria gonorrhoeae</i> bind host pyruvate kinase via their Opa proteins (Poster 21) JM Williams and RF Rest .....	59
<b>Lipooligosaccharides</b>	
The lipooligosaccharides of the pathogenic <i>Neisseria</i> (Review) MA Apicella, P Densen· A Preston, et al. ....	63
The <i>ice</i> (inner core extension) lipooligosaccharide biosynthesis operon of <i>Neisseria meningitidis</i> B CM Kahler, RW Carlson, MM Rahman, LE Martin and DS Stephens	71
Regulation of gonococcal sialyltransferase expression DJ McGee and RF Rest .....	73
The properties of a sialyltransferase-deficient mutant of <i>Neisseria gonorrhoeae</i> and studies on lactate enhancement of LPS sialylation NJ Parsons, MJ Gill, DP McQuillen et al. ....	76
Genetic basis for the production of multiple lipooligosaccharides by <i>Neisseria gonorrhoeae</i> DC Stein, CL Burch and RJ Danaher .....	78
Analysis of two loci involved in biosynthesis of the inner core and lipid A parts of <i>Neisseria meningitidis</i> lipopolysaccharide P van der Ley, M Kramer, L Steeghs, and JT Poolman .....	80
LPS sialylation studies with gonococcal strain F62 and a sialyltransferase-deficient mutant, JB1 (Poster 22) J Bramley, H Croke, NJ Parsons, H Smith and JA Cole .....	82
Inhibition of meningococcal induced inflammation by anti-CD14 monoclonal antibodies and bactericidal/permeability increasing protein <i>in vitro</i> (Poster 23) B Chan, O Daramola, U Grunwald, and M Levin .....	84

Sialylation of <i>Neisseria meningitidis</i> lipooligosaccharide (LOS) inhibits serum bactericidal activity by masking lacto- <i>N</i> -neotetraose (Poster 24)	
MM Estabrook .....	86
Non-opsonic phagocytosis of <i>Neisseria meningitidis</i> by human neutrophils (Poster 25)	
MM Estabrook and M Berger .....	88
Proposed specificity of the <i>Neisseria gonorrhoeae</i> lipooligosaccharide epitope identified by monoclonal antibody 2C7 (Poster 25a)	
S Gulati, DP McQuillen, RE Mandrell, and PA Rice .....	91
Lipopolysaccharide biosynthesis in <i>Neisseria meningitidis</i> : A genetic analysis of <i>lgt</i> loci in immunotype typing strains (Poster 26)	
MP Jennings, P van der Ley, M Kramer et al. ....	93
Detection of opsonophagocytosis of <i>Neisseria meningitidis</i> by chemiluminescence with demonstration of the effect of immunotypes L3,7,9 which can be sialylated and L1,8,10 which cannot be sialylated on the process (Poster 27)	
AS Johnson, DM Jones, M Potter et al. ....	95
Molecular characterization of antibodies specific for meningococcal lipooligosaccharide (Poster 28)	
JS Evans, IM Feavers and MCJ Maiden .....	97
Interaction of a gonococcal sialyltransferase-deficient mutant with human epithelial cells and neutrophils (Poster 29)	
DJ McGee, GC Chen and RF Rest .....	100
Identification of an <i>htrB</i> analog of <i>Neisseria meningitidis</i> serogroup B (Poster 30)	
D Post, W Nichols, M Sunshine et al. ....	102
Structure of the lipooligosaccharide (LOS) of pathogenic <i>Neisseria meningitidis</i> serogroup B (Poster 31)	
MM Rahman, RW Carlson, CM Kahler and DS Stephens .....	104
Characterization of terminal NeuNAc <sub>2-3</sub> Gal $\beta$ 1-4GlcNAc sequence in lipooligosaccharides of <i>Neisseria meningitidis</i> (Poster 32)	
C-M Tsai, WH Chen and PA Balakonis .....	105
Systemic survival of <i>Neisseria meningitidis</i> serogroup B depends on sialic acid of both the capsule and the sialylated oligosaccharide (Poster 33)	
U Vogel, S Hammerschmidt and M Frosch .....	107
Complement factor C3b deposition via the classical pathway of complement activation on surfaces of isogenic sialic acid mutants of <i>Neisseria meningitidis</i>	

(Poster 34)

Vogel U, A Weinberger, A Müller, JP Atkinson and M Frosch .109

Cloning of the Lipooligosaccharide  $\alpha$ -2,3-sialyltransferase from the bacterial pathogens *Neisseria meningitidis* and *Neisseria gonorrhoeae* (Poster 35)

M Gilbert, DC Watson, A Cunningham, et al. ....111

*Neisseria gonorrhoeae* must express the paraglobosyl LOS in order to invade human genitourinary epithelial cells (Poster 36)

J Wang, H Schneider, and JMcL Griffiss .....112

Sialylation of LOS inhibits gonococcal killing primarily through an effect on classical pathway activation (Poster 37)

A Zaleski and P Densen .....114

### **Noncapsular Vaccines**

Clinical trials with outer membrane protein vaccines and PorA recombinant vaccines (Review)

JT Poolman .....117

Recombinant and synthetic antigens from meningococcal class 1 protein

JE Heckels, SJ Ward, M Christodoulides, J Brooks and E Rattue 123

Infant rat meningitis passive protection assay and protection evoked by human group B OMV vaccine induced antibodies

H Käyhty, L Saarinen, M Toropainen, et al. ....125

Immunization with a low molecular weight meningococcal outer membrane protein protects against lethal experimental infection

D Martin, N Cadieux, J Hamel, CR Rioux and BR Brodeur .....127

Anti-endotoxin activity of monoclonal antibodies against meningococcal LOS and the memory response to LOS incorporated into liposomes

AB Petrov, HJ Hamstr, P van der Ley et al. ....129

Design and production of meningococcal vaccine based on transferrin binding proteins

MJ Quentin-Millet, G Renauld, B Danve, et al. ....131

Immunogenicity and safety of intranasal vaccination with meningococcal native outer membrane vesicles in mice and rabbits

WD Zollinger, DR Shoemaker, NB Saunders, BL Brandt and EE Moran 133

Opsonic activity induced by a monoclonal antibody against the Lip (H.8) antigen (Poster 38)

A Aase, J Kolberg, E Rosenqvist, et al. ....135

Expression and purification of meningococcal class 1 porin from <i>E. coli</i> : influence of adjuvants on specificity of the immune response to native protein (Poster 39) JL Brooks, M Christodoulides and JE Heckels .....	137
Expression of the outer membrane protein complex of <i>Neisseria meningitidis</i> group B in different culture conditions (Poster 40) R Abreu, R Barberá, B García, et al. ....	139
Consistency in the large scale production of the outer membrane protein complex of group B <i>Neisseria meningitidis</i> (Poster 41) R Barberá, R Abreu, A Morin, et al. ....	141
Recombinant Opc reconstituted into liposomes elicits opsonic antibodies (Poster 42) T Carmenate, M Delgado, M Perez and G Guillen .....	143
Influence of adjuvants on the humoral immune response towards a synthetic peptide containing a B-cell epitope from meningococcal class 1 protein (Poster 43) M Christodoulides and JE Heckels .....	145
IgG antibodies specific to the linear B-cell epitope on the class 3 outer membrane protein can promote opsonophagocytic killing of <i>Neisseria meningitidis</i> (Poster 44) AA Delvig, E Wedege, TE Michaelsen et al. ....	147
Immune response of mice to <i>Neisseria meningitidis</i> serogroup B protein antigens (Poster 45) E Jessouroun, IAFB Silveira, MG Danelli, et al. ....	149
Vaccine potential of meningococcal transferrin binding proteins: mouse protection studies (Poster 46) AR Gorringe, SGP Funnell, KM Reddin and A Robinson .....	150
Prospects for a nasal vaccine against group B meningococcal disease B Haneberg, R Dalseg, IL Haugen et al. ....	152
Analysis of the human Ig isotype response to individual Tbp1 and Tbp2 from <i>Neisseria meningitidis</i> (Poster 48) AS Johnson, AR Gorringe, R Borrow, A Robinson, AJ Fox .....	154
Inducement and duration of cellular response to VA-MENGOC-BC <sup>®</sup> in babies and children (Poster 49) O Pérez, Martín, ML, González, JL et al. ....	156
Anamnestic B cell response by ELISPOT after a challenge in humans vaccinated with VA-MENGOC-BC <sup>®</sup> 5 years ago (Poster 50) M Lastre, González, AB, Duharte, JL et al. ....	160

IgG subclass response after systemic immunization with the Norwegian outer-membrane vesicle vaccine against group B meningococci (Poster 51) T E Michaelsen, T Aarvak, LM Næss, F Oftung and A Aase ....	163
Epitope specificity and functional activities of human and murine antibodies against class 4 outer membrane protein from <i>Neisseria meningitidis</i> (Poster 52) A Musacchio, A Aase, R Dalseg, et al. ....	165
Recombinant Opc meningococcal protein, folded <i>in vitro</i> , elicits bactericidal antibodies after immunization (Poster 53) A Musacchio, T Carmenate, M Delgado and S González .....	168
Induction of antigen specific human T cell responses after nasal immunization with the Norwegian group B meningococcal outer membrane vesicle vaccine (Poster 54) F Oftung, LM Næss, A Aase et al. ....	171
Cellular immune response after immunization with the Norwegian group B <i>Neisseria meningitidis</i> outer membrane vesicle vaccine (Poster 55) LM Næss, F Oftung, A Aase, et al. ....	172
Analysis of the continuous epitopes recognized by antibodies against a recombinant meningococcal high molecular weight antigen (Poster 56) C Nazábal, S González, L Viña, et al. ....	174
Evaluation of the antigenic and molecular conservation of a new neisserial low molecular weight outer membrane protein (Poster 57) M Plante, N Cadieux, CR Rioux, et al. ....	176
Bactericidal effect of human neutrophils on meningococci incubated in pre- and post-vaccination serum of complement deficient patients (Poster 58) AE Platonov, IV Vershinina, AJ Dolgoplova, CAP Fijen and H Kayhty	178
<i>Neisseria meningitidis</i> LOS micelle-based vaccine (Poster 59) M Velucchi, A Rustici, C-M Tsai <sup>2</sup> and M Porro .....	180
Heterogeneity of <i>tbp2</i> genes among <i>Neisseria meningitidis</i> B strains belonging to the ET-5 complex (Poster 60) B Rokbi, DA Caugant and MJ Quentin-Millet .....	183
Human B- and T-cell responses after three doses of a hexavalent PorA meningococcal outer membrane vesicle vaccine (Poster 61) EM Rouppe van der Voort, H van Dijken, B Kuipers, et al. ....	185
Kinetics of bactericidal antibodies and specific IgG and IgA antibodies elicited by a meningococcal B:4:P1.15 outer membrane protein vaccine (Poster 62) JA Fernández, JA Malberty, FT Sotolongo, et al. ....	187

Cloning and expression of human immunoglobulin gene encoding anti-meningococcal P1.7 epitope antibody SS269 (Poster 63)  
J-F Wang, GA Jarvis, M Achtman, and JMCL Griffiss .....188

IgG antibody activity against meningococcal class 1 and 3 outer membrane proteins  
in patient sera: Comparison between immunoblot and ELISA analyses (Poster 64)  
E Wedege, K Bolstad, LM Wetzler and H-K Guttormsen .....190

Immunoblot analyses of antibody responses in sera, saliva and nasal fluids from volunteers  
immunized nasally with the Norwegian group B meningococcal vaccine (Poster 65)  
E Wedege, EA Høiby, SR Andersen, et al. ....192

Liposomes as a vaccine delivery system for neisserial transferrin binding proteins  
(Poster 66)  
FG Mackinnon, AR Gorrings, A Robinson and LM Wetzler .....194

Antibody response of rabbits to intranasally administered meningococcal native  
outer membrane vesicles (Poster 67)  
DR Shoemaker, NB Saunders, BL Brandt, E Moran, and WD Zollinger 196

Immune response of mice to intranasally administered meningococcal native outer membrane  
vesicles (Poster 68)  
NB Saunders, DR Shoemaker, T Larsen, et al. ....198

### **Conjugate and Polysaccharide Vaccines**

Meningococcal polysaccharide-protein conjugate vaccines (Review)  
DM Granoff .....203

Protective epitope of N-propionylated group B meningococcal polysaccharide  
HJ Jennings, R Pon, M Lussier and Q-L Yang .....212

Preclinical evaluation of a combination vaccine against groups A, B, and C meningococci in both  
mice and nonhuman primates  
JY Tai, F Michon, PC Fusco, and MS Blake .....214

Peptide mimic-induced primary human antibody response to the capsular  
polysaccharide of *Neisseria meningitidis* serogroup C  
MAJ Westerink, WA Hutchins, PK Holder, et al. ....216

Murine monoclonal antibodies to an N-propionylated meningococcal B polysaccharide exhibit  
heterogeneity with respect to cross-reactivity with N-acetylated meningococcal  
B polysaccharide and autoreactivity to host polysialylated glycoproteins (Poster 69)  
A Bartoloni, S Ricci, E Gallo, et al. ....218

Immunogenicity of a meningococcal serogroup A and C conjugate vaccine in UK  
infants (Poster 70)

R Borrow, CK Fairley, N Begg, et al. ....	220
Evaluation of the innocuity of a group B meningococcal polysaccharide conjugate in hyperimmunized, pregnant cynomolgus monkeys and their offspring (Poster 71) J Bruge, J-C Moulin, B Danve, et al. ....	222
Safety and immunogenicity of an N-propionylated group B meningococcal polysaccharide conjugate vaccine in adult volunteers (Poster 72) B Danve, J Bruge, N Bouveret-Le Cam, et al. ....	225
Immunological activity of serogroup B meningococcal vaccine from natural complex of capsular polysaccharide and outer membrane proteins (Poster 73) VI Kuvakina, LI Golovina, TF Chernishova, et al. ....	227
Cost-effectiveness analysis for routine immunization with a quadrivalent meningococcal polysaccharide (A,C,Y,W-135)- protein conjugate vaccine in the United States (Poster 74) OS Levine, P Shaffer, A Haddix and BA Perkins .....	228
Bivalent A/C meningococcal conjugate vaccine in toddlers: persistence of antibodies and response to a polysaccharide vaccine booster (Poster 75) JM Lieberman, VK Wong, S Partridge, et al. ....	231
Analytical methods for the quality control of <i>Neisseria meningitidis</i> C polysaccharide (Poster 76) I Martínez, J Sánchez, A Mandiarote, et al. ....	233
Long-term follow-up of late complement component deficient patients vaccinated with meningococcal polysaccharide vaccine: Antibody persistence and efficacy of vaccination (Poster 77) AE Platonov, IV Vershinina, J Dankert, et al. ....	235
NMR analysis of meningococcus type A and C polysaccharide antigens: patterns of <i>O</i> -acetylation (Poster 78) N Ravenscroft, S D'Ascenzi, and A Ferrett .....	237
An improved method for meningococcus C polysaccharide purification (Poster 79) MM Tanizaki, L Garcia, JB Ramos, et al. ....	240
Efficacy of <i>Neisseria meningitidis</i> serogroup A/C polysaccharide vaccine among children in Mongolia (Poster 80) CG Whitney, N Dondoc, B Enkтуja, et al. ....	242

## **Pathogenesis**

Virulence determinants of meningococci and factors that may determine between

the carrier state and invasive disease (Review) M Virji .....	247
The development of a primary urethral epithelial cell system for the study of adherence and invasion by <i>Neisseria gonorrhoeae</i> H Harvey, M Ketterer, A Preston, et al. ....	256
The role of the lutropin receptor and the cryptic plasmid in gonococcal invasion of HecIB cells VL Clark, DA Daines, LE Silver, and JM Spence .....	259
Host cell factors involved in opacity (Opa) protein-mediated cell adherence and cell invasion by gonococci C Dehio, OG Gómez-Duarte, A Meyer auf der Heyde, et al. ....	261
Molecular interaction of <i>Neisseria gonorrhoeae</i> and <i>Neisseria meningitidis</i> to host cell receptors A-B Jonsson .....	264
In vitro interaction of <i>Neisseria meningitidis</i> (MC) with a monolayer of cells forming tight junctions as a model to study the crossing of the blood-brain barrier C Pujol, E Eugène, M Marceau and X Nassif .....	266
<i>Neisseria gonorrhoeae</i> mutants lacking outer membrane protein Rmp (PIII) are deficient in invasion of human epithelial cells RF Rest, GC CHEN, and EC Gotschlich .....	267
CGM1a antigen of neutrophils, a receptor of gonococcal opacity proteins for phagocytosis (Poster 81) T Chen and EC Gotschlich .....	270
Role of the gonococcal cryptic plasmid in epithelial cell invasion (Poster 82) DA Daines, LE Silver, and VL Clark .....	272
Internalization of <i>Neisseria gonorrhoeae</i> by Chinese Hamster Ovary cells (Poster 83) TD Duensing and JPM van Putten .....	274
<i>Neisseria meningitidis</i> toxicity for cultured human endothelial cells requires soluble CD14 (Poster 84) KLR Dunn, and M Virji .....	275
Inhibitory effects of a monoclonal antibodies against <i>Neisseria meningitidis</i> on bacterial adhesion and invasion of HeLa cells (Poster 85) EN De Gaspari, AC Fernandes and LMC De Oliveira .....	277
Functionality of Por, Opa, and the 3F11 LOS epitope expressed simultaneously in <i>Escherichia coli</i> (EC): A gonococcal surrogate in the human Fallopian Tube model? (Poster 86)	



GL Gorby, AF Ehrhardt, MA Apicella, C Elkins, RF Rest .....	279
Construction, characterization, and analysis of chimeric Opa proteins in <i>Neisseria gonorrhoeae</i> (Poster 87)	
CCR Grant, MP Bos, J Swanson and RJ Belland .....	282
Deletion of <i>porA</i> by site specific recombination in clinical <i>Neisseria meningitidis</i> isolates (Poster 88)	
CThP Hopman, J Dankert and A van der Ende .....	284
Gonococcal entry into Chang conjunctiva epithelial cells (Poster 89)	
RM Ireland, HUC Grassmé and JPM van Putten .....	285
Complement component C1q is required for IgA1-initiated killing of <i>Neisseria meningitidis</i> (Poster 90)	
GA Jarvis and J Li .....	287
Characterization of a eukaryotic pilus receptor for <i>Neisseria gonorrhoeae</i> and <i>Neisseria meningitidis</i> (Poster 91)	
H Källström, M Rahman and A-B Jonsson .....	289
High levels of interleukin 10 are associated with fatality in meningococcal disease (Poster 92)	
AK Lehmann, A Halstensen, S Sørnes, O Røkke and A Waage	291
The IgA1 protease of pathogenic <i>Neisseriae</i> increases LAMP1 turnover and promotes survival of bacteria in epithelial cells (Poster 93)	
L Lin, P Ayala, M Mulks, C Enns and M So .....	293
Gonococci and meningococci traverse a polarized epithelium: maintenance of epithelial barrier function and importance of GC type IV pili (Poster 94)	
AJ Merz, DB Rifken, CG Arvidson and M So .....	294
Carbon metabolism of <i>Neisseria meningitidis</i> serogroup B with a view to potential pathogenic links (Poster 95)	
MP Leighton, JG Shaw, DJ Kelly and MP Williamson .....	296
Activation of NK- $\kappa$ B and cytokine gene expression in <i>Neisseria gonorrhoeae</i> infected epithelial cells (Poster 96)	
B Wieland, S Weßler, I Scheurplug, M Naumann and TF Meyer	298
A recombinant molecule of <i>Neisseria gonorrhoeae</i> that confers C1q dependent virulence in experimental animals (Poster 97)	
S Nowicki, P Ram, A Skarpetowski, and B Nowicki .....	299

<i>Neisseria meningitidis</i> infections and terminal complement component deficiency in Ireland. Diagnosis and management, and investigations of C6*/C7* DNA haplotypes (Poster 98) A Orren, BA Fernie, CAP Fijen, et al. ....	300
The problem of septic shock in patients with meningococcal disease (Poster 99) V Beloborodov, D Trochansky, A Platonov, O Dzeksenbaev ....	302
Characterization and surface translocation of pilus associated protein PilC of <i>Neisseria gonorrhoeae</i> and <i>Neisseria meningitidis</i> (Poster 100) M Rahman, H Källström, S Normark and A-B Jonsson .....	304
Experimental coinfection of human rhinopharyngeal mucosa with influenza virus and Group B <i>Neisseria meningitidis</i> (Poster 101) RC Read, MA Parsons, M Pickett, et al. ....	306
Intracellular <i>Neisseria gonorrhoeae</i> bind host pyruvate kinase via their Opa proteins (Poster 102) JM Williams and RF Rest .....	308
The role of the lutropin receptor in gonococcal invasion of Hec1B cells: A preliminary report (Poster 103) JM Spence and VL Clark .....	310
High erythromycin prescribing during an outbreak of meningococcal disease (Poster 104) JM Stuart, PM Robinson, KAV Cartwright and ND Noah .....	313
Respiratory syncytial virus infection and meningococcal disease (Poster 105) JM Stuart, KAV Cartwright and NJ Andrews .....	314
Gc susceptibility to heparin-like compounds (Poster 106) J Swanson, D Kao, D Dorward, and SF Hayes .....	315
The N-domain of the human CD66a adhesion molecule is a target for Opa proteins of <i>Neisseria meningitidis</i> (Poster 107) M Virji, SM Watt, S Barker and K Makepeace .....	317
CD66 adhesion molecules on polymorphonuclear phagocytes and epithelial cells are targets for Opa proteins of <i>Neisseria meningitidis</i> and <i>Neisseria gonorrhoeae</i> (Poster 108) M Virji, SM Watt, S Barker and K Makepeace .....	319
Meningococcal interactions with human phagocytic cells: a study on defined phenotypic variants (Poster 109) G McNeil and M Virji .....	321
Investigations on the glycosylation status of pilins of carriage and clinical isolates of <i>Neisseria meningitidis</i> (Poster 110)	

M Virji, S Barker and K Makepeace .....	324
Rapid detection of blood contamination in the cerebro-spinal fluid of infant rats by Sangur™test strips (Poster 111)	
U Vogel and M Frosch .....	326

Antimicrobial polypeptides of human polymorphonuclear leucocytes increase interaction of <i>Neisseria meningitidis</i> with epithelial cells in an opacity protein independent way (Poster 112)	
FP de Vries, JPM van Putten and J Dankert .....	327

The potential of [Cu,Zn]-superoxide dismutase to contribute to survival of <i>Neisseria meningitidis</i> in the presence of human polymorphonuclear leukocytes (Poster 113)	
KE Wilks, PR Langford and JS Kroll .....	329

## Genetics

The Neisserial genome: Importance and where do we stand? (Review)	
DW Dyer, E Gray, and BX Behrens, et al. ....	333

Chromosome organization in <i>Neisseria gonorrhoeae</i> and <i>N. meningitidis</i>	
JAF Dempsey, ME Maurer and JG Cannon .....	341

Characterization of a peptidoglycan transglycosylase from <i>Neisseria gonorrhoeae</i>	
JP Dillard and HS Seifert .....	343

Molecular mechanisms of capsule phase variation in group B <i>Neisseria meningitidis</i>	
M Frosch, S Hammerschmidt, R Hilse, et al. ....	345

Transcriptional control of antibiotic resistance in <i>Neisseria gonorrhoeae</i> due to the <i>mtr</i> efflux system	
CE Lucas, JT Balthazar and WM Shafer .....	347

Do sexual bacterial have species?	
N H Smith, GM Donovan, and BG Spratt .....	349

Analysis of the genetic differences between <i>Neisseria meningitidis</i> and <i>Neisseria gonorrhoeae</i>	
CR Tinsley and X Nassif .....	351

A two-component regulatory system in <i>Neisseria gonorrhoeae</i> involved in Opa (P.II) expression (Poster 114)	
A Preston, A Zaleski, B Gibson and MA Apicella .....	353

A sixteen bp palindrome sequence encompassing the putative ribosomal binding site is conserved in pathogenic <i>Neisseria rfaC</i> genes and is involved in the regulation of expression of meningococcal <i>rfaC</i> (Poster 115)	
--	--

D Zhou, A Zaleski, B Buscher, A Preston, and MA Apicella	....356
Identification and characterization of <i>glyI</i> , a PilA-regulated locus in <i>Neisseria gonorrhoeae</i> (Poster 116)	
CG Arvidson, J Larson, LS Waldbeser, et al.	.....358
A phase-variable type III restriction-modification system in <i>Neisseria gonorrhoeae</i> (Poster 117)	
RJ Belland, SG Morrison and D Hogan	.....360
Detection of single-strand DNA during transformation of <i>Neisseria gonorrhoeae</i> (Poster 118)	
MS Chaussee and SA Hill	..... 362
PilA is unlikely to be an activator of <i>pilE</i> transcription in <i>Neisseria gonorrhoeae</i> (Poster 119)	
JAM Fyfe and JK Davies	.....364
Regulation of DNA repair in <i>Neisseria gonorrhoeae</i> (Poster 120)	
CG Black, JAM Fyfe and JK Davies	.....366
The gonococcal <i>rsp</i> gene appears to have evolved from a two component regulatory system that controls type IV piliation in another species (Poster 121)	
CS Carrick, JAM Fyfe and JK Davies	.....367
Identification and characterization of PilP, a lipoprotein essential for type IV pilus biogenesis in <i>Neisseria gonorrhoeae</i> (Poster 122)	
S Drake, S Dunham and M Koomey	.....369
Expression of capsular polysaccharide in <i>Neisseria meningitidis</i> : Comparison of biosynthetic and transport genetic loci responsible for serogroup A, B, C, Y and W-135 capsules (Poster 123)	
S Edupuganti, L-J Liu, JH Ahn, JS Swartley, and DS Stephens	371
Integration host factor is required for efficient transcription of <i>pilE</i> in <i>Neisseria gonorrhoeae</i> (Poster 124)	
SA Hill, S Samuels, J Carlson, et al.	.....372
IS1301, a novel IS element of <i>Neisseria meningitidis</i> : Site-specific insertion and variable distribution in genetically related strains (Poster 125)	
R Hilde, S Hammerschmidt, DA Cagant, M Achtman and M Frosch	373
Promoter strength influences phase variation of Neisserial <i>opa</i> genes (Poster 126)	
DM Hogan, JH Carlson and RJ Belland	.....375
Analysis of the recombination producing pilin antigenic variation using insertions in silent and expressed pilin loci (Poster 127)	
BS Howell, LA Wainwright, and HS Seifert	.....377

Regulation of the prepilin-peptidase <i>pilD</i> gene of <i>Neisseria gonorrhoeae</i> and <i>meningitidis</i> (Poster 128) M Larribe, B Dupuy, D Giorgini, and MK Taha .....	379
Characterization of an IPTG-inducible <i>pilE</i> strain: relationships between <i>pilE</i> transcription, piliation and DNA transformation in <i>Neisseria gonorrhoeae</i> (Poster 129) CD Long and HS Seifert .....	380
Molecular characterization of the pyruvate dehydrogenase gene cluster of <i>Neisseria meningitidis</i> (Poster 130) A Martin, S González, E Caballero and EC Nogueiras .....	382
Isolation of mutants deficient in pilin antigenic variation (Poster 131) IJ Mehr and HS Seifert .....	384
Genetic analysis of the <i>tonB</i> , <i>exbB</i> , and <i>exbD</i> operon in <i>Neisseria gonorrhoeae</i> (Poster 132) S Berish, I Stojiljkovic, and SA Morse .....	385
Primary structure of the <i>rpoB</i> gene of <i>Neisseria meningitidis</i> , coding for the beta subunit of RNA polymerase, which is organized within an operon and description of a new attenuator-like sequence (Poster 133) O Nolte .....	387
Genetic transfer between Neisseriae: simulation in microcosm (Poster 134) P Orús and M Viñas .....	389
Identification and characterization of <i>pilU</i> , a gene whose product modifies pilus-associated phenotypes in <i>Neisseria gonorrhoeae</i> (Poster 135) HM Park and M Koomey .....	391
Genetic analysis of post translational modifications of meningococcal pilin (Poster 136) G Payne, M Virji and JR Saunders .....	393
Tetrameric repeats in <i>Neisseria</i> (Poster 137) IRA Peak MP Jennings, D Hood and ER Moxon .....	395
Characterization of cell division gene homologues <i>ftsZ</i> , <i>ftsE</i> and <i>ftsX</i> in <i>Neisseria gonorrhoeae</i> strain CH811 (Poster 138) S Bernatchez, A Radia and JR Dillon .....	397
Studies on FA1090 S-Pilin Variants (Poster 139) R Madraswala and HS Seifert .....	399

Identification of a second homologue of the lysophosphatidic acid acyltransferase in <i>Neisseria meningitidis</i> and implications for meningococcal membrane phospholipid biosynthesis (Poster 140)	
GC Shih, CM Kahler, JS Swartley, J Coleman, and DS Stephens	400
Regulatory pathways of adhesion in pathogenic <i>Neisseriae</i> (Poster 141)	
Y Pereira, A Gueye, D Giorgini, et al. ....	401
A repetitive sequence element cause polymorphism in the PilQ protein of <i>Neisseria meningitidis</i> (Poster 142)	
T Tønjum, DA Caugant and M Koomey .....	402
PCRDOP Amplification and Analysis of a 1.8Kb fragment of a potentially novel two-component regulatory system in <i>Neisseria meningitidis</i> (Poster 143)	
DB Wells, BW Wren and SP Borriello .....	404
Transformation defects in genetically defined pilus mutants of <i>Neisseria gonorrhoeae</i> (Poster 144)	
M Wolfgang and M Koomey .....	405
<b>Epidemiology Typing and Diagnostics</b>	
Population genetics of the pathogenic <i>Neisseria</i> and its relevance to molecular epidemiology and typing methods (Review)	
BG Spratt, M O'Rourke and NH Smith .....	409
Microevolution during epidemic spread of subgroup III serogroup A meningococci	
M Achtman, B Malorny, G Morelli, K Müller and A Seiler .....	415
Identification and typing of <i>Neisseria meningitidis porB</i> from cerebrospinal fluid using nested PCR and biotin labeled probe hybridization	
M Bash, DE Barroso, and C Frasc .....	417
Assessment of molecular typing methods for differentiation of <i>Neisseria gonorrhoeae</i>	
HY Chenia, D Pillay, AA Hoosen and B Pillay .....	419
Molecular typing of <i>Neisseria gonorrhoeae</i> to identify sexual contacts	
CA Ison, IMC Martin, A Ghani, et al. ....	421
The molecular epidemiology of the <i>porB</i> gene of <i>Neisseria meningitidis</i> isolated in England and Wales	
R Urwin, MCJ Maiden, IM Feavers, P Kriz, and AJ Fox .....	423
Clonal analysis of <i>Neisseria meningitidis</i> : Sequence studies on the 16S ribosomal RNA (Poster 145)	
PE Carter, FJR Abadi and TH Pennington .....	425

Measurement of antibodies against meningococcal capsular polysaccharides B and C in ELISA: An approach towards an improved surveillance of meningococcal disease (Poster 146)	
J Andersen, L Berthelsen and I Lind .....	427
<i>Neisseria meningitidis</i> strains that were not serosubtypable in whole-cell ELISA (Poster 147)	
FF Arhin, F Moreau, JW Coulton and EL Mills .....	429
Appearance of <i>N. meningitidis</i> serogroup B:ET15 in Canada (Poster 148)	
FE Ashton, A Ryan, L Mancino, et al. ....	431
Antimicrobial susceptibility test for evaluation of <i>Neisseria meningitidis</i> C isolated during an urban epidemic, Rio de Janeiro 1993-1995 (Poster 149)	
DE Barroso, SA Nogueira, CA Solari, et al. ....	433
Epidemiology and molecular analysis of epidemic meningococcal disease related to group C <i>Neisseria meningitidis</i> in a Brazilian metropolis: Rio de Janeiro, 1993-1995 (Poster 150)	
DE Barroso, DM Carvalho, SA Nogueira, et al. ....	435
Antigenic variation of the class 1 outer membrane protein in an emerging <i>Neisseria meningitidis</i> clone in the Netherlands (Poster 151)	
A Bart, DJ Hijnen, J Dankert and A van der Ende .....	438
Non-culture diagnosis and serogroup determination of meningococcal B and C infection by a sialyltransferase ( <i>siaD</i> ) PCR ELISA (Poster 152)	
R Borrow, H Claus, M Guiver, et al. ....	439
Epidemiology of meningococcal meningitis in Niamey, Niger: 1989-1995 (Poster 153)	
G Campagne, A Schuchat, A Ousseini, et al. ....	441
Improved surveillance of meningococcal disease in Norway by continual connection of the epidemiological and bacteriological data (Poster 154)	
DA Caugant, LO Frøholm, EA Høyby, H Blystad and A Lystad	443
Detection of <i>Neisseria gonorrhoeae</i> in clinical samples by the polymerase chain reaction (Poster 155)	
HY Chenia, D Pillay, AA Hoosen and B Pillay .....	445
Prevalence of <i>Neisseria meningitidis</i> serotype 22 in Germany (Poster 156)	
I Ehrhard, P Kriz, M Musilek, and HG Sonntag .....	447
Random Amplified Polymorphic DNA (RAPD) genotyping of serogroup A meningococci yields results comparable to those of Multilocus Enzyme	

Electrophoresis (MEE) (Poster 157) A Bart, I Schuurman, M Achtman, et al. ....	448
Epidemic meningococcal disease and tobacco smoke: A risk factor study in the Pacific Northwest (Poster 158) M Fischer, K Hedberg, P Cardosi, et al. ....	449
Epidemiology of meningococcal disease in the Republic of Ireland (Poster 159) J Fogarty, MT Cafferkey, and AC Moloney .....	452
Production of monoclonal antibodies against <i>Neisseria meningitidis</i> that recognize specific and cross reactive antigens (Poster 160) EN De Gaspari and LMC De Oliveira .....	454
Prevalence and variation in class 5 expression by serogroup A,C and B during epidemics in Brazil (Poster 161) AC Fernandes, LMC De Oliveira and EN De Gaspari .....	455
A monoclonal antibody as a probable immunological differential marker to discriminate bacterial from non-bacterial meningitis (Poster 162) LMC De Oliveira, AC Fernandes, S Takimoto, A Collucci and EN De Gaspari	457
<i>Neisseria gonorrhoeae</i> is clonal - sometimes (Poster 163) KA Ghavimi and TH Pennington .....	459
Macrorestriction profiles of <i>Neisseria meningitidis</i> using pulsed-field gel electrophoresis: Novel epidemiological examples (Poster 164) SJ Gray, F Khan, DM Jones, KAV Cartwright and AJ Fox .....	461
Molecular analysis of <i>Neisseria meningitidis</i> class 3 outer membrane protein in the strains recognized by the Monoclonal antibody CB-Nm.2 (Poster 165) G Guillen, A Alvarez, C Nazabal, et al. ....	464
Meningococci causing disease in South Australia 1971 through 1995:A 25 year study (Poster 166) D Hansman, A Lawrence and F Ashton .....	465
PFGE-RFLP analysis of meningococci of the phenotype C:2b:P1.2 causing geographically diverse outbreaks of disease in Australia (Poster 167) J Jelfs , R Munro, and J Ellis .....	467
Examination of the usefulness of three genotype methods to characterize epidemiologically related meningococci (Poster 168) J Jelfs, R Munro, and J Ellis .....	469
Meningococcal disease isolate surveillance, New South Wales, Australia,	



1994 - 1995 (Poster 169) J Tapsall, J Jelfs, R Munro, T Shultz, and E Limnios .....	471
Stability of the meningococcal <i>porA</i> gene in serial isolates from military recruits (Poster 170) GR Jones, JL Brooks, AJ Fox and JE Heckels .....	473
Optimizing ascertainment of meningococcal infection in England and Wales - impact of novel diagnostic techniques and reconciliation of available datasets between the national reference laboratory and other surveillance schemes (Poster 171) EB Kaczmarski, R Borrow, SJ Gray, et al. ....	475
Clonal distribution of disease-causing <i>Neisseria meningitidis</i> in the county of Telemark, Norway 1987-95; studied by PCR Amplicon restriction endonuclease analysis (PCAREA) (Poster 172) BE Kristiansen, R Kersten, A Jenkins, et al. ....	477
Molecular epidemiology of meningococcal disease in Iceland 1977-1995 (Poster 173) M Kristjánsson, DA Caugant, LO Fröholm, et al. ....	480
Antigenic variations within the genetic clone ET-15/37 of <i>Neisseria meningitidis</i> occurring in the Czech Republic (Poster 174) P Kriz and M Musilek .....	482
The new serotype of <i>Neisseria meningitidis</i> (Poster 175) P Kriz, M Musilek, V Danielova and J Holubova .....	484
The molecular characterization of a new meningococcal serotype: serotype 22 (Poster 176) P Kriz, R Urwin, M Musilek, et al. ....	486
Antigenic phenotype of meningococcal strains isolated from patients and carriers in Greece using the new monoclonal antibody designated 22 (Poster 177) G Tzanakaki, P Kriz, J Kremastinou, M Musilek and CC Blackwell	488
Factors relating to carriage of <i>Neisseria meningitidis</i> and the Lewis antigen phenotype (Poster 178) P Kriz, M Musilek, J Vlckova, CC Blackwell and DM Weir .....	490
Automated direct nucleotide sequence analysis in the study of meningococcal antigenic variation (Poster 179) MCJ Maiden, JA Bygraves, AJ Fox, and IM Feavers .....	492
Confirmation of meningococcal sepsis using diagnostic nPCR of urine samples - a case report (Poster 180) MP Mammen, NB Saunders, JT Burgess, et al. ....	494

Epidemic of serogroup B meningococcal disease in New Zealand has parallels with that observed in the Netherlands, 1980-1990 (Poster 181) DR Martin, SJ Walker, MG Baker, AP Roberts, and DR Lennon	496
PCR-SSCP of clinical specimens for non-culture-based sub-typing of the meningococcus in clinical specimens (Poster 182) J Newcombe, K Cartwright, WH Palmer and J McFadden	498
Meningoencephalitis. Notified cases between 1969 and 1995 in Argentina (Poster 183) NP Miceli, CA Riva Posse, R Chuit, et al.	500
Polymerase chain reaction of peripheral blood for the diagnosis of meningococcal disease (Poster 184) J Newcombe, K Cartwright, WH Palmer and J McFadden	501
Comparison between DNA sequencing and fingerprinting by pulsed-field gel electrophoresis for strain typing : Preliminary results using 12 meningococcal strains and isolates of 4 further <i>Neisseria</i> species (Poster 185) O Nolte, I Ehrhard, J Patzelt and H-G Sonntag	503
The high incidence of meningococcal disease in indigenous Australians (Poster 186) MS Patel	505
Cochrane Reviews: The way ahead in the control of meningococcal disease (Poster 187) MS Patel, and RM Douglas	508
Typing of <i>N. meningitidis</i> in Moscow: Prevalence of non-European strains (Poster 188) IS Koroleva, AE Platonov, A van der Ende, EJ Kuijper and J Dankert	511
Heteroduplex mobility analysis for identification of pathogens causing bacterial meningitis (Poster 189) GA Shipulin, AE Platonov, A van den Ende, E Kuijper, and J Dankert	513
Comparison of different methods to diagnose bacterial meningitis in Russia (Poster 190) AE Platonov, IS Koroleva, GA Shipulin, et al	515
Outbreak of group A meningococcal disease in Moscow (Poster 191) AE Platonov, IS Koroleva, and TM Chernyshova	517
Molecular typing of <i>Neisseria gonorrhoeae</i> by repetitive element sequence-based PCR in comparison with arbitrarily primed PCR analysis (Poster 192)	

CL Poh, V Ramachandran, JE Heckels and CA Ison .....	519
Analysis of serogroup C <i>Neisseria meningitidis</i> causing sporadic meningococcal disease (Poster 193)	
NJ Raymond, M Reeves, G Ajello, et al. ....	520
A study of the sero/subtypes and antimicrobial resistance of <i>Neisseria meningitidis</i> isolated in Argentina during 1991-1996 (Poster 194)	
M Regueira, S Palmerio, A Corso, et al. ....	521
Evolution of the second pandemic due to strains of <i>Neisseria meningitidis</i> A:4:P1.9/clone III-1. Survey in four African countries Niger, Burkina Faso, Cameroon and Chad October 1995-May 1996 (Poster 195)	
M Guibourdenche, JP Chippaux, R Ouedraogo-Traore, et al. ....	523
Evaluation of the cross reactivity of antisera raised to recombinant Transferrin binding protein 2 variants from <i>Neisseria meningitidis</i> against a genetically diverse collection of serogroup B strains (Poster 196)	
B Rokbi, M Mignon, G Maitre-Wilmotte, et al. ....	525
Serogroup Y meningococcal disease in the United States (Poster 197)	
NE Rosenstein, MW Reeves, GW Ajello, JD Wenger, and BA Perkins	527
Outbreaks of meningococcal disease in England and Wales in the winter of 1995/6 (Poster 198)	
JM Stuart, F Sufi, A Rushdy, and EB Kaczmarek .....	529
Characterization of two porin genes present in <i>Neisseria flavescens</i> (Poster 199)	
J Suker, MCJ Maiden and IM Feavers .....	530
Molecular typing of <i>Neisseria meningitidis</i> strains using polymorphism of <i>pilA</i> gene (Poster 200)	
D Giorgini, A Gueye, M Guibourdenche, J-Y Riou and M-K Taha	533
The molecular epidemiology of <i>tetM</i> genes in <i>Neisseria gonorrhoeae</i> (Poster 201)	
A Turner, KR Gough and JP Leeming .....	534
Assessment of serological response to meningococcal disease in the United States: descriptive epidemiology and a case-control analysis (Poster 204)	
R Wall, SJ Gray, R Borrow, et al.....	536
P1.19 specificity of a previous P1.15 reference monoclonal antibody demonstrated by blotting methods, porA sequencing and peptide mapping (Poster 203)	
E Wedege, DA Caugant and WD Zollinger.....	538
School-based clusters of meningococcal disease in the United States: descriptive epidemiology and a case-control analysis	

KM Zangwill, A Schuchat, FX Riedo, et al.....540

### **Environmentally Regulated Proteins**

Neisserial iron regulated stress proteins: What do they do? What can we do with them? (Review)

PF Sparling, CN Cornelissen, G Biswas, et al. ....545

Function and virulence studies of the gonococcal transferrin receptor  
CN Cornelissen, JE Anderson, M Kashkari, et al. ....552

Periplasm-to-cytosol free iron transport by pathogenic *Neisseria*  
AJ Nowalk, P Adhikari, HD Bittner et al. ....554

The *N meningitidis* hemoglobin receptor genes and interaction between the  
hemoglobin receptor and the hemoglobin molecule  
I Stojiljkovic .....556

Cloning, sequencing and genetic characterization of *tonB-exbB-exbD* genes of  
*Neisseria gonorrhoeae* (Poster 205)  
GD Biswas, JE Anderson and PF Sparling .....558

Genetic and serological analysis of lactoferrin receptors in the Neisseriaceae:  
evidence for the antigenically conserved nature of LbpB (Poster 206)  
RA Bonnah, H Wong and AB Schryvers .....560

Characterization of the interaction between *Neisseria meningitidis* transferrin binding proteins  
and transferrin by gel filtration and surface plasmon resonance (Poster 207)  
IC Boulton, AR Gorringer, N Allison, B Gorinsky, and RW Evans 562

Analysis of respiration linked nitrite reduction in *Neisseria gonorrhoeae*: AniA, the major  
anaerobically induced outer membrane protein, is probably not the terminal  
nitrite reductase (Poster 208)  
JA Cardinale, LE Silver, WA Belli and VL Clark .....564

Gonococcal FrpB: a possible role in siderophore uptake (Poster 209)  
SD Biegel Carson and PF Sparling .....566

A phase varying, hemoglobin-binding outer membrane protein from *Neisseria gonorrhoeae*  
(Poster 210)  
CJ Chen, PF Sparling, LA Lewis, DW Dye and C Elkins .....568

Diversity, topology, and functional domain mapping of gonococcal transferrin-  
binding proteins (Poster 211)  
CN Cornelissen, JE Anderson, and PF Sparling .....570

Evidence for a bi-lobed structure for meningococcal transferrin binding protein B (Poster 212) CA Fuller MD Retzer, E Jacobs and AB Schryvers .....	572
Conserved interactions between heterologous TbpB-TbpA pairs and Tf (Poster 213) CA Fuller, R-H Yu, SW Irwin and AB Schryvers .....	574
Specificity of the gonococcal heme transport system (Poster 214) PJ Desai and CA Genco .....	576
Molecular analysis of <i>lbpAB</i> encoding the two component meningococcal lactoferrin receptor (Poster 215) LA Lewis, KH Rohde, B Behrens, et al. ....	577
Transcriptional regulation of <i>pilC2</i> of <i>Neisseria gonorrhoeae</i> : Response to oxygen availability and evidence for growth phase regulation in <i>E. coli</i> (Poster 216) J Mellies and TF Meyer .....	579
Sequence analysis of the structural <i>tbpA</i> gene: protein topology and variable regions within neisserial receptors for transferrin iron acquisition (Poster 217) R Pajon, G China, E Marrero, D Gonzalez and G Guillen .....	580
Molecular characterization of FrpB, the 77 kDa iron-regulated OMP (Poster 218) A Pettersson, J van der Biezen, P van der Ley, JT Poolman, and J Tommassen	582
Co-localization of the meningococcal transferrin binding proteins (Tbp1 and Tbp2) and evaluation of their relative roles in binding human transferrin (Poster 219) NBL Powell, K Bishop, AR Gorringer, AB Schryvers, and SP Borriello	584
Study of human transferrin binding sites within the transferrin binding protein Tbp2 from <i>N. meningitidis</i> M982 using the pMAL expression system (Poster 220) G Renaud-Mong�nie, D Poncet and MJ Quentin-Millet .....	585
Characterization of the meningococcal lactoferrin receptor (Poster 221) A Pettersson, T Prinz, P van der Ley, JT Poolman, and J Tommassen	587

### Structure of Neisserial Proteins

Characterization of the relative conformational stability of <i>Neisseria meningitidis</i> porins CASA Minetti, DP Remeta, MS Blake, and JY Tai .....	591
Studies on the PorA protein of <i>Neisseria meningitidis</i> by X-ray crystallography and NMR JP Derrick, MCJ Maiden, IM Feavers, LY Lian, and J Suker ....	593
High Resolution Model of the <i>Neisseria</i> Pilus Fiber	

K Forest, E Getzoff, and J Tainer .....595

**Noncapsular Vaccines (Addendum)**

Opsonophagocytosis responses to meningococcal antigens adsorbed to beads (Poster)

AK Lehmann, A Halstensen, J Holst, EA Høiby, S Sørnes and C-F Bassøe 586

Serum bactericidal activity elicited by two outer membrane protein serogroup B meningococcal vaccines among infants, pre-school children, and adults in Santiago, Chile (Poster)

J Tappero, R Lagos, A Maldonado, P Herrera, L Gheesling, D Williams,  
G Carlone, B Plikaytis, H Nokleby, J Holst, G Sierra and B Perkins. 598