production and a greater degree of inflammation, and favour the penetration of antibiotics into the gastric mucosa; bacterial genetic traits may therefore be linked not only to gastric histopathology, but also to the success of antibiotic treatment.

In conclusion, multiparametric studies are required to better define the heterogeneous nature of *H. pylori* strains colonising humans. A combined approach, including the correlation between in-vitro antibiotic testing, in-vivo treatment outcome, and bacterial genotypic traits, may improve our knowledge significantly.

P. De Paoli, M. L. Tomasini and G. Basaglia*
Microbiology, Immunology, Virology,
Centro Di Riferimento Oncologico,
IRCCS,
Aviano,
Italy
*E-mail: pdepaoli@cro.it

REFERENCES

1. Alarcon T, Domingo D, Lopez-Brea M. Antibiotic resistance problems with *Helicobacter pylori*. *Int J Antimicrob Agents* 1999; **12**: 19–26.
2. Jorgensen M, Daskalopoulos G, Warburton V, Mitchell H, Hazell S. Multiple strain colonization and metronidazole resistance in *H. pylori*-infected patients: identification from sequential and multiple biopsy specimens. *J Infect Dis* 1996; **174**: 631–635.
3. Henriksen T, Lerang F, Lia A *et al.* Laboratory handling of *Helicobacter pylori* critically influences the results of in-vitro metronidazole resistance determination. *Clin Microbiol Infect* 2004; **10**: 315–321.
4. Van der Wouden E, de Jong A, Thijs J, Kleibeuker J, van Zweet A. Subpopulations of *H. pylori* are responsible for discrepancies in the outcome of nitroimidazole susceptibility testing. *Antimicrob Agents Chemother* 1999; **43**: 1484–1486.
5. Tomasini M, Zanussi S, Sozzi M, Tedeschi R, Basaglia G, De Paoli P. Heterogeneity of *cag* genotypes in *Helicobacter pylori* isolates from human biopsies. *J Clin Microbiol* 2003; **41**: 976–980.
6. Basaglia G, Sperandio S, Tomasini M, Stocco S, Giordari F, De Paoli P. Analysis of antimicrobial susceptibility and virulence factors in *Helicobacter pylori* clinical isolates. J Chemother 2004 (in press).
7. Suerbaum S, Michetti P. *Helicobacter pylori* infection. *N Engl J Med* 2002; **347**: 1175–1186.
8. Figura N, Trabalzini L, Mini R *et al.* Inactivation of *Helicobacter pylori cagA* gene affects motility. *Helicobacter* 2004; **9**: 185–193.
9. Karita M, Blaser MJ. Acid-tolerance response in *Helicobacter pylori* and differences between $cagA^+$ and $cagA^-$ strains. *J Infect Dis* 1998; **178**: 213–219.

10.1111/j.1469-0691.2004.01035.x

Antimicrobial resistance of *Acinetobacter* spp. in Europe

We congratulate Drs Van Looveren and Goossens for their excellent review regarding the antimicrobial resistance of *Acinetobacter* spp. in Europe [1]. We agree with their statement that colistin should be considered as a therapeutic option in patients with severe infections caused by multidrug-resistant *Acinetobacter baumannii* strains. However, we believe that results from recent studies suggest that colistin is less toxic than thought previously and reported in the review. In fact, the reported rates of nephrotoxicity (27% and 58% in patients with baseline normal and abnormal renal function, respectively) do not represent development of 'renal failure', as stated in the review [1] and the original paper by Levin *et al.* [2], but rather renal dysfunction, as evidenced by only a moderate increase in serum creatinine levels. Specifically, it is stated in the original paper [2] that the mean (± SD) increase in serum creatinine concentration was 0.9 ± 0.6 mg/dL in patients with normal baseline creatinine levels, and 1.5 ± 1.4 mg/dL in patients with abnormal baseline creatinine levels. In addition, nephrotoxicity did not lead to discontinuation of treatment for any of the patients in that study, and was reversible in a considerable proportion of patients. Other investigators, including our own group [3,4], have noted that the use of intravenous colistin is associated with considerably less nephrotoxicity than reported previously. In addition, Garnacho-Montero *et al.* [5] reported an almost two-fold nephrotoxicity rate among patients treated for *A. baumannii* ventilator-associated pneumonia with imipenem when compared to colistin-treated patients [5].

Another point of interest is that methods of colistin administration other than the intravenous route may have clinical value. These include aerosolised (nebulised) administration of the antibiotic to patients with severe nosocomial pneumonia. The value of aerosolised colistin in the prevention and treatment of infections caused by *Pseudomonas aeruginosa* strains has already been proven for patients with cystic fibrosis. In addition, intraventricular administration of colistin

may prove to be a life-saving intervention for patients with *A. baumannii* meningitis who do not respond to intravenous treatment with antimicrobial agents, including colistin, as has been demonstrated for a patient of our own [6] and a patient from Spain [7].

M. E. Falagas, S. K. Kasiakou and A. Michalopoulos*
Alfa HealthCare,
Athens,
Greece,
Department of Medicine,
'Henry Dunant' Hospital,
Athens,
Greece,
Tufts University School of Medicine,
Boston, MA,
USA
*E-mail: m.falagas@alfahc.gr

REFERENCES

1. Van Looveren M, Goossens H, the ARPAC Steering Group. Antimicrobial resistance of *Acinetobacter* spp. in Europe. *Clin Microbiol Infect* 2004; **10**: 684–704.
2. Levin AS, Barone AA, Penco J *et al*. Intravenous colistin as therapy for nosocomial infections caused by multidrug-resistant *Pseudomonas aeruginosa* and *Acinetobacter baumannii*. *Clin Infect Dis* 1999; **28**: 1008–1011.
3. Markou N, Apostolakos H, Koumoudiou C *et al*. Intravenous colistin in the treatment of sepsis from multiresistant Gram-negative bacilli in critically ill patients. *Crit Care* 2003; **7**: R78–R83.
4. Michalopoulos AS, Tsiodras S, Rellos K, Mentzelopoulos S, Falagas ME. Colistin treatment in patients with ICU-acquired infections caused by multiresistant Gram-negative bacteria: the renaissance of an old antibiotic. *Clin Microbiol Infect* (in press).
5. Garnacho-Montero J, Ortiz-Leyba C, Jimenez-Jimenez FJ *et al*. Treatment of multidrug-resistant *Acinetobacter baumannii* ventilator-associated pneumonia (VAP) with intravenous colistin: a comparison with imipenem-susceptible VAP. *Clin Infect Dis* 2003; **36**: 1111–1118.
6. Kasiakou SK, Rafailidis PI, Liaropoulos K, Falagas ME. Cure of post-traumatic recurrent multiresistant Gram-negative rod meningitis with intraventricular colistin. *J Infection* (in press).
7. Fernandez-Viladrich P, Corbella X, Corral L, Tubau F, Mateu A. Successful treatment of ventriculitis due to carbapenem-resistant *Acinetobacter baumannii* with intraventricular colistin sulfomethate sodium. *Clin Infect Dis* 1999; **28**: 916–917.