22. **He J,** Baldini RL, Deziel E, *et al*. The broad host range pathogen *Pseudomonas aeruginosa* strain PA14 carries two pathogenicity islands harboring plant and animal virulence genes. *Proc Natl Acad Sci U S A* 2004;**101**:2530—5.
23. **Tateda K,** Comte R, Pechere JC, *et al*. Azithromycin inhibits quorum sensing in *Pseudomonas aeruginosa*. *Antimicrob Agents Chemother* 2001;**45**:1930—3.
24. **Essar DW,** Eberly L, Crawfords IP. Identification and characterization of genes for a second anthranilate synthetase in *Pseudomonas aeruginosa*: interchangeability of the two anthranilate synthases and evolutionary implications. *J Bacteriol* 1990;**172**:884—900.
25. **Köhler T,** Kocjancic-Curty L, Barja F, *et al*. Swarming of *Pseudomonas aeruginosa* is dependent on cell-to-cell signaling and requires flagella and pili. *J Bacteriol* 2000;**182**:5990—6.
26. **Köhler T,** Buckling A, Van Delden C. Cooperation and virulence of clinical *Pseudomonas aeruginosa* populations. *Proc Natl Acad Sci U S A* 2009;**106**:6339—44.
27. **Pesci EC,** Pearson JP, Seed PC, *et al*. Regulation of *las* and *rhl* quorum sensing in *Pseudomonas aeruginosa*. *J Bacteriol* 1997;**179**:3127—32.
28. **Sandoz KM,** Mitzimberg SM, Schuster M. Social cheating in *Pseudomonas aeruginosa* quorum sensing. *Proc Natl Acad Sci U S A* 2007;**104**:15876—81.
29. **Zulianello L,** Canard C, Kohler T, *et al*. Rhamnolipids are virulence factors that promote early infiltration of primary human airway epithelia by *Pseudomonas aeruginosa*. *Infect Immun* 2006;**74**:3134—47.
30. **Davey ME,** Caiazza NC, O'Toole GA. Rhamnolipid surfactant production affects biofilm architecture in *Pseudomonas aeruginosa* PAO1. *J Bacteriol* 2003;**185**:1027—36.
31. **Jensen PO,** Bjarnshold T, Phipps R, *et al*. Rapid necrotic killing of polymorphunuclear leukocytes is caused by quorum-sensing-controlled production of rhamnolipid by *Pseudomonas aeruginosa*. *Microbiology* 2007;**153**:1329—38.
32. **Shaver CM,** Hauser AR. Relative contributions of *Pseudomonas aeruginosa* ExoU, ExoS, and ExoT to virulence in the lung. *Infect Immun* 2004;**72**:6969—77.
33. **Bleves S,** Soscia C, Nogueira-Orlandi P, *et al*. Quorum sensing negatively controls type III secretion regulon expression in *Pseudomonas aeruginosa* PAO1. *J Bacteriol* 2005;**187**:3898—902.
34. **Hentzer M,** Wu H, Andersen JB, *et al*. Attenuation of *Pseudomonas aeruginosa* virulence by quorum sensing inhibitors. *EMBO J* 2003;**22**:3803—15.
35. **Lesic B,** Lepine F, Deziel E, *et al*. Inhibitors of pathogen intercellular signals as selective anti-infective compounds. *PLoS Pathog* 2007;**3**:1229—39.

Lung alert

Clinical biomarkers in resectable NSCLC

In the last decade there have been small but real advances in the understanding and management of non-small cell lung cancer (NSCLC), with targeted treatments being a key innovation.

Hypoxia-induced upregulated tissue expression of carbonic anhydrase IX (CAIX) and elevated plasma CAIX levels are associated with more aggressive phenotypes in urological cancers. In this study, resected specimens of 555 patients with NSCLC were analysed by immunohistochemistry for CAIX and 209 preoperative plasma samples by ELISA for CAIX, with median follow-up of 35 months. 24.3% of the tissue specimens expressed high levels of CAIX and were associated with shorter overall survival in stage I and II, as was a plasma CAIX level >11 pg/ml. Tissue CAIX was underexpressed in adenocarcinoma subtypes.

This study shows that in resected early stage NSCLC, high tissue CAIX can serve as an independent predictor for shorter survival, as can plasma CAIX ELISA with 84% sensitivity and 95% specificity. Though targeted treatments directed specifically at CAIX are under development, this study also demonstrates a potential non-invasive clinical biomarker of early stage NSCLC, representing another of the technologies being developed involving proteome analysis of pretreatment peripheral blood in real time to help define the optimal thrapeutic approach.

► **Ilie M**, Mazure NM, Hofman V, *et al*. High levels of carbonic anhydrase IX in tumour tissue and plasma are biomarkers of poor prognostic in patients with non-small cell lung cancer (NSCLC). *Br J Cancer* 2010;**102**:1627—35.

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