

Antibiotics Alone **Cannot** Protect a Population Against an Anthrax Attack!

Anthrax (*Bacillus anthracis*) has been made to resist every recommended antibiotic available by prescription or stored in the Strategic National Stockpile.^{1, 2, 3, 4, 5} Antibiotics affected include:

- ciprofloxacin (Cipro[®])^{2, 3, 6} and ofloxacin (Floxin[®])^{2, 4, 6}
- doxycycline^{3, 4} and tetracycline^{3, 4}
- penicillin G² and amoxicillin (Amoxil[®])²
- ceftriaxone (Rocephin[®])²
- vancomycin (Vancocin[®])² and clindamycin (Cleocin[®])²
- erythromycin^{2, 3} and azithromycin³ (Zithromax[®]) and clarithromycin (Biaxin[®])^{2, 3}

Per researchers at Johns Hopkins, the 60 day antibiotic treatment regimen currently recommended for post-exposure may not be enough to prevent anthrax in some cases.

- Antibiotics have no effect on anthrax spores or the toxins produced by the organism.⁶
- Spores can lay dormant in the host mammal for up to 60 days before germinating and attacking.⁷
- Anthrax spores can be detected in the lungs of monkeys (the best model for human disease) for at least 100 days after exposure.⁸ This lingering threat can outlast antibiotic regimens.⁹
- At least 100 days of antibiotics are needed to protect against infection by lingering spores which germinate later.¹⁰

Patient adherence to long term antibiotic regimens is poor.¹¹

- In the 2001 anthrax attacks, compliance and persistency to the prescribed 60 day course of Cipro[®] ranged from 21% of persons exposed at the Morgan postal facility in New York City to 64% of persons exposed at the Brentwood postal facility in Washington, D.C.

Adverse events associated with antimicrobial prophylaxis in victims of the 2001 anthrax attacks were commonly reported.¹¹

- Of the 5,343 persons who reported taking at least one dose of antibiotic, 57% (n=3,032) reported adverse events during the first 60 days of the prescribed regimen.¹¹
- At the post 60 day follow-up, 16% (n=842) of respondents who took at least one dose of antibiotic reported seeking medical care for adverse events caused by the antibiotic.¹¹

If not first used on civilians as a weapon, resistant anthrax strains may result from long term antibiotic regimens.

- Long term antibiotic therapy, as recommended for the treatment of exposure to anthrax might induce antimicrobial resistance in *Bacillus anthracis* by the selection of resistant mutants.^{2, 12}

CONCLUSION: Pre-attack vaccination is the cornerstone of preparedness against anthrax.

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¹ Athamna et al. Selection of *Bacillus anthracis* isolates resistant to antibiotics. J Antimicrob Chemotherapy(2004) 54, 424-428.

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³ Pomerantsev, A. P., Shishkova, N. A. & Marinin, L. I. (1992). Comparison of therapeutic effects of antibiotics of the tetracycline group in the treatment of anthrax caused by a strain inheriting tet-gene of plasmid pBC16. Antibiotiki i Khimioterapiia 37, 31-4.

⁴ Price, L. B., Volger, A., Pearson, T. et al. (2003). In vitro selection and characterization of *Bacillus anthracis* mutants with high level resistance to ciprofloxacin. Antimicrobial Agents and Chemotherapy 47, 2362-5.

⁵ Choe, C. H., Bouhauala, S., Brook, I. et al. (2000). In vitro development of resistance to ofloxacin and doxycycline in *Bacillus anthracis*. Antimicrobial Agents and Chemotherapy 44, 1766.

⁶ Spencer R. C., *Bacillus anthracis*. J Clin Pathol 2003;56:182-197

⁷ Friedlander A. M., Welkoss L., Pitt, M. L. M., et al. Postexposure prophylaxis against experimental inhalation anthrax. J Infect Dis: 1993;167:1239-43.

⁸ Henderson D. W., Peacock, S., Belton, F.C. Observations on the prophylaxis of experimental pulmonary anthrax in the monkey. J Hyg (Lond): 1956; Mar;54(1):28-36.

⁹ Brookmeyer R., Johnson, E., Bollinger, R. Modeling the optimum duration of antibiotic prophylaxis in an anthrax outbreak. PNAS (2003) Vol. 100, No. 17; 10129-10132.

¹⁰ Brookmeyer R., Johnson E., Barry S. Modelling the incubation period of anthrax. Stat Med. 2005 Feb 28; 24(4):531-42.

¹¹ Shepard CW, Soriano-Gabarro M, Zell ER, et al. Antimicrobial postexposure prophylaxis for anthrax: adverse events and adherence. Emerg Infect Dis 2002;10: 1124-1132.

¹² Levy, SB. The 2000 Garrod lecture. Factors impacting on the problem of antibiotic resistance. J Antimicrob Chemother. 2002 Jan;49(1):25-30.