

Research brief

Small and mighty

Findings from a study done in mice show that a newly identified, small molecule compound can protect animals from otherwise lethal doses of H1N1 influenza. The compound also neutralised viral infection in human bronchial epithelial cells. The molecule, called JNJ4796, was engineered to mimic the action of a broadly neutralising antibody against influenza. Researchers screened half a million small molecule compounds, identified one that targeted an epitope on the highly conserved haemagglutinin stem of the virus, and then further honed its chemical properties to create JNJ4796. Such so-called antibody mimetic drugs could provide an oral treatment option for a range of viral infections.

More mega than meets the eye

A member of the human herpesvirus family, cytomegalovirus causes fetal birth defects and severe lung infections in immunocompromised patients. A new study suggests that the virus might also contribute to the development of allergic airway disease. Experiments in mice showed that coincident exposure to both the virus and ovalbumin—a protein antigen with low allergic potential—predisposed the animals to allergic airway disease, whereas exposure to each component individually did not. The researchers suggest that viral activation of dendritic cells leads to a more efficient uptake, and thus enhanced allergic potential, of inhaled environmental antigens.

Another page in bacterial playbook

Ribosome-targeting antimicrobials account for more than half of medicines used to treat infections, and their usefulness is severely compromised by the emergence of antibiotic resistance. Findings from a new study have shed light on a potential mechanism by which bacteria have become resistant to these drugs. Experiments in the

Gram-positive gastrointestinal bacteria *Bacillus subtilis* show that, to protect themselves against antibiotics, bacterial cells can modulate magnesium ion uptake to avoid lethal hyperpolarisation and stabilise their ribosomes. Further understanding and therapeutic manipulation of this mechanism might breathe life into antibiotics with dwindling potency.

Answers lurk below

A metagenomics analysis of an extensive collection of untreated sewage samples (gathered from 79 sites in 60 countries) has shown differences in the prevalence and diversity of antibiotic-resistant bacteria around the globe. Levels of resistance are generally lowest in North America, western Europe, Australia, and New Zealand, and highest in Asia, Africa, and South America. Diversity of resistant organisms is highest in Brazil, India, and Vietnam, and lowest in Australia and New Zealand. By linking their data with World Bank datasets, the researchers showed that the abundance of resistance genes in a region is correlated with socioeconomic, health, and environmental factors. Their findings suggest that efforts to improve sanitary conditions in the most burdened regions could help stem the global tide of antibiotic resistance.

Like a bat out of cell

Bat-derived influenza A viruses do not bind to the host sialic acid moieties used by all previously known influenza viruses. Without an understanding of their potential transmission dynamics, the zoonotic potential of these bat viruses cannot be confidently predicted. In a new study that used transcriptomic profiling of susceptible versus non-susceptible human and other animal cells, and then genome-wide CRISPR-Cas9 knockout screening, scientists identified major histocompatibility

complex class II proteins as the route of infection. These proteins are present in many animal species, suggesting a zoonotic transmission potential worth monitoring.

An inhaled tuberculosis vaccination?

The currently available tuberculosis vaccine, BCG, which is delivered intramuscularly, has limited effectiveness against adult pulmonary disease. Efforts to develop a more potent inhaled vaccine have been hampered by adverse inflammatory responses in the lungs. Researchers have now shown the efficacy of a new inhaled candidate vaccine formulation in mice. They treated BCG with petroleum ether to remove inflammatory lipids from the bacterial surface. The experimental vaccine significantly increased protection and reduced lung inflammation compared with pulmonary-delivered conventional BCG vaccine. The next steps are to begin testing in non-human primates.

The buzz around climate change

An international team of scientists has predicted that if no action is taken to curb climate change, by 2050 nearly half the world's population will live in areas endemic for at least one of two important mosquito disease vectors, *Aedes aegypti* and *Aedes albopictus*. The team modelled the spread of the two species with distribution data for 3000 locations from as far back as 1970. They also mapped present locations and assessed their viability as mosquito habitats to assess spread along with other human factors, such as migration and travel. Other than serving as a readily understandable ramification of unchecked climate change, these high-resolution maps could be used for pre-emptive disease control strategies.

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For more on **small molecule treatments for influenza** see *Science* 2019; **363**: eaar6221. <https://doi.org/10.1126/science.aar6221>

For more on **cytomegalovirus and allergy** see *PLoS Pathog* 2019; **15**: e1007595. <https://doi.org/10.1371/journal.ppat.1007595>

For more on **antibiotic resistance in *B subtilis*** see *Cell* 2019; **177**: 1–9. <https://doi.org/10.1016/j.cell.2019.01.042>

For more on the **global distribution of antimicrobial resistance genes** see *Nat Commun* 2019; **10**: 1124. <https://doi.org/10.1038/s41467-019-08853-3>

For more on **cell entry of influenza viruses** see *Nature* 2019; **567**: 109–12. <https://doi.org/10.1038/s41586-019-0955-3>

For more on **an inhaled tuberculosis vaccine** see *Mucosal Immunol* 2019; published online Feb 18. <https://doi.org/10.1038/s41385-019-0148-2>

For more on **mapping *Aedes* mosquitoes** see *Nat Microbiol* 2019; published online Mar 4. <https://doi.org/10.1038/s41564-019-0376-y>