THIS WEEK

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A three-step plan for antibiotics

If the threat of antibiotic resistance is to be managed, existing drugs must be marshalled more effectively and new medicines must get to market fast.

If the first step towards solving a problem is to acknowledge its existence, then some important progress has been made on the thorny issue of antibiotic resistance. Last July, *Nature* noted approvingly a "notable rise in awareness among policy-makers and the public" on the issue and credited the advocacy of scientists for the surge (see *Nature* **499,** 379; 2013). That rise has continued, but with increased public and political awareness comes a greater demand for action. Much of that heavy expectation will fall on scientists. So, after the advocacy, how can the antibiotic-resistance threat be countered?

The first step, and one that must be pursued with urgency, is better stewardship of existing antibiotics. This demands fresh research and discoveries, but significant gains are also possible if officials and policy-makers can crank up the funds and willpower to match their rhetoric. Doctors and others who routinely overprescribe antibiotics for everything from sore throats to bronchitis need clear and explicit instructions from the top to stop. Medical schools that do not drum into their trainees the importance of prudence must start to do so.

It is not enough for doctors to urge their patients to finish the prescribed course when they are dishing out the pills with such abandon. A study published in the *Journal of the American Medical Association* last week showed that despite guidelines that veto such use of antibiotics for acute bronchitis and decades of research showing no benefit, the number of antibiotic prescriptions for this indication rose in the United States from 1996 to 2010 (M. L. Barnett & J. A. Linder *J. Am. Med. Assoc.* **311,** 2020–2022; 2014).

Over-the-counter sales of antibiotics must be banned. The countries that allow it are squandering a precious resource as surely as if they were tipping oil down the toilet. Regional regulations that limit the use of antibiotics to speed up the growth of livestock should extend worldwide. Public education — both to restrict the waste of antibiotics and to build support for measures to restrict unnecessary use — is vital. These are low-hanging fruit and they must be picked with all possible urgency. They need top-down political action, and that means governments. Cross-party consensus should be explicitly hammered out and publicized — there is no equivalent of Big Oil or Big Tobacco in this debate to delay and obfuscate.

The second step, and this is the one in which scientists have the biggest role, is to find ways to maximize the impact of our existing stocks. Researchers in the public and private sectors must re-examine all compound libraries for drugs that could couple with rapid diagnostic tests to offer new, narrow-spectrum therapies. Other compounds could be used in combination to reverse resistance to existing medicines and so extend their useful life — similar cocktails of drugs have been successful in treating HIV, after all.

Research can improve diagnosis too, to both speed up treatment of patients and minimize the waste of ineffective drugs. As a Comment article on page 557 points out, genome sequencing of infectious bacteria can rapidly identify resistance genes. So samples from an infected patient — analysed in clinical microbiology labs as close to point of care as possible — could steer drug treatment, at least in the developed world. Mass spectrometry was introduced for clinical use in this way a few years ago, it notes, and is now commonly used to identify pathogens from signature microbial peptides. Such a rapid front-line diagnostic kit to improve antibiotic use is one of the six major challenges identified by the UK government in its new Longitude Prize, intended to boost innovation.

The third step must be to boost the number of antibiotic drugs that are reaching the market. Between 1983 and 1992, the US Food and Drug Administration approved 30 new antibiotics; between 2003 to 2012, it approved just seven.

"Much of the heavy expectation will fall on scientists."

Reversing this trend is less about research and more about restructuring the financial incentives for firms to do that work. In 2012, for instance, the United States passed the Generating Antibiotic Incentives Now Act, which gives companies an extra five years of exclusive use for new antibiotics that they develop.

Others, including the World Health Organization (WHO), are considering more radical changes to the drug-development model itself. Last week, WHO members met to discuss a draft global action plan on antimicrobial resistance that floated "new business models" driven by public need rather than market forces. Such action would demand global consensus on the problem, and a Comment piece on page 555 argues that the globe needs a new body to help to achieve that and to drive action — an intergovernmental panel on antimicrobial resistance.

We have come a long way in a year. But the real work starts now. ■

Clean break

Improved biomass stoves are not popular, people everywhere deserve modern cooking methods.

For the billions of people who rely on food cooked over smoky open fires, a less-polluting stove seems like a clear solution. The devices allow people who have limited resources to use the same fuels — wood, charcoal, animal dung and agricultural waste — but generate less toxic fumes and therefore save millions of lives.

For decades, that apparent win–win strategy has held great appeal for big international donors, non-governmental organizations and engineers. This week, for example, the US Environmental Protection Agency announced grants to six universities for more research into clean-cooking stoves.

Unfortunately, these efforts are failing, at least on the broad scale.

Even though high-profile programmes have distributed millions of stoves to households in south Asia, Africa and Latin America, it is hard to find signs that the stoves are being widely used. There is a vast gap between reported accomplishments and what researchers see when they step into people's homes.

The crux of the problem is that simply supplying the stoves does not establish demand for them.

As a News Feature reports on page 548, women often complain that the stoves do not meet their needs. Some designs require wood to be chopped up into small pieces, thereby creating extra work; others do not burn hot enough, break easily or are too small or too expensive. Cooks from Bolivia to Bangladesh will use the stoves only if the devices make their lives easier. Too often, this is not the case, so the stoves get set aside — or are modified to work more like the traditional, pollution-producing stoves.

The downbeat assessment will not be popular with those who distribute the devices, such as the Global Alliance for Clean Cookstoves, a coalition based in Washington DC. But it should not come as a big surprise. In 2012, a report by the Massachusetts Institute of Technology in Cambridge, called *Up in Smoke*, found no long-term improvement in pulmonary health or in fuel savings among villagers who had received the stoves, mainly because people had abandoned the devices.

The alliance countered that the stoves just need to be adapted to meet local needs and that users need more training. The perpetual claim is that the biomass stove of people's dreams is just around the corner.

But some researchers looking at the health effects of cooking fires say that it is time for a fundamental shift in strategy — one that moves people away from burning biomass entirely.

Efforts could be redirected to providing people with the energy they most aspire to: not a stove designed by someone in the developed world to cook cleaner, but the actual stoves used in the developed world, which run on electricity or hydrocarbons such as liquefied petroleum gas (LPG).

"It is time for a fundamental shift in strategy — one that moves people away from burning biomass entirely."

This is not an absurd goal. The International Energy Agency (IEA) estimates that bringing electricity and clean-cooking facilities to every person on Earth by 2030 will cost US$49 billion a year. Although that is a considerable sum, the agency points to major commitments by Indonesia, Ghana and Nigeria to aggressively switch large portions of their population to cooking with LPG.

Where will all this new energy come from? It will require some additional consumption of fossil fuels, and that will increase the emissions of carbon dioxide into the atmosphere. But the extra pollution would be minimal at the global scale: the IEA estimates that it would boost CO_2 emissions by just 0.7% above its base scenario.

Renewable sources should be able to supply a major fraction of the needed energy: electrical micro-grids that use agricultural waste, solar cells or wind turbines to provide energy are popping up, for instance. Clean-cooking programmes have an enduring appeal, just not for their intended users. It is time to rethink the approach. ■

ANNOUNCEMENT

Welcome, *Scientific Data*!

Everybody is talking about data. Experimental scientists live and breathe data. Theorists are challenged by data. Funders are wondering how to make the data produced with their support more accessible without stretching their budgets. Research communities are seeking new data repositories, and standards to support them. And scientific publishers are wondering how to host data and provide quality control.

Scientific Data is a new journal, launched by *Nature*'s publishers this week, that will help to address some of these challenges. By publishing formal descriptions of data sets — Data Descriptors, the publication's main article type — it will render the data more visible and give originators explicit credit for those data, rather than for the papers that use them. The journal is peer-reviewed and online-only. Authors pay a charge on publication: this ensures that the final, published versions of their contributions to the journal are immediately freely accessible to all. The content is licensed under one of three Creative Commons licences, and machine-readable metadata are released with every article to maximize reuse.

To quote *Scientific Data*'s launch editorial: "The question is no longer whether research data should be shared, but how to make effective data sharing a common and well-rewarded part of research culture". When it is feasible to do so, many journals, including all those in the *Nature* family, have long insisted that data are deposited in repositories where available, before publication. For other areas of research, we at *Nature* have significantly increased the figure limits in our papers. In *Nature Protocols*, there is a place for more-specific methods descriptions than is conventional in scientific papers.

Now, in *Scientific Data*, there is space for researchers to formally describe a data set and the techniques used to derive it, and to refer readers to research papers that have already incorporated the data.

Crucially, the journal's descriptors, being peer-reviewed and citable, provide a way to assign credit to the originators of reusable data sets. In other words, the delivery and sharing of data becomes as credit-worthy, in principle, as publishing conventional research papers. It is important that the assessment of research and reward of researchers does more justice to this essential component of science.

The journal's first publications include articles describing previously unpublished data sets — demonstrations that *Scientific Data* can help to motivate scientists to share valuable data. The journal's editors highlight work by Zengchao Hao and colleagues detailing data sets that track drought around the world (Z. Hao *et al. Sci. Data* http://doi.org/sww; 2014). Using the Data Descriptor, anyone can download the data, generate their own maps (past or future) for any area of the world and even use the authors' source code to recalculate the drought metrics.

Another article, by Graham Edgar and Rick Stuart-Smith, provides an example of a Data Descriptor that builds on previous publications (G. J. Edgar and R. D. Stuart-Smith *Sci. Data* http://doi.org/sxv; 2014). It is based around the data produced by the Reef Life Survey, a citizen-science project that uses volunteer divers to help to survey biodiversity on the world's reefs. Analyses of these data, which are relevant to our understanding of reef ecology and to conservation, have been published in a number of research papers. The data are given in full in the Data Descriptor, along with the authors' descriptions of the survey procedures and data standardization — crucial information for other scientists interested in using these data.

Beyond its significance for data buffs, the journal is a further step in Nature Publishing Group's drive to enhance research reproducibility. The more researchers take steps to make their data available and discoverable, the more a core principle of science — that others can replicate the work — can be fulfilled, in an era in which such replication is often beset by obstacles. For that reason alone, we at *Nature* welcome *Scientific Data*. ■