# 



**Health Protection Research Unit in Healthcare Associated Infections & Antimicrobial Resistance**

**Public and Patient Engagement Activity**

**Battling the Bugs: Antibiotic Arms Race**

Battling the Bugs: Antibiotic Arms Race

This pack is designed as a free guide, with printable resources, to allow you to run your own engagement activity about antimicrobial resistance.

The activity aims to educate participants about antibiotic resistance and how antibiotic use drives antibiotic resistance.

Antibiotic resistance has serious implications at individual as well as global levels that the participants might not be aware of. This activity will highlight these and the role that all individuals can play in reducing antimicrobial resistance.

**Crediting the HPRU in HCAI and AMR at Imperial College.**

We would be delighted to hear from you if you choose to use our resources. Please do contact us at [head.ops@imperial.ac.uk](mailto:head.ops@imperial.ac.uk) and tweet pictures of the activity and tag us: @HPRUamr

Artwork by welovesolo.com under Creative Commons (Attribution 3.0)

## Activity Objectives

The objective of the activity is to teach participants what antibiotic resistance and how important antibiotic stewardship is to preventing it, in a fun, “shooting gallery” style format. The activity is ideally suited for a Science Fayre or Festival, or other public engagement event.

By the end of the activity:

All participants should understand that:

* antibiotics only work on bacteria and **not** on viruses
* illnesses caused by bacteria and caused by viruses may have the same symptoms
* inventing and using a new antibiotic will not solve the problem of resistance
* as individuals we should all help safeguard the effectiveness of existing antibiotics by only taking them when really necessary and by taking them as instructed by a healthcare professional.

**Background Information**

Antibiotics are used to treat infections caused by bacteria. They often do this by attacking the cell wall which surrounds a bacterium, or through other mechanisms which prevent the bacteria from multiplying or functioning properly.

Antibiotics do not work on viruses which are about a hundred times smaller and lack the cellular machinery which antibiotics target.

Antibiotics are not only used to treat a range of diseases which, in the past would have been fatal, they also underpin much of modern medicine from routine surgery to cancer treatment, by helping to prevent infection.

However, every time antibiotics are used, there is a chance that some bacteria which are exposed to them can develop (evolve) ways to avoid being killed by antibiotics. This is particularly the case if they are used incorrectly.

The ability of bacteria to survive in the presence of antibiotics is called resistance. These drug resistant bacteria are harder to kill than non-resistant bacteria. Bacteria can pass on the ability to be resistant to antibiotics, to other bacteria, including those of other species.

Bacteria can also become resistant to several different types of antibiotics, this is called multi-drug resistance and can eventually lead to illness which is impossible to treat.

**Activity Preparation**

You will need: A table or other surface to set up the activity

* 9 empty tin cans to represent viruses, bacteria, drug resistant bacteria and multi-drug resistant bacteria
* Coloured paper to printed labels for the cans (see resources)
* Lentils or rice to weight the cans and a weighing scale
* Gaffer tape or parcel tape to seal the cans
* Nerf guns and bullets in 3 different sizes representing, penicillin, carbapenems and colistin (see table 1)
* Mini-shelf, or hard-back book or shoe box to place cans on
* Safety glasses

**Overview of Main Activity**

The bullets are antibiotics; the cans are viral or bacterial infections. Participants have 10 seconds to decide whether they prescribe (shoot) or not, as they do resistance evolves and they need a bigger gun with each iteration as described in the instructions.

* Ensure participants are supervised
* Ensure all participants and demonstrators wear eye protection in case of ricochet
* Encourage participants to get near the tin cans – most people are terrible shots and some of the guns (rocket launcher in particular) are not very accurate

Prepare the tin cans, by filling them with the correct weight or rice or lentils listed below, sealing them firmly with tape and labelling appropriately.

Buy or borrow the appropriate nerf guns and bullet combinations.

|  |  |  |
| --- | --- | --- |
| WEAPON | ANTIBIOTIC REPRESENTED | TARGET |
|  | Penicillin | **SUSCEPTIBLE BACTERIA**- unweighted cans (labels 1.a, 2b, 3b)  **VIRUSES-** cans weighted in excess of 360g (lables 1.b, 2a, 3a)  “Susceptible bacteria” will be knocked over by regular Elite nerf bullets (any N-Strike gun, we suggest an N-Strike Elite Jolt Blaster pictured). Viruses will not. |
|  | Carbapenem | **RESISTANT BACTERIA**- cans weighted to 106g. (labels 4 a/b)  “Resistant bacteria” will not be knocked over by the N-strike above, representing penicillin, but can be knocked over by the Mega nerf bullets (any Mega Blaster, we suggest N-Strike Mega Cyclone Shock pictured) representing carbapenem. |
|  | Colistin | **MULTI-DRUG BACTERIA**- cans weighted to 330g. (label 5)  This will not be knocked over by N-Strike or Mega since it is now resistant to both antibiotics represented.  Colistin, represented by a Mega missile will treat multi-drug resistant infection (any Mega Missile launcher- we suggest Thunderblast launcher pictured or an Elite Demolisher 2-in-1 Blaster and any modulus guns with Missile launcher elements) |

**Activity Description**

This activity uses a “shooting gallery” style game, to explain that antibiotics only work on bacteria and NOT on viruses and that using antibiotics drives resistance meaning that we are in a never ending “arms race” with bacteria.

The tin cans are differently weighted and labelled (see printable resources later) to represent:

1. Viruses
2. Bacteria
3. Drug resistant bacteria
4. Multi-drug resistant bacteria.

The guns/ bullets represent different types of antibiotics;

To start the “game” show the participants the two cans labelled “virus” and “bacteria” (Resource 1.a and 1.b).

Give the participant the smallest gun/bullet, explain this represents an antibiotic called penicillin.

Ask them to shoot the virus- which will not move, and then shoot the bacteria tin- which will move (i.e. it’s susceptible) . State clearly that this shows antibiotics work on bacteria but not on viruses (Note: you may have to shoot the bacteria tin more than once to topple it. This is “finishing the course” of antibiotics.)

Next introduce the cans which represent pneumonia and tonsillitis (recourses 2 a/b and 3 a/b) caused by a bacterial infection and a viral infection respectively. Make sure the symptoms face the participant.

Explain that while antibiotics only work on bacterial infections, the problem is that viral and bacterial infections can have very similar if not identical symptoms and there is no easy, rapid point-of-care test to show which illness is caused by bacteria and which by a virus. Doctors have on average a 10 minute consultation window to decide whether to prescribe or not.

Ensure the gun is loaded and then give the participant 10 seconds to decide whether to prescribe or not, counting down the seconds. Help re-load the gun during this time.

At the end, the participant may have successfully “treated” the infection i.e. knocked over a can – which you can show is labelled as a bacterial infection.

However they have probably also prescribed against a viral illness and in any case, in prescribing antibiotics at all, other bacteria in the community/environment will have been exposed.

Explain that when this happens, it is the same as showing the enemy the weapon so that they can build a defence against it (the arms race analogy.)

Next introduce the illnesses which have become drug resistant (resource 4 a/b). They are the same bacteria that were previously treatable.

Ask the participant to shoot them again with the penicillin. This time it will not work. They have become drug resistant.

Give the participant the gun/bullet representing carbapenem. Explain this is an alternative antibiotic- which works in a different way. Ask them to shoot the drug-resistant illness. This will work- although again they may need to shoot more than once “finish the course”.

Ask the participant what they think will happen to any bacteria exposed to the antibiotic at doses not sufficient to kill them? The answer is that they are likely to develop resistance to this too.

Finally, introduce them to the illness which is multi-drug resistant (resource 5.) and ask them to try again with the carbapenem. It will not work.

Introduce the final big gun- the colistin. Explain this is a drug of last resort because it is highly toxic. Ask them to shot the multi-drug resistant bacteria, which had previously been susceptible to penicillin and to carbapenems. It will work, but may take more than one shot.

Ask them what they think will happen to the bacteria now that they have been exposed to colistin, and what they think will happen if we introduce/invent a new antibiotic.

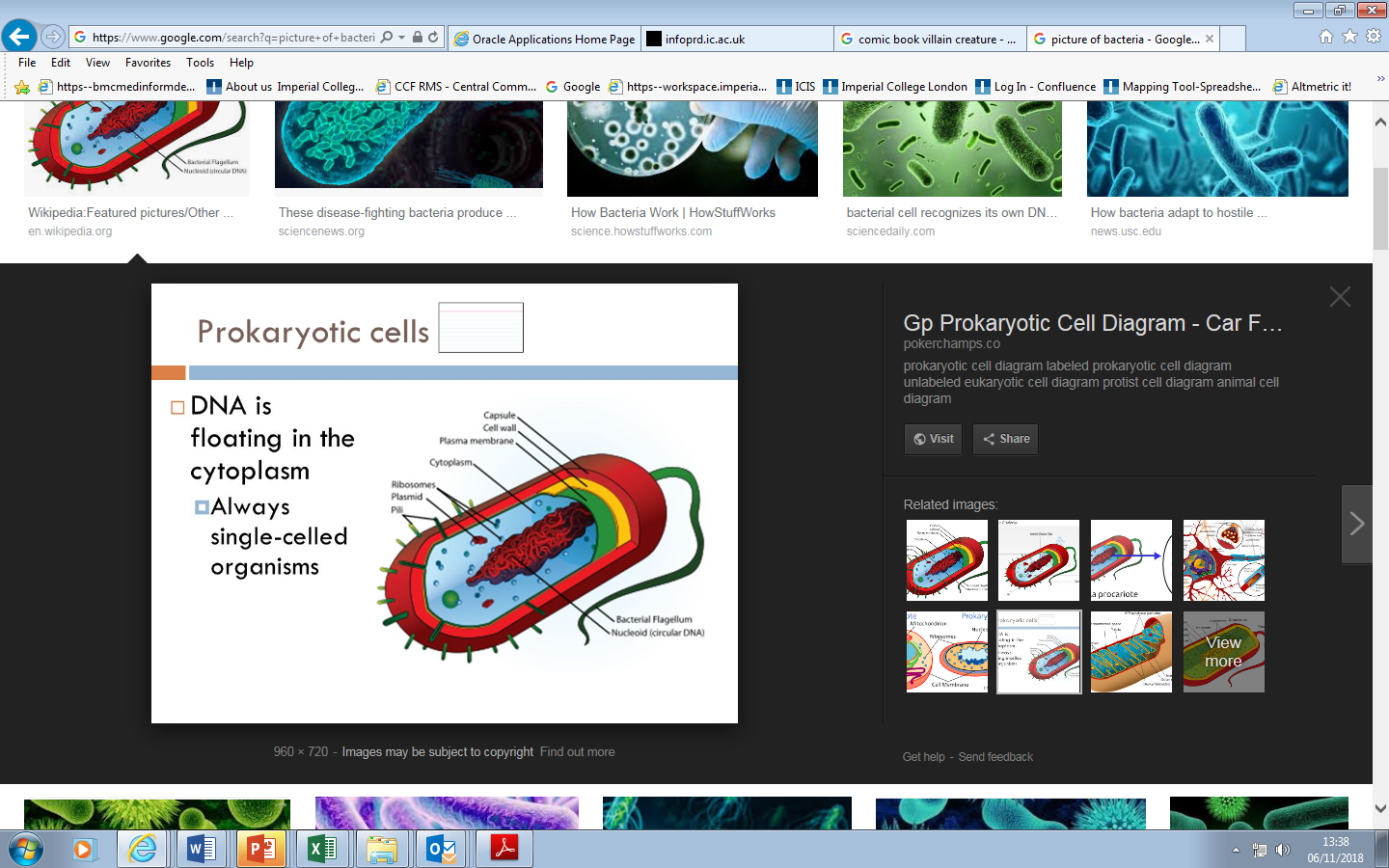
The overall take home message, is that antibiotic use drives antibiotic resistance because antibiotic resistance happens naturally as bacteria struggle to survive in their environment.

Inventing new antibiotics will not solve antibiotic resistance/drug resistant infections, but we can all help reduce resistance by only taking antibiotics when really necessary and always taking them in line with instructions from our healthcare professional and NEVER buying them over the internet.

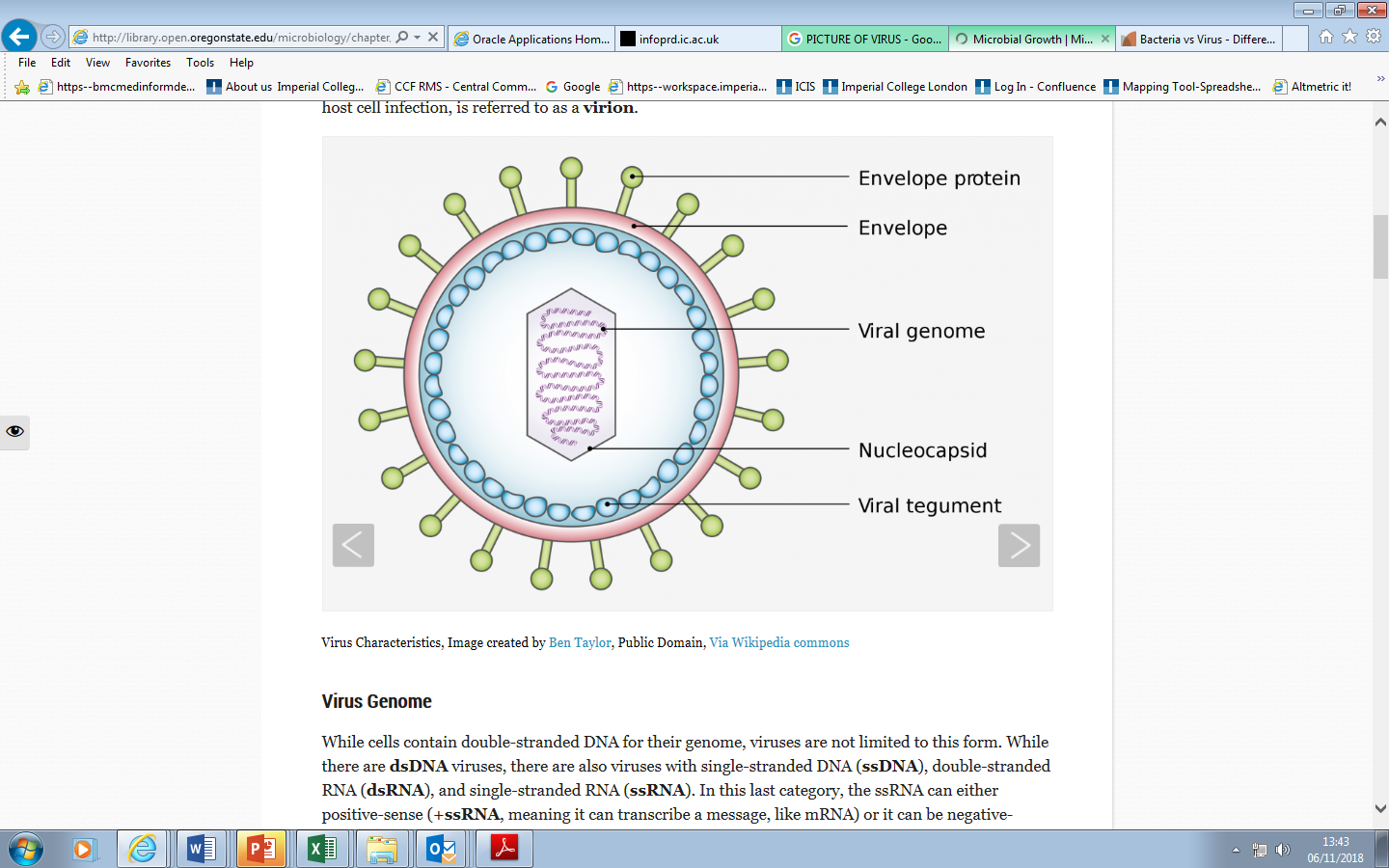
**Top tips**

* Ensure participants are supervised
* Ensure all participants and demonstrators wear eye protection in case of ricochet
* Encourage participants to get near the tin cans – most people are terrible shots and some of the guns (rocket launcher in particular) are not very accurate
* Ensure the cans are placed towards the **BACK** of the shelves/hard back book/shoe box, this is to make them easier to knock off
* For ease of identification for the demonstrator you may wish to mark the viral illness with a “V” on the top, the Bacterial ones with a “B”, Resistant Bacteria with an “R” and the Multidrug Resistant Bacteria with an “M”- however this is optional.

Resource 1.a



Resource 1.b



VIRUS (10 to 100 times smaller than bacteria)

Resource 2.a

* Cough
* Rapid heartbeat
* Fever

PNEUMONIA (VIRAL)

Respiratory syncytial virus (RSV)

Resource 2.b

PNEUMONIA (BACTERIAL)

Streptococcus pneumoniae

* Cough
* Rapid heartbeat
* Fever

Resource 3.a

* Sore throat
* Difficulty swallowing
* Temp >38 degrees

VIRAL TONSILITIS

Rhinovirus

Resource 3 b

* Sore throat
* Difficulty swallowing
* Temp >38 degrees

BACTERIAL TONSILITIS

Streptococcus pyogenes

Resource 4 a/b

* Cough
* Rapid heartbeat
* Fever

DRUG RESISTANT

Streptococcus pyogenes   
(resistant to penicillin)

DRUG RESISTANT

Streptococcus pneumoniae  
 (resistant to penicillin)

* Sore throat
* Difficulty swallowing
* Temp >38 degrees

Resource 5

**Multi-drug resistant organism**

* Temp >38 degrees
* Vomiting
* Headache
* Blotchy rash
* Stiff neck
* Dislike of bright lights
* Drowsiness

Streptococcus pyogenes (causing meningitis.) Resistant to penicillin and carbapenems