Is there life beyond earth?

with Dame Dr Maggie Aderin-Pocock

Royal Institution Christmas Lectures Activities

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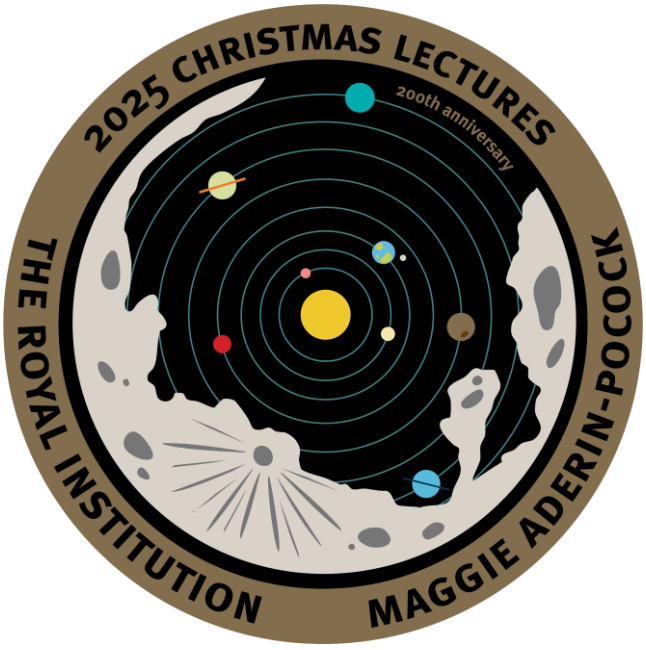
In this year's CHRISTMAS LECTURES from the Royal Institution (Ri) supported by CGI, Dr Dame Maggie Aderin-Pocock will take us on an epic voyage through time and space.

Scientists in 2025 detected the 'strongest hint yet' of biological activity outside our solar system on exoplanet K2-18b, sparking growing excitement about the real possibility of extraterrestrial life. In this series of lectures, Maggie sets out on a journey to find it.



Are We Alone? Exploring the Drake Equation!

This is a Key Stage 3 schools resource focused on learning about the Drake Equation and encouraging students to think critically about what numbers they would choose.

Learning objectives:

- Understand what the Drake Equation is
- Explore how scientists think about the chances of life in space
- Use your own ideas to create a number for how many alien civilizations we might be able to communicate with

Warm up

Do you think there is life elsewhere in the universe? Circle your choice.

Yes

No

Not sure

Write one reason for your choice:

Background

The Drake Equation is a special tool scientists use to guess how many alien civilizations we might be able to communicate with that might be out there in our galaxy – the Milky Way. It was created by a scientist called Dr. Frank Drake in 1961. It's not a magic answer, but a fun way to think like a scientist about space, stars, and life.

Here is the equation:

$$N = R^* \times fp \times ne \times fl \times fi \times fc \times L$$

Let's break down this equation together

Letter	What does this mean?	Drake's guess
R*	How many new stars are made in our galaxy each year?	1
fp	How many stars have planets. Do stars have planets like Earth?	0.2
ne	How many of those planets could have life. Can life live there?	1
fl	How many planets actually grow life. Does life start there?	1
fi	How many of those have intelligent life. Are there alien people?	1
fc	How many send messages into space?	0.1
L	How many years does their civilisation last? Do their signals last long enough for us to hear them?	1,000–100,000,000
N	The number of alien civilisations we might hear from. This is the number we want to find out	20–2,000,000

Understanding over time

Over the years, our understanding of the factors involved in the equation has increased, although some are still very uncertain.

There are many more stars being made in our galaxy each year than previously thought, could this increase the chances of life? There are many more stars that have planets than previously thought, with more planets, could there be a greater chance of life? With more and more research ongoing our understanding can continue to change and this can affect the prediction for the number of alien civilisations that we might hear from.

Activity 2 – The Class Drake Equation

Your teacher will give your number cards.

For each factor decide as a group which number you think is the most realistic.

Calculate N – the prediction for alien civilisations

Factor	Explanation	Your estimate
R*	How many new stars are made in our galaxy each year.	
fp	How many stars have planets.	
ne	How many of those planets could have life.	
fl	How many planets actually grow life.	
fi	How many of those have intelligent life.	
fc	How many can send messages into space?	
L	Do their signals last long enough for us to hear them?	

Let's calculate N by putting your values in the equation:

$$N = R^* \times fp \times ne \times fl \times fi \times fc \times L$$

N = ☐ x ☐ x ☐ x ☐ x ☐ x ☐ x ☐

My result for N is

_____

Was your number for N big or small? What does that tell us?

_____
_____
_____
_____

Which factor do you think is the most important? Why?

_____
_____
_____

What could be missing from the equation? Let's think about:

- What about **moons** that could have life?
- Could **alien civilizations hide** their signals on purpose?
- Could life be **very different** from life on Earth?

Extension: Design a New Equation!

What would you add to the Drake Equation to make it more accurate? Add one extra factor, give it a letter and name:

My new factor is: _____

It means: _____

I would estimate it as: _____

So my **new version** of the Drake Equation is:

$$N = R^* \times fp \times ne \times fl \times fi \times fc \times L \times \_\_\_$$

Print as many as required for each group. The blank ones they can fill in themselves

1	0.5	0.9
0.1	1,000	50
10,000		

1	0.5	0.9
0.1	1,000	50
10,000		