

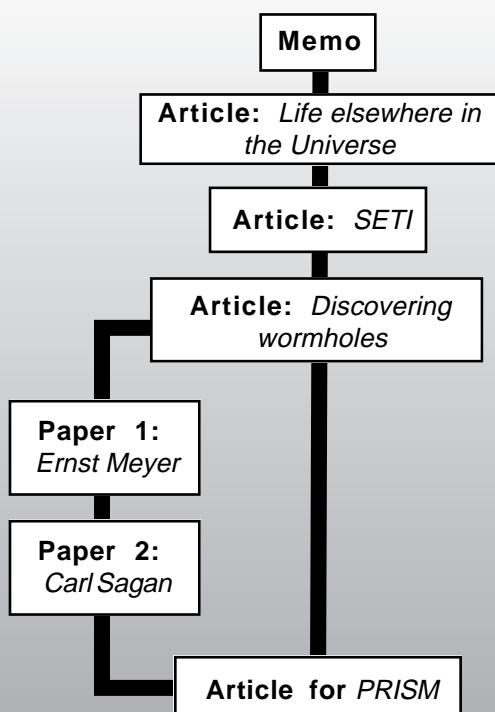
## Pupil Research Brief

### Teachers' Notes

#### Syllabus Coverage *Subject Knowledge and Understanding*

- ❑ our Sun is just one of many millions of stars in a group of stars called a galaxy
- ❑ the stars in a galaxy are often millions of times further away from each other than the planets in the Solar System
- ❑ the Universe as a whole is made up of at least a billion galaxies
- ❑ fossils are the 'remains' of plants or animals from many years ago which are found in rocks
- ❑ we know that all species of living things that exist today have evolved from simple life forms which first developed more than 3 billion years ago

#### Route through the Brief



#### Introduction

In this Brief pupils are placed in the position of a group of space scientists asked to write an article for *PRISM*, the PRI pupil journal, about the possibility of the existence of extraterrestrial life. They are asked to use a number of background articles and papers as a basis for their article and also to suggest activities that the readers of *PRISM* could carry out - possibly an investigation.

#### Experimental and investigative skills

- analysing and evaluating evidence and drawing conclusions (from secondary sources)

Note : if pupils plan and trial an investigation activity to go into the *PRISM* article for other pupils to do, then this could possibly cover all four skill areas of *Experimental and Investigative Science* (England, Wales, Northern Ireland GCSE syllabuses).

#### Prior knowledge

Before attempting this Brief, pupils should have done some work about the planets in the Solar System and the conditions prevailing on our planet that allowed life to evolve. Some idea of the distance between stars would be useful.

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## Teachers' Notes continued

### Running the Brief

#### Pupil grouping

The Brief could be set as an individual assignment. However, there is a great deal to be gained from the pupils working in pairs and/or small groups, analysing and discussing arguments and evidence, forming their own views, and then preparing a balanced article for *PRISM*.

There are three short background articles and two longer papers, and so the reading tasks for an individual pupil would be demanding. Hence the benefits of sharing the tasks and reporting back, or making the analysis of the two longer papers an optional activity. The following pupil groupings are suggested:

*Initial briefing* - whole class; teacher introduces the topic to stimulate interest

*Analysis of memo* - groups of 3 - 6

*Analysis of three background articles and/or two papers* - tasks shared between individuals or pairs within the small groups

*Feedback and discussion of background reading followed by planning of PRISM article* - original groups of 3 - 6

*Communication* - compilation of *PRISM* article (individual or group) and whole class discussion of topic (optional)

#### Timing

The Brief should take approximately 3 hours of classroom time; alternatively some of the work could be set as homework.

#### Activities

The teacher should issue pupils with the **Study guide** which provides pupils with a summary of what they should produce as they work through the Brief. It can also act as a checklist for pupils to monitor their own progress.

The first three background articles cover :

1 the possibility of the existence of primitive life-forms on Mars

2 the possibility of travel between solar systems  
3 the possibility of communicating with extraterrestrial life-forms

In the first article, the existence of bacterial life on Mars is considered. There is information about the tests carried out by the Viking probes in the 1970s and information about how knowledge of methods to test for the presence of bacteria has improved since then. The article includes some information about the possible discovery of microfossils of bacteria inside a meteorite that is thought to have come from Mars.

The second article on interstellar travel suggests three possibilities on how this could be achieved given the huge distances between stars:

- the Space Ark
- the Interstellar Photon Jet
- travelling through wormholes.

Each possibility presents problems, which are mentioned briefly.

The third article on communication with extraterrestrial life-forms sketches in the origins of SETI (Search for Extraterrestrial Intelligence) and includes an explanation of the Green Bank equation. There is information on what work is being carried out now, and some proposals for possible further developments in this area.

The Brief contains **two further, longer papers**, which could be used as optional exercises. The 2 papers are condensed and simplified from papers by two distinguished scientists, Ernst Mayr and Carl Sagan. The two papers argue against (Mayr) and in favour of SETI (Sagan), and they first appeared in consecutive editions of *Bioastronomy News*. Both contain provocative, contentious statements. Pupils are asked to identify some of these and offer counter-arguments to them as part of their preparation for writing the article for *PRISM*. The inclusion of this material is intended to show that opinions can differ sharply between distinguished scientists in the absence of conclusive proof, and that things are not always cut and dried in science.

The background articles and papers presented in the Brief could be supplemented by other material - articles from magazines and newspapers, books, CD Roms and information from the Internet, etc. - depending on the level of enthusiasm shown by the pupils. Pupils are asked to **suggest and try out** investigations or projects that the readers of *PRISM* could do (see memo). Possible small scale projects could include devising their own message to be sent out to nearby solar systems, some work on UFO's

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## Teachers' Notes continued

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(these are not mentioned in the given material), and consideration of how the human body would react to long periods in zero-gravity conditions. Possible investigation suggestions could include designing a method to test for bacteria in soil samples obtained from another planet. For example, culturing microorganisms from soil samples using sealable agar plates, or detecting CO<sub>2</sub> emissions from a soil sample using bicarbonate indicator.

*Using IT.* Pupils could use word processing or desktop publishing packages to produce their article. Other IT applications, such as datalogging, use of spreadsheets, databases, multimedia and the Internet are all possibilities, depending on the activity or investigation which the pupils plan for *PRISM* readers.

### Safety issues

PLEASE NOTE: Pupils will be planning and carrying out an investigation, details of which they will include in their article. It is therefore important that you prepare your own risk assessments for this practical work in the usual way. It is advisable for pupils to wear goggles and plastic gloves when handling chemicals.

### Assessment issues for *Experimental and Investigative Science* (National Curriculum for England and Wales, Northern Ireland Curriculum)

Pupils' ability to analyse, evaluate and draw conclusions from expert opinions (provided in secondary sources) are encouraged by this Brief. However, since details of the investigation methods used by the authors are not made plain in the background papers, assessment opportunities are unlikely to arise. However, if pupils plan and carry out their suggested pupil investigation for the *PRISM* article, then assessment opportunities will be available, possibly for each of **Skill Areas P, O, A and E**.

### Scottish syllabus coverage

Standard Grade Physics - *Space Physics*

### Further pupil research opportunities

The subject of the search for extraterrestrial intelligence is very lively and topical, particularly since the discovery of planets orbiting other stars. Pupils can look out for any news that appears on television or in newspapers and magazines and incorporate any new issues or findings in their *PRISM* article or any possible follow-up article.

The topic would also be an excellent one for a class, year group or even school debate. This would be an ideal activity to hold during a school science fair or a *set*/astronomy week event. It would also be a good basis for a longer term project since there is good coverage of the topic in science magazines, newspapers, on television and the Internet.