SCIENCE & TECHNOLOGY IN SOCIETY

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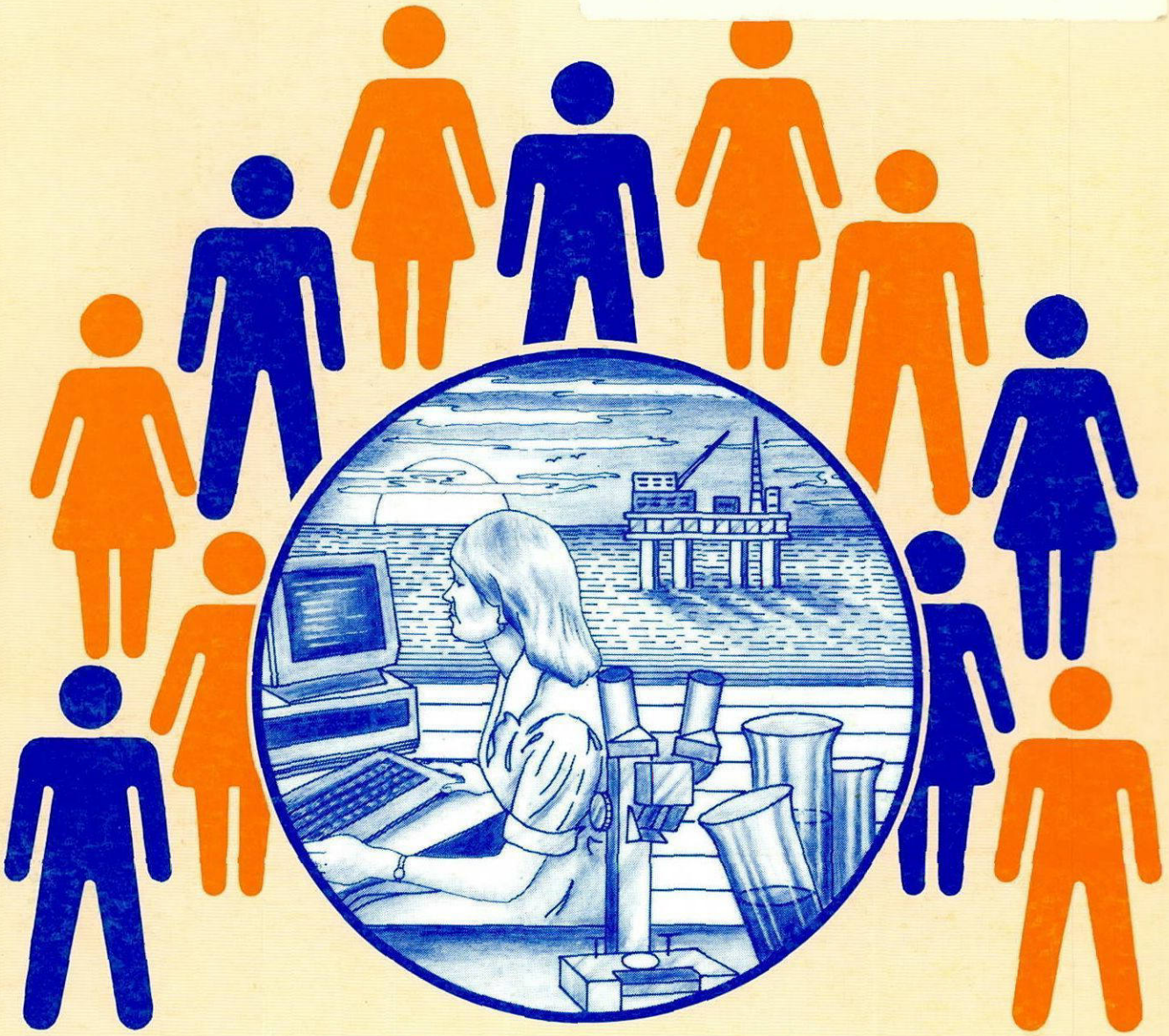

SATIS

ABOUT SATIS

Science and Technology in Society units are designed to be used in conjunction with conventional science courses, particularly those leading to GCSE examinations. Each unit has links to major science topics as well as exploring important social and technological applications and issues.

The units are self-contained and generally require about 2 periods (around 75 minutes) of classroom time. Each unit comprises Teachers' Notes (blue sheets) and Students' materials (white sheets). Full guidance on use is given in the Teachers' Notes accompanying each unit, which also include background information and suggest further resources.

Each SATIS book contains ten units. The units are numbered in a system giving the number of the book followed by the number of the unit within that book. Thus the first unit in the first SATIS book is numbered 101.

In addition to the SATIS books, there is a *General Guide for Teachers* which gives guidance on some of the teaching techniques involved as well as ideas for further activities.

Many people from schools, universities, industry and the professions have contributed to the writing, development and trials of the SATIS project. A full list of contributors appears in *General Guide for Teachers.*

The names of contributors to this particular book are given on the inside of the back cover.

First published 1988 by The Association for Science Education

Designed by P & PS (Cambridge) Ltd.

SATIS 9

List of units in this book

EVALUATION OF SATIS UNITS

Users of the units in this book are invited to evaluate them by completing the questionnaire on the next page. Such feedback is of great value in helping to revise and improve the units and in determining future policy.

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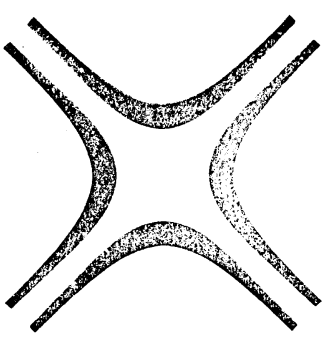

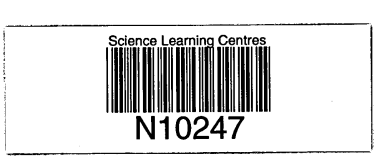

List of units in the SATIS series

SATIS 1
101 Sulphurcrete
102 Food from Fungus
103 Controlling Rust
104 What's in our Food? — a look at food labels
105 The Bigger the Better?
106 The Design Game
107 Ashton Island — a problem in renewable energy
108 Fibre in your Diet
109 Nuclear Power
110 Hilltop — an agricultural problem

SATIS 2
201 Energy from Biomass
202 Electric Vehicles
203 Drinking Alcohol
204 Using Radioactivity
205 Looking at Motor Oil
206 Test-tube Babies
207 The Story of Fritz Haber
208 The Price of Food
209 Spectacles and Contact Lenses
210 The Pesticide Problem

SATIS 3
301 Air Pollution — where does it come from?
302 Living with Kidney Failure
303 Physics and Cooking
304 A Medicine to Control Bilharzia — Part 1
305 A Medicine to Control Bilharzia — Part 2
306 Fibre Optics and Telecommunications
307 Chemicals from Salt
308 The Second Law of — What?
309 Microbes make Human Insulin
310 Recycling Aluminium

SATIS 4
401 Fluoridation of Water Supplies
402 DDT and Malaria
403 Britain's Energy Sources
404 How would you Survive? — an exercise in simple technology
405 The Label at the Back — a look at clothing fibres
406 Blindness
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409 Dam Problems
410 Glass

SATIS 5
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502 The Coal Mine Project
503 Paying for National Health
504 How Safe is Your Car?
505 Making Fertilizers
506 Materials for Life — new parts for old
507 Computers and Jobs
508 Risks
509 Homoeopathy — an alternative kind of medicine
510 Perkin's Mauve

SATIS 6
601 Electricity on Demand
602 The Limestone Inquiry
603 The Heart Pacemaker
604 Metals as Resources
605 The Great Chunnel Debate
606 The Tristan da Cunha Dental Surveys
607 Scale and Scum
608 Should we Build a Fallout Shelter?
609 Hitting the Target — with monoclonal antibodies
610 Robots at Work

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702 The Gas Supply Problem
703 Vegetarianism
704 Electric Lights
705 Physics in Playgrounds
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707 Artificial Limbs
708 Appropriate Pumps
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710 What is Biotechnology?
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807 Radiation — how much do you get?
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SATIS 9
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902 Acid Rain
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906 IT in Greenhouses
907 Your Stars: Revelation or Reassurance?
908 Why not Combined Heat and Power?
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1001 Chocolate Chip Mining
1002 Quintonal: an industrial hazard
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1005 Mental Illness
1006 As Safe as Houses
1007 240 Volts Can Kill
1008 Why 240 Volts?
1009 Trees as Structures
1010 Can it be done? Should it be done?
Index to SATIS 1 to 10

Evaluation of SATIS units

Your opinions as an experienced teacher will help to revise and improve the SATIS units in this book and to influence the style of future units.

Please
- Complete a response table (overleaf) for any unit you have used. If you need more response tables, please make photocopies.
- Return the completed sheet(s) to:

  SATIS Evaluation, ASE, College Lane, Hatfield, Herts AL10 9AA

Information about your school

Name of SATIS contact person: .....

Role: .....

Name of school: .....

Address: .....

.....

Type of school *(Please circle):*

Comprehensive Grammar Secondary Modern Independent Other

Boys only Girls only Mixed

Age range: ..... Total school roll: .....

Your opinions about the SATIS units in this book

The aspects for comment are listed below and we have provided response tables on the other side of this sheet. For each unit:

Please
- Complete the headings
- Tick the box which most closely reflects your opinion about each aspect of the unit you have taught
- If you have 'no opinion', or do not wish to give one, please tick the box on the extreme right.

Aspects for comment

(a) Relevance for GCSE courses (Is the unit relevant to your course?)
(b) Students' apparent interest (Did the unit stimulate interest in your students?)
(c) Language level (Is the unit written at a suitable level for your students?)
(d) Concept level (Were the conceptual demands appropriate?)
(e) Suggested amount of time (Was there enough time to complete the unit?)
(f) Recommended teaching/learning method (Was this appropriate for the unit?)
(g) Presentation (layout, diagrams, photos, print size) (Was all this suitable?)
(h) Teachers' notes (blue sheets) (Did you find these useful?)
(i) The teaching sequence in the unit (Was the unit organised suitably?)
(j) Requirements for students' response (Did the unit require suitable activities and feedback from students?)

I intend to use the following units again without revision. (Please quote unit number only.)
I intend to use the following units again, with revision.
I do not intend using the following units again.

SATIS unit number .....

Years and abilities used with .....

(a) Relevance for GCSE	Very relevant	Relevant	Little relevance	Not relevant	No opinion
(b) Students' apparent interest	Very interested	Interested	Little interest	Bored	No opinion
(c) Language level	Very suitable	Suitable	Quite difficult	Very difficult	No opinion
(d) Concept level	Very appropriate	Appropriate	Not appropriate	Completely in-appropriate	No opinion
(e) Suggested amount of time	Very satisfactory	Satisfactory	Difficult to meet	Badly estimated	No opinion
(f) Recommended teaching/ learning method	Very appropriate	Appropriate	Needs improving	Not at all appropriate	No opinion
(g) Presentation (Layout, diagrams, photos, print size, etc.)	Excellent	Good	Needs improving	Poor	No opinion
(h) Teachers' notes (the blue sheets)	Very useful	Useful	Need improving	Of little use	No opinion
(i) The teaching sequence in the unit	Very suitable	Suitable	Needs some reorganising	Needs much reorganising	No opinion
(j) Requirements for students' response	Very suitable	Suitable	Need improving	Unsuitable	No opinion

Further comment:

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(j) Requirements for students' response	Very suitable	Suitable	Need improving	Unsuitable	No opinion

Further comment:

The Chinese Cancer Detectives

Contents: Reading, questions, role-play and practical work related to the story of the identification of the cause of oesophageal cancer in Lin Xian, China.

Time: Homework plus 2 to 3 periods.

Intended use: GCSE Biology and Science.

Aims:

- To complement work on cell division, nutrition, and food preservation
- To describe in outline the nature and variety of cancers
- To develop an awareness of the research needed to identify the causes of a disease such as cancer
- To provide an opportunity to evaluate information
- To provide an opportunity to practise a range of communication skills.

Requirements: Parts 1 and 2 of the students' worksheets No.901 will be needed for homework. Part 3 will then be required for follow-up in class. A variety of materials for making leaflets and posters may be necessary in Part 3. Some students may wish to use a tape recorder.

Author: Anne Charlton

Suggested use of the unit

The unit is in three parts. Parts 1 and 2 could be set for homework so that the students are familiar with the information before they start Part 3 which will need a double period in school. At the end, each group might be asked to put across their 'message' to the rest of the class.

Possible recommendations to the people of Lin Xian (pronounced Lin Zyan) based on the research findings might be:

- To drink only purified water low in nitrites
- To eat only fresh vegetables, not pickled mouldy ones
- To add molybdenum to the seeds when they are sown
- Not to eat mouldy food
- To build waterproof drying areas for grain to stop it going mouldy when stored.

Perhaps the most important message for the students in this unit is that there are hundreds of different types of cancer, all with different causes and different behaviour. There can be more than one cause for cancer in a particular organ. *It is important to emphasize that the one described here is exceptional and a very local one.* However, the Lin Xian example illustrates well both the complex process of tracking down the various elements involved in causing the cancer, and the problems involved in getting people to change their time-honoured procedures in order to prevent one particular cancer. We have the same problem in this country where cigarette smoking has been indentified as the main cause of lung cancer. Even so, some people are unwilling to give up smoking.

Background information

Much of the research into the causes and prevention of cancers investigates the distribution of particular types of cancer among specific groups of people.

There is a very wide variation between the most frequent cancers from country to country. For example, in many westernised countries, including Britain, USA, Canada, Australia, New Zealand and Western Europe, lung cancer is the most common cancer in men and breast cancer is the most frequent for women. However, in Japan, stomach cancer is the most frequent in both sexes. In South America, cancer of the uterine cervix is the most frequent cancer in women, while in other parts of the world, including Egypt, and much of Africa, liver cancer is most frequent.

When a 'high risk' group is identified, researchers attempt to identify the factor in the life style of the members of the group which might be carcinogenic. When a possible factor is strongly suspected it is put to the test of laboratory research.

There is, however, a very important problem in the identification of the carcinogen because the process of carcinogenesis is almost certainly caused by many factors and often includes a long latent period between contact with the carcinogen and the appearance of a recognisable cancer.

The process of carcinogenesis is not well understood. In the case of the cancer sufferers of Lin Xian it seems odd that a product of digestion should cause cancer of the gullet. However, it quite often happens that the effect of a carcinogen appears at a different site from that of contact. Tobacco smoke can cause cancer of the pancreas and liver; bracken (when eaten by humans as it is in Japan) causes cancer of the gullet; aflatoxins produced by the fungus *Aspergillus flavus* cause liver cancer. Presumably the products which act as carcinogens are absorbed and carried in the blood as are other products of digestion. Certain types of cell are sensitive to particular carcinogens, so presumably if they enter these cells, and other necessary conditions are also fulfilled, a cancer will be initiated.

Other resources

1 Edward Goldwyn's article, 'The Chinese cancer detectives' (*The Listener*, 21 February 1980, pp.236-8) tells the story of Lin Xian.

2 A wall chart and accompanying leaflet on the distribution of the most frequent cancers throughout the world are available on sale from the Cancer Research Campaign, 2 Carlton House Terrace, London SW1Y 5AR. (Tel. 01-930 8972.)

3 There are several very good basic books about cancer and its causes in general. Two are: *Cancer: the Facts* by Sir Ronald Bodley Scott (Oxford University Press, new edn, 1981); *The Causes of Cancer* by R. Doll and R. Peto (Oxford University Press, 1982).

Acknowledgements Figure 1 supplied by the Cancer Research Campaign Laboratories, Department of Medical Oncology, Charing Cross Hospital; Figure 2 supplied by the Department of Medical Illustration, St Bartholomew's Hospital.

THE CHINESE CANCER DETECTIVES

This unit tells the story of a group of scientists who tracked down the cause of one kind of cancer. The scientists studied the people of Lin Xian in China where the cancer was unusually common. They worked like detectives, collecting clues, until they were able to work out the likely cause of the disease.

The unit is in three parts:

Part 1 What is cancer?
Part 2 The story of Lin Xian
Part 3 How can we save lives?

Part 1 What is cancer?

Cells in our bodies divide all through our lives. They do this for two reasons:

- so that we can grow, and
- to replace cells which are worn out, or lost in other ways.

Normally cell division is under strict control. Just the right number of new cells are made.

Sometimes something causes a cell to begin to divide in an uncontrolled way. Fortunately this does not happen very often. When it does happen a group of unusual cells forms. These abnormal cells do not become muscle cells, or skin cells or blood cells. Instead they just keep dividing more rapidly than normal cells. A lump of cells forms which is called a tumour.

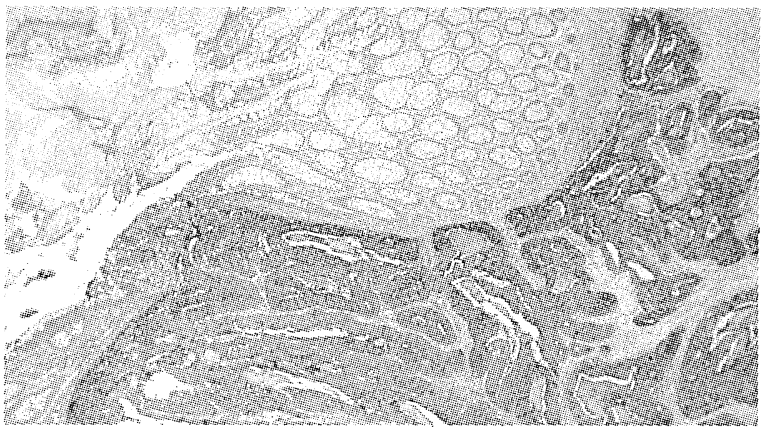

Figure 1 Normal and cancerous cells under the microscope (magnified 40 times). The cells are from a human bowel. The normal cells are the regularly shaped ones at the top. The cancer cells are the oddly shaped ones at the bottom.

Some tumours are **benign** tumours. Cells from these tumours do not spread between the surrounding normal cells.

Other tumours are **malignant** tumours, or cancers. Cells from malignant tumours can spread between surrounding cells and eventually reach blood vessels or lymph vessels. Small groups of cells may break off from the tumour and be carried by the blood, or lymph, to start secondary cancers in other parts of the body. This process is called **metastasis**.

Answer questions 1 to 3.

Questions

1 *Why do cells in our bodies divide throughout the whole of our lives?*
2 *Uncontrolled cell division produces unusual cells. How are the abnormal cells different from normal cells?*
3 *What is the main difference between a benign tumour and a malignant tumour?*

There are hundreds of different kinds of tissue in our body. Cell division happens in them. So there are many places where cell division can go wrong. This means that there are hundreds of kinds of cancer according to where the first tumour starts to grow. These cancers are all very different in their causes and effects, and need different treatments.

There must be some kind of 'trigger' to start a cell dividing in the wrong way. This trigger is called a **carcinogen**. The way in which a carcinogen has its effect may not be simple. Sometimes there may be a long gap between contact with the carcinogen and the start of the cancer. Also the carcinogen may not have an effect on its own.

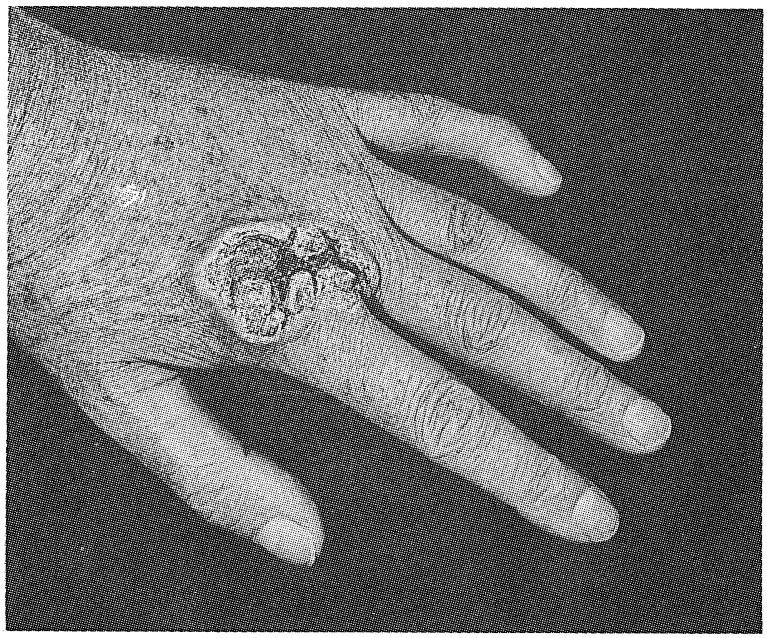

Figure 2 A skin cancer

Some groups of people seem more likely to develop particular types of cancer. Scientists try to discover what these people have in common in the hope of finding the carcinogen. Then it may be possible to reduce the risk of cancer by cutting down the exposure to the carcinogen.

Part 2 of this unit describes one type of cancer in a particular group of people. The causes of all cancers are complex and the same detailed research is needed for all of them.

Answer questions 4 to 6.

Questions

4 *Why is it so difficult to identify the causes of cancer?*

5 *What information can sometimes give researchers the first clue to the cause of some cancers?*

6 *Give an example of a substance which has been identified as a carcinogen and is now being removed, as far as possible, from our environment.*

Part 2 The Story of Lin Xian

Lin Xian is a remote valley in China. Cancer of the gullet (oesophagus) is about one hundred times more common among the people who live in this valley than in the surrounding areas of China. This seems to have been the case for many centuries.

Why? It needed a team of scientists to find out the reason. You will see why as you look at the evidence and the deductions.

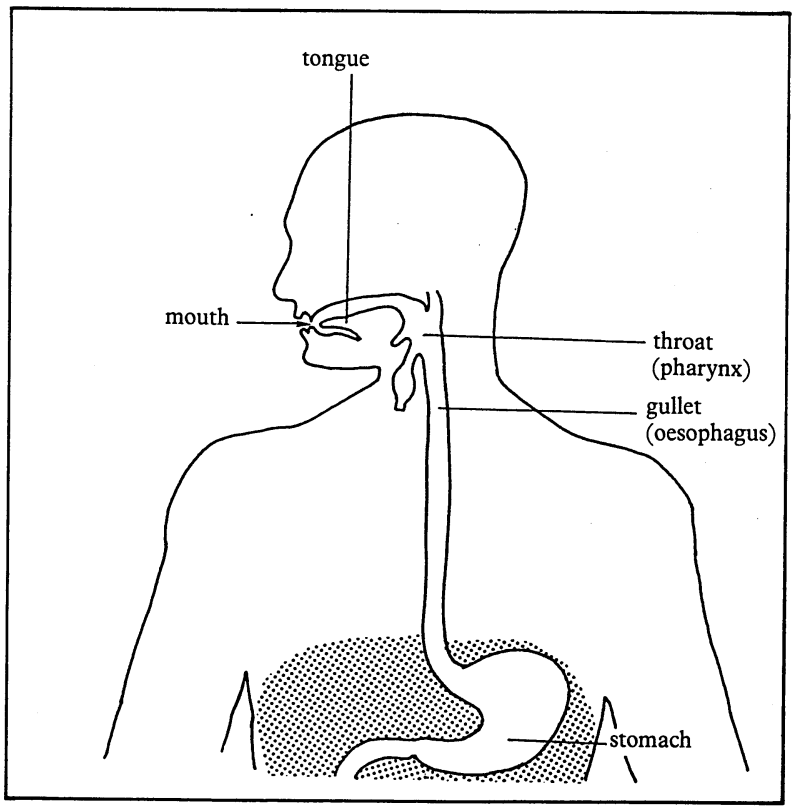

Figure 3

Evidence

- Analysis showed that the soil in the Lin Xian valley is short of the element molybdenum.
- The water supply in the valley was found to be high in chemicals called nitrites.
- The people of Lin Xian liked mouldy food. They ate mouldy bread, pickled cabbage rotted in water, and persimmon (a fruit) preserved in a crust of dried wheat husk.
- Wherever the people of Lin Xian valley had a high rate of cancer, so too did their chickens.
- The people in Lin Xian had a high level of nitrites in their bodies and a low level of vitamin C.

Deductions

The scientists used this evidence to find the cause of cancer. Here is part of their reasoning.

a The chickens probably got the cancer because they were fed on food scraps by the people of Lin Xian. So it was probably something in the food which caused the cancer.

b Plants which are short of molybdenum contain more nitrites than normal. They also contain little vitamin C.

c Nitrites in food can be turned into harmful chemicals called nitrosamines during digestion.

d Some of the moulds on the bread and cabbage in Lin Xian produced nitrosamines. They also produced amines which can combine with nitrites during digestion to make nitrosamines.

e Nitrosamines can cause cancer. It was probably nitrosamines causing the high rate of cancer of the gullet in the people of Lin Xian.

f Vitamin C helps to protect against the effects of nitrosamines.

Answer questions 7 to 11.

Questions

7 *What did the people of Lin Xian - and their chickens - have in common?*

8 *What two things are unusual about plants grown on soil which is short of molybdenum?*

9 *Which two chemicals were formed by the moulds on the bread, cabbage and fruit?*

10 *What chemical was there too much of in the water supply in Lin Xian? Does the evidence suggest that this chemical is harmful on its own?*

11 *What advice do you think should be given to the people of Lin Xian to help them reduce the risk of cancer of the gullet? Write down your recommendations in four or five short statements.*

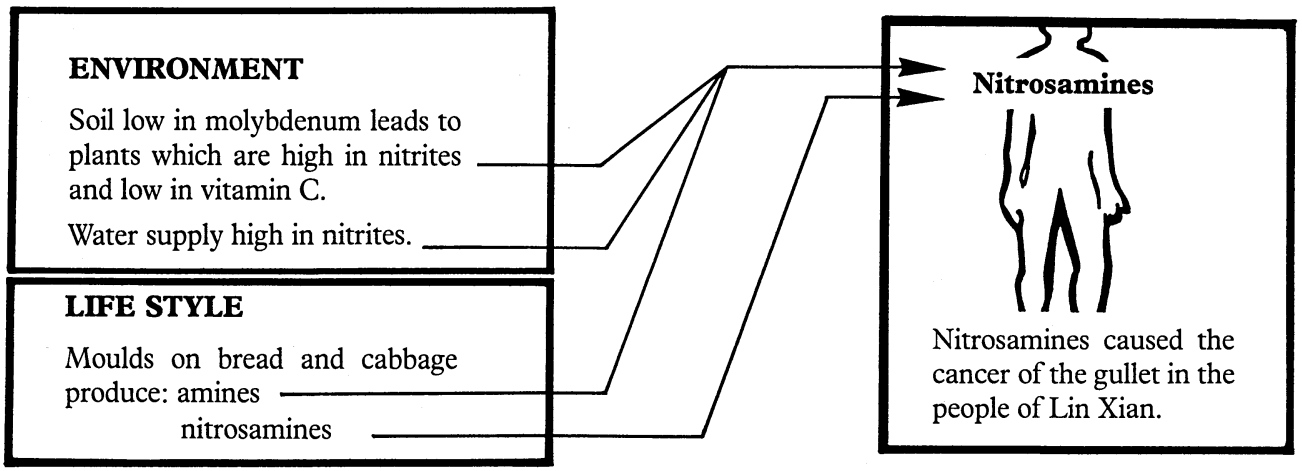

Figure 4

Part 3 How can we save lives?

In this role-playing exercise you will be working in groups of four. Each student in a group will take the part of one of the following characters: a doctor, a research worker, a social worker, a school teacher. Together you form a small group of village leaders. You have studied the results of the research into the causes of cancer of the gullet in Lin Xian. You are meeting to decide what should be done to help the people who live in the valley.

You have to decide two things to help people cut down the risk of cancer of the gullet:

A What advice should be given to the people based on the research results?

B How the message should be put across so that people change their life style and cut down the risk.

Each member of the group is asked to give a brief report on his or her recommendations. The group also has to produce some sample publicity material. You may decide to use posters, leaflets, slogans, radio or TV items, and so on.

Read the brief guidelines on your role below, before making your report.

Dr Ko You are the doctor who has had to treat so many people in Lin Xian for cancer of the gullet. You feel that the cancers are a tragic waste of life, particularly now that they can be prevented. You are aware of the difficulties of getting people to pay attention to health campaigns. You have met many patients who have ignored your advice about smoking and eating habits.

Ms/Mr Wong You are one of the researchers who helped to find the causes of cancer. You are very keen to see that the results of your work are fully understood by the people of the valley.

Mr/Ms Lo You are the social worker. Your job is to help to persuade the people to change their habits so as to help to prevent cancer. You know from past experience how difficult it can be to persuade people to change their ways. This is particularly true with older people.

Ms/Mr Chang You are a local school teacher. You want to get the message across to your young pupils so that they will be unlikely to get cancer. You already have a programme of health education in your school. You have to decide how to add this new message to your teaching. Past experience tells you that many children are influenced more by family and friends than by what they are told in school.
