

Academic Reading Paper 09

Seeds, Clocks and Journeys

Time allowed: 1 hour

INSTRUCTIONS TO CANDIDATES

- Do not open this booklet until you are told to do so.
- Write your name and the date at the top of the answer sheet.
- Answer **all** the questions.
- Write your answers **on the answer sheet**, not in this booklet.
- You must transfer your answers within the hour. **No extra time is given for transferring answers in the Reading test.**
- Do not remove this booklet from the examination room.

INFORMATION FOR CANDIDATES

- There are 40 questions in this paper.
- Each question carries one mark.
- There are three passages, with 13, 13 and 14 questions.

These passages were written for this library. They are **not** reproduced from any published past paper. The format, timing and task types follow the published specification for the Academic Reading test so that sitting this on paper feels like the real thing.

You should spend about 20 minutes on Questions 1–13, which are based on Reading Passage 1 below.

Keeping seeds alive

A seed is a plant with its metabolism turned almost off, wrapped in a container, waiting. That is an unusual thing for living tissue to be able to do, and it is the entire basis of seed banking: if a seed can survive a season in the soil, it can be persuaded to survive a century in a jar. The persuasion has three parts — take out the water, take out the heat, and keep the light off — and the whole industry of preserving plant diversity rests on how well those three things can be done.

The procedure is more exacting than it sounds. Seeds are collected at maturity, cleaned of husk and debris, and dried in a room held at fifteen degrees and fifteen per cent relative humidity until the moisture content inside the seed falls to somewhere around five per cent. They are then X-rayed, which sounds excessive and is not: a proportion of any wild collection is empty, malformed or already eaten from the inside by an insect, and there is no point banking a shell. What survives the X-ray is sealed in glass jars and put into a vault at minus twenty degrees.

The whole thing is then checked, repeatedly, for as long as it is kept. A sample of every accession is germinated at intervals of about a decade, and if the proportion that sprouts has fallen below a threshold the collection is grown out and replaced with fresh seed. A seed bank that is not tested is not a seed bank; it is a cupboard, and the difference will not become apparent for fifty years. The interval is not arbitrary either. A collection tested too often is being consumed by its own quality control, since every test destroys the seed it uses, and a collection tested too rarely can be dead for years before anybody finds out.

The largest wild collection is at Kew's Millennium Seed Bank in southern England, which opened in 2000 and holds seeds from around forty thousand species, something over two billion seeds in total. Its stated aim is to bank a quarter of the world's plant species. The better-known vault, on the island of Spitsbergen at seventy-eight degrees north, does a different job: the Svalbard Global Seed Vault stores duplicates of crop collections held elsewhere, and holds more than a million samples. It is not a collection but an insurance policy against the failure of other collections. Neither institution is a museum. Both exist to be drawn on, and a deposit that could never be withdrawn would be an expensive way of doing nothing at all.

That insurance was claimed for the first time in 2015. An agricultural research centre that had been based in Aleppo, holding one of the world's most important collections of wheat, barley and lentil varieties from the dry lands of the Middle East, had been forced out by the war in Syria. It asked Svalbard for its own deposits back, and used them to re-establish the collection at new sites in Lebanon and Morocco. The withdrawal is the reason the vault exists and the reason the principle behind it — that no collection is safe in one place — is not a theoretical one.

There is a limit to all of this, and it is not a matter of funding. The method works only on seeds that tolerate being dried and frozen, which botanists call orthodox. A large minority do not. Recalcitrant seeds are shed with a high water content and are killed by drying them out; the group includes oak, mango, avocado, cacao, rubber and a great many trees of the wet tropics. For these the vault is simply unavailable, and preservation means either an orchard, which occupies land and can burn, or freezing dissected embryos in liquid nitrogen, which has to be worked out separately for each species and mostly has not been.

This produces an awkward geography. The technique is cheapest and most effective for the seeds of dry and temperate places, and least available for the wet tropics, which is where most plant species actually live. The collections that exist are therefore not a sample of global plant diversity. They are a sample of the plants whose seeds happen to suit the method, and reading a seed bank's holdings as a picture of what has been saved gets the situation backwards. It also means that a good many of the species most at risk are the ones the method cannot hold, which is an uncomfortable position for a conservation technology to occupy.

None of which is an argument against the vaults. A jar of dried seed at minus twenty degrees is the cheapest form of preservation anyone has devised, by an enormous margin, and it will keep some species alive through events that would remove them entirely. It is worth being clear that it is a method with a domain rather than a solution with a budget.

accession: a single batch of seed entered into a collection, with its own record

relative humidity: the amount of water in the air as a percentage of the maximum it could hold

Questions 1–6

Complete the table below.

Choose **NO MORE THAN TWO WORDS AND/OR A NUMBER** from the passage for each answer.

Banking a seed		
Stage	What is done	The figure that matters
Drying	held in a controlled room	the moisture inside the seed is brought down to about 1 per cent.
Screening	every batch is X-rayed	this removes seeds that are empty, malformed or eaten from the inside by an 2
Storage	sealed in glass jars	the vault is held at minus 3 degrees.
Testing	a sample is germinated	this is repeated about every 4 , and a failing collection is grown out again.

Duplicating	crop collections are copied to Svalbard	the vault holds more than a 5 samples.
Withdrawing	deposits returned to their owner	the first withdrawal, in 2015, re-established a collection in Lebanon and 6

Questions 7–13

Do the following statements agree with the information given in Reading Passage 1?

Write **TRUE** if the statement agrees with the information, **FALSE** if the statement contradicts the information, or **NOT GIVEN** if there is no information on this.

- 7** A seed bank whose collections are never germination-tested cannot be relied on.
- 8** The Millennium Seed Bank holds around two billion species.
- 9** The Svalbard vault was opened in response to the war in Syria.
- 10** Most of the seeds held at Svalbard come from wild plants rather than crops.
- 11** Recalcitrant seeds are damaged by the drying stage of the process.
- 12** Freezing embryos in liquid nitrogen works in the same way for every species.
- 13** Seed banking costs more per species than maintaining a living orchard.

You should spend about 20 minutes on Questions 14–26, which are based on Reading Passage 2 below.

How the body keeps time

- A** In 1729 a French astronomer, Jean-Jacques d'Ortous de Mairan, noticed that the leaves of a mimosa on his windowsill opened in the morning and closed at dusk. Everybody had noticed that. What de Mairan did next was put the plant in a dark cupboard and look at it anyway, and the leaves went on opening and closing on the same schedule with no light reaching them at all. The rhythm was not a response to the sun. It was being produced inside the plant, and the sun was merely keeping it honest.
- B** The observation sat almost unused for two hundred years, because it raised a question nobody had a method for. A rhythm generated internally implies a mechanism, and until it was possible to break a mechanism deliberately and see what happened, the subject could not move. The tool that finally allowed it was genetics, and the animal was the fruit fly. Rhythms were catalogued in the meantime, in plants, in insects and in mammals, and the catalogue established that the phenomenon was general without explaining any part of it.
- C** In 1971 Ronald Konopka and Seymour Benzer treated flies with a mutagen and screened thousands of them for anything wrong with the timing of their emergence from the pupa, which normally happens near dawn. They found three abnormal lines. One emerged on a nineteen-hour cycle, one on a twenty-eight-hour cycle, and one at no particular time at all. All three mutations turned out to lie in the same gene, which they named period. A single gene could lengthen a day, shorten it, or abolish it.
- D** Finding what the gene did took another thirty years and three laboratories. Jeffrey Hall and Michael Rosbash at Brandeis, and Michael Young at Rockefeller, cloned period and then established what its protein does. The protein accumulates in the cell through the night, and when enough of it is present it enters the nucleus and switches off the very gene that produces it; production stops, the protein degrades through the day, the block is lifted and the cycle begins again. Young's laboratory found a second gene whose protein is required to get the first one into the nucleus at all. The clock is a loop that turns itself off, and the time it takes to do that is roughly a day.
- E** The loop turned out not to be a fly's peculiarity. Genes closely related to those found in the fly run the same negative feedback in mice and in humans, in tissue after tissue, and in cells kept alive in a dish with no organism around them. The Nobel Prize in 2017 went to Hall, Rosbash and Young for the mechanism. The similarity across species is not a family resemblance. The proteins do the same job, in the same order, on the same timescale, which is a strong indication that the arrangement is very old.

- F** What the clock is worth knowing about in humans came from a different tradition. Charles Czeisler and his colleagues put volunteers on schedules deliberately unlike twenty-four hours, so that the internal rhythm and the imposed day would drift apart and could be measured separately. The intrinsic human period came out at about twenty-four hours and eleven minutes, which corrected a figure of twenty-five hours that had stood for decades and had been an artefact of letting subjects control their own lighting. Czeisler's group also showed that ordinary indoor light, not just daylight, is strong enough to shift the human clock.
- G** That last point is why the subject has escaped the laboratory. If the clock is reset by light, then a person working nights under electric light and sleeping by day is not merely tired; their tissues are keeping different times from one another, and the consequences of that misalignment show up in metabolism, in alertness and in the timing of medical events. Whether a drug is given at eight in the morning or eight at night can change how well it works, for reasons that have nothing to do with the patient's habits. Nor do the tissues all reset at the same rate. The liver follows the timing of meals more closely than it follows light, so a body on a night shift can finish with its brain keeping one schedule and its digestion keeping another.
- H** The through-line from a mimosa in a cupboard to shift-work policy is unusually clean, and it has a single shape. Each step took something everybody could see, asked what would happen if the obvious cause were removed, and found the thing still happening.

Questions 14–19

Reading Passage 2 has eight sections, A–H.

Choose the correct heading for sections A–D, F and H from the list of headings below.

Write the correct number, I–XII.

List of Headings

- i A rhythm that continues without its cue
- ii A rhythm that stops without its cue
- iii Why the finding could not be followed up
- iv Why the finding was not believed
- v One gene, three broken clocks
- vi Three genes, one broken clock
- vii What the protein actually does
- viii What the protein was expected to do
- ix Correcting a number that had stood for decades
- x Confirming a number that had stood for decades
- xi The shape every step of the story shares
- xii The shape the story never had

14 Section A

15 Section B

16 Section C

17 Section D

18 Section F

19 Section H

Questions 20–23

Look at the following findings and the list of researchers below.

Match each finding with the correct researcher, A–D.

NB You may use any letter more than once.

List of Researchers

- A** Jean-Jacques d'Ortous de Mairan
- B** Konopka and Benzer
- C** Michael Young
- D** Charles Czeisler

- 20** He showed that a daily rhythm persists in constant darkness.
- 21** They found that damage to one gene could lengthen, shorten or abolish a cycle.
- 22** His laboratory identified a second gene needed for the first protein to reach the nucleus.
- 23** He established the true length of the human internal day.

Questions 24–26

Complete the summary using the list of words, A–H, below.

List of Words

- A** loop
- B** chain
- C** light
- D** habit
- E** nucleus
- F** cytoplasm
- G** misalignment
- H** fatigue

From a plant to a shift pattern

The clock is built as a **24** in which a protein enters the **25** and shuts down its own gene. Because the whole system is reset by **26**, a person working at night has tissues keeping different times from one another.

You should spend about 20 minutes on Questions 27–40, which are based on Reading Passage 3 below.

Does travel broaden the mind?

The sentence usually quoted is Mark Twain's, from 1869: travel is fatal to prejudice, bigotry and narrow-mindedness. It has been repeated for a century and a half by people selling holidays, by universities recruiting for exchange programmes and by travellers describing themselves, and it is almost never treated as a claim that could be false. It is a claim that could be false, and there is a literature on it.

The relevant work does not begin with travel at all. In 1954 the psychologist Gordon Allport proposed that contact between groups reduces hostility between them, but only under conditions, and he specified four: that the parties meet as equals within the situation, that they are pursuing a shared goal, that they are cooperating rather than competing for it, and that the arrangement has the support of the relevant authorities or customs. Allport's point was not that contact is good. It was that contact is a mechanism with requirements, and that contact failing to meet them can leave attitudes untouched or make them worse.

The evidence since has largely supported him with one important amendment. A meta-analysis by Thomas Pettigrew and Linda Tropp, drawing on more than five hundred studies, found that contact does reduce prejudice on average, and that it does so even where Allport's conditions are not fully met — the conditions are not strictly necessary. But the effect is markedly larger where they are met, and the mechanism the analysis identifies is the reduction of anxiety about the encounter and the growth of the ability to take the other party's perspective, neither of which is produced by proximity on its own.

Set ordinary tourism against those requirements and the fit is poor. The traveller and the person they meet are rarely equals within the situation: one is paying and one is being paid, and the asymmetry organises everything about the interaction. There is no shared goal, unless a transaction counts as one. Cooperation is what the arrangement purchases rather than what it consists of. And the encounter is brief, which matters because the anxiety reduction Pettigrew and Tropp identify takes time it does not have.

There is a further problem specific to travel, which is that the traveller chooses. People select destinations that appeal to them, arrive with expectations formed in advance, and interpret what they see through those expectations; and a two-week visit supplies far more raw material for confirming a prior belief than for dislodging one. Somebody who arrives believing a country to be chaotic will find traffic, and somebody who arrives believing it to be spiritual will find a temple, and both will come home with evidence. This is not a failure of honesty. It is what anybody does with a large quantity of unfamiliar information in a short time, and the traveller has no way of noticing it happening.

None of this shows that travel cannot change anybody, and it would be a poor reading of the argument to conclude that. The conditions are sometimes met, and where they are the effect appears. A student on a year abroad who studies alongside local students, in the same classes, assessed on the same terms, is in

something close to Allport's arrangement. So is somebody working on a shared project, or living somewhere long enough for the transaction to stop being the frame. The evidence for attitude change in long structured exchanges is considerably better than the evidence for it in tourism, which is what the theory predicts. What distinguishes those cases is not that the people in them are unusually open-minded. It is that the arrangement removes the transaction and supplies the time.

The useful conclusion is therefore not about travel. It is that the variable doing the work is the structure of the encounter, and distance is at best a weak proxy for it. A person can meet Allport's four conditions in the next street and fail to meet any of them on the other side of the world, and each of those things happens constantly. Treating the aeroplane as the active ingredient is a category error that happens to be extremely good for the tourism industry.

What follows is not that people should travel less. It is that the claim should be stated in a form that can be acted on. Travel arranged so that people meet as equals, work at something together and stay long enough to stop being guests will change how they see one another. Travel arranged as consumption will mostly confirm what the traveller brought with them, and calling the second one broadening does not make it so. The distinction is worth keeping because it can be acted on. An institution can change the arrangement it offers; it cannot change how broadening a fortnight felt to the person who spent it.

Questions 27–32

Do the following statements agree with the claims of the writer in Reading Passage 3?

Write **YES** if the statement agrees with the claims of the writer, **NO** if the statement contradicts the claims of the writer, or **NOT GIVEN** if it is impossible to say what the writer thinks about this.

- 27 Allport argued that contact between groups is beneficial in itself.
- 28 The writer thinks travel is incapable of changing anyone's attitudes.
- 29 Twain intended his remark to apply to short holidays.
- 30 The writer accepts that Allport's conditions are not strictly required for contact to help.
- 31 The writer believes universities should reduce the number of exchange programmes.
- 32 The writer holds that the arrangement of the encounter matters more than the distance travelled.

Questions 33–36

Choose the correct letter, A, B, C or D.

- 33 How many conditions did Allport specify?
 - A Two.
 - B Four.
 - C Five hundred.
 - D One.

- 34 According to the passage, the Pettigrew and Tropp analysis found that
- A contact only reduces prejudice when Allport's conditions are met.
 - B contact reduces prejudice most where Allport's conditions are met.
 - C Allport's conditions have no measurable effect.
 - D contact increases prejudice where the conditions are absent.
- 35 Why does the writer say the shortness of a tourist visit matters?
- A Because the traveller cannot see enough of the country.
 - B Because the reduction of anxiety identified in the research needs time.
 - C Because short visits are more expensive per day.
 - D Because tourists choose their destinations.
- 36 Which of the following best describes the writer's position?
- A People should travel less than they do.
 - B Tourism should be replaced by structured exchange.
 - C The claim about travel should be restated so that it can be acted on.
 - D Prejudice cannot be reduced by contact of any kind.

Questions 37–40

Complete the sentences below.

Choose **NO MORE THAN TWO WORDS** from the passage for each answer.

- 37 Allport required that the parties meet as within the situation.
- 38 The mechanism the meta-analysis identifies is a reduction in about the encounter.
- 39 In ordinary tourism the relationship is organised by the fact that one party is paying and the other is being
- 40 The writer says that travel arranged as will mostly confirm what the traveller already believed.