students each on a variety of general subjects. All of these courses are residential and take over a college for accommodation; most of the teaching is done by the regular tutors from the extramural department with occasional lectures given by other Oxford University professors.

Obviously the options of a university or college must be limited by its facilities, but it seems clear that many institutions take too little interest in the full exploitation of their facilities.

INSTRUMENTS

James Short's Telescopes

THE Royal Scottish Museum in Edinburgh has been holding an exhibition of the life and work of James Short, the Scottish telescope maker who died two hundred years ago. Short was born in Edinburgh in 1710, where he was educated at Heriot's Hospital, a school for the sons of burgesses, at the high school and the university, where he came under the influence of the professor of mathematics, Colin Maclaurin. It was at the university, in one of Maclaurin's rooms, that Short began to experiment with the construction of reflecting telescopes. He soon developed considerable skill and Maclaurin reported that the telescopes Short was producing were "by far the best of their lengths that have yet been executed".

During the 17th century, telescopes were of the refracting type and the quality of the image they formed was limited by spherical aberration and chromatic dispersion. To produce a satisfactory image, objectives had to have low curvatures, and hence long focal lengths, so that during the second half of the 17th century telescopes were inordinately lengthy. Sir Isaac Newton then realized that a telescope based on mirrors would be free from chromatic aberration, and in 1668 he built what was almost certainly the first reflector. James Gregory, the Scottish mathematician who held the chair of mathematics at Edinburgh University before Maclaurin, had earlier published a design for a reflecting telescope in which the image was viewed through a hole in the centre of the primary mirror, but the telescope was not built until after his death because opticians could not make mirrors of the required curvature. Following Newton's work, reflectors were preferred for many years—experiments with refractors had been discouraged by the mistaken assertion by Newton that it was impossible to correct a lens for chromatic aberration. It was at this stage in the history of telescopes that James Short was working, constructing the outstanding instruments of his time. Ten years before Short died, the London optician John Dolland made the first achromatic objective lens, but the technique of constructing reflectors had by then been brought to such a state of perfection that it was many years before refractors came back into favour among astronomers in the 19th century. The absorption of light by glass objectives of large aperture led to the reflectors which are now the world's largest optical telescopes.

In 1737, Short was elected to the Royal Society and a year later he moved to London, where he made telescopes for the aristocrats who at that time were the patrons of astronomy. He made the first 12 foot focus reflector for the Duke of Marlborough at a cost of 600 guineas, and a 12 foot telescope which he sold

A 49 inch focus, 9¼ inch aperture Gregorian reflector, made by James Short for the Paris Observatory, which lent it to the Royal Scottish Museum for the exhibition.

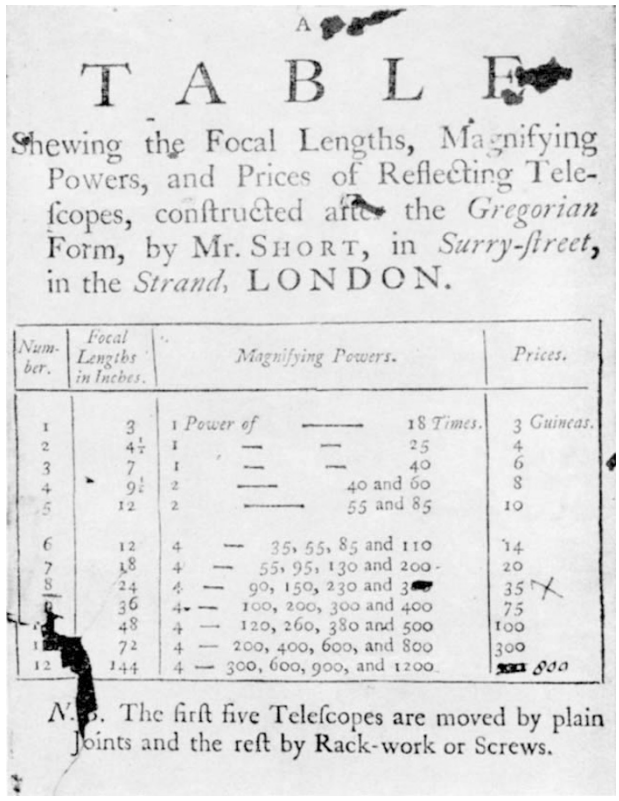

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TABLE

Shewing the Focal Lengths, Magnifying Powers, and Prices of Reflecting Telescopes, conſtructed after the *Gregorian* Form, by Mr. SHORT, in *Surry-ſtreet*, in the *Strand*, LONDON.

Number.	Focal Lengths in Inches.	Magnifying Powers.	Prices.
1	3	1 Power of —— 18 Times.	3 Guineas.
2	4½	1 — — 25	4
3	7	1 — — 40	6
4	9½	2 —— 40 and 60	8
5	12	2 —— 55 and 85	10
6	12	4 — 35, 55, 85 and 110	14
7	18	4 — 55, 95, 130 and 200	20
8	24	4 — 90, 150, 230 and 3[illegible]	35
9	36	4 — 100, 200, 300 and 400	75
10	48	4 — 120, 260, 380 and 500	100
11	72	4 — 200, 400, 600, and 800	300
12	144	4 — 300, 600, 900, and 1200	600

N.B. The firſt five Teleſcopes are moved by plain Joints and the reſt by Rack-work or Screws.

James Short's price list.

to the King of Spain in 1752 for £12,000. This latter telescope never reached its destination, however; it was lost in a shipwreck on the way to Spain. During his life, Short gave his backing to a number of scientists. When James Watt first came to London to learn the techniques of instrument making, Short found a teacher for him. It was Short who put before the Royal Society Dolland's work on the achromatic objective, and who supported the watchmaker Harrison in his struggle to obtain the prize money for his development of a method for determining longitude at sea. In all, Short made some 1,360 instruments ranging in price from three guineas for his smallest model of 3 inch focal length to the 12-foot telescope sold to the King of Spain, and his business sense enabled him to amass an estate of £20,000.

BIOSPHERE

Bandwagon for Unesco

UNESCO'S "Biosphere" conference, being held in Paris this week and next, was suggested at about the time the International Biological Programme (IBP) was rumbling into its stride. (The IBP's operational phase is dated officially from July 1967.) The proposal was greeted with considerable reserve—partly because of the duplication of effort but chiefly because the Unesco enterprise would involve the people who were already considered fully committed to IBP affairs. But Unesco argued that the Biosphere meeting would involve governments—which IBP does not—and that these are in a position to vote funds and adopt programmes, which again IBP cannot.

In the event, Unesco and the IBP have reached an accommodation and several leading figures in IBP are taking part in the meeting as consultants or main speakers. These include Dr Stanley A. Cain, assistant secretary for Wildlife and Parks of the US Department of the Interior, Professor F. Bouliere of the Sorbonne and a section convener, together with the scientific director, Dr E. B. Worthington from the IBP Central Office. Altogether, some 300 people from 50 countries are involved, usually in a dual role as specialists in their own fields and as representatives of their governments.

The full title of the meeting—a good example of Unesco language—is the "Intergovernmental Conference of Experts on the Scientific Basis for Rational Use and Conservation of the Biosphere". The "biosphere" is defined as "that part of the world in which life can exist", but for the present conference, the terms of reference end at highwater mark. (Another United Nations body already has international responsibility for the seas and oceans and for the life in them.) The underlying theme is the need to conserve rather than conquer the natural world. "Man . . . has suddenly become aware that he cannot go on living beyond his means off natural resources which it has taken aeons to accumulate. And he does not have much time left . . . he must learn to live in harmony with nature, in a dynamic balance that will enable him to survive on what has been called Spaceship Earth."

Four focal topics are being dealt with by representatives of other UN agencies—food needs and opportunities by the new director-general of the FAO, Mr A. H. Boerma, for example. Each participating nation is to report on its own experience and prospects, and the British delegation is taking a notably down-to-earth approach. Sir William Slater, head of the delegation and until recently chairman of the Agricultural Research Council, hopes for "a thorough exchange of ideas". His implicit assumption is that nobody is going to rush into providing funds for large nebulous schemes, either national or international, and that experience gained in temperate climates cannot in any case be applied directly to the tropical regions where most of the developing countries lie.

The British report dwells particularly on agricultural practice in Britain. The farming pattern has for many years been prompted by the pressures of a large population on a limited amount of land, and the introduction of rotational farming as early as the eighteenth century is a proof of the need to sustain soil productivity for the future while at the same time increasing crop yields per acre. By adopting a rational basis for development, it is estimated that land today is as fertile as it has ever been, and the "buffered" approach has avoided the gross problems of soil impoverishment, pests and disease. The British delegation is urging the value of the soil survey and the newly initiated agricultural land classification maps. The British report is not smug, however. On the management of water resources, it admits that the control of floods in some areas is poor, while densely populated regions elsewhere are rapidly running short of water.

With luck, and if there is not too much rhetoric, the biosphere conference could have real value. The signs are certainly more propitious than for the parallel exercise called by the UN Peaceful Uses of Space Subcommittee which discussed the practical value of space in Vienna last month.

MUSEUMS

Lost Opportunity

from our Special Correspondent

VISITING the London museums is usually, in the summer, made hazardous by the need to avoid fragments of ice cream and hot dogs on the pavement. At weekends the throng of people, predominantly young people, is thicker than ever, which is why it is to be hoped that the provisions made by the Science Museum for catering for children on the recent bank holiday will prove to be the nadir of a somewhat shabby record. For the past 20 years, the children's exhibition has been housed at one end of the basement. This year, more than half the exhibits have been replaced by notices saying that the exhibition will be closed down altogether at the end of September and reopened elsewhere in the museum during 1969. Those familiar with the children's exhibition will no doubt consider that their present deprivation is in a good cause, and that any change is bound to be an improvement; this section of the exhibition is notoriously cramped, ill lit, badly ventilated and poorly set out. There will, however, be less cheering at the news that the Science Museum is proposing to transfer most of the present exhibits to another—though larger—part of the basement. There seems to be no prospect of the thorough re-design of the children's exhibition which would be necessary to give children a sense of how things have changed since Addison invented the diode and since photoelectric cells were first conceived of as means of operating burglar alarms.