labelled carbon dioxide in the dark for 1 min.–2 hr., radioactivity was incorporated into the acids of the Krebs tricarboxylic acid cycle and amino-acids such as glutamic acid, aspartic acid and alanine. The authors considered that the amino-acids arose from the α-keto acids of the cycle by transamination reactions. The extremely low activity of transaminase observed by us at night may be indicative of predominance of organic acid production during dark fixation of carbon dioxide in cactus, with minimal transformation of α-keto acids to amino-acids. Conversely, the high activity of the enzyme commencing at noon and reaching an abrupt peak at 4 p.m. may be associated with increased amino-acid synthesis in the day-time. Our work on non-protein nitrogen of cactus tissue has been of a preliminary nature, but estimations of total protein reveal a rhythmic increase in the day-time.

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Shortening the Juvenile Phase of Apple Seedlings

Apple seedlings usually take 7–14 yr. to come into bearing. Many attempts have been made by plant breeders and others to reduce this juvenile phase, in order to obtain an earlier assessment of new seedlings.

Variations in pruning, nutrition and cultural practices have failed to shorten this juvenile period. By working seedlings on the dwarfing rootstock *MIX*, Tydeman[1] was able to shorten the juvenile phase by approximately one year. This practice has the disadvantage that many clones of this rootstock carry virus diseases and will consequently infect the new seedlings. It is therefore necessary to maintain the unworked seedling as well as its progeny worked on the rootstock, a system which doubles the land required by the plant breeder.

It has been found that apple seedlings worked on apomictic seedling rootstocks from *Malus sikkimensis* have a shorter juvenile phase than when worked on *MIX*; and since the apomictic seedlings are virus-free it should not be necessary to maintain the original seedling.

In an experiment begun in 1956, three crosses were made from which twenty-five seedlings were raised. These were multiplied vegetatively during their first year by budding on to one-year-old seedlings of *M. sikkimensis*; the young trees were later transplanted into the orchard.

It can be seen (Table 1) that 15 per cent of the trees were flowering 3 yr. after budding and 53 per cent after 4 yr. Since about one-third of the trees were fruiting by the end of their fourth year, and were carrying an average of seven fruits, it was possible to obtain an early assessment of the value of these new seedlings. None of the original twenty-five seedlings planted alongside for comparison has fruited during the same period, although both sets of trees have been treated similarly and no pruning has been carried out.

The possibility that other apomictic species may have a similar effect on the juvenile phase of apple seedlings worked on them is being investigated.

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Table 1. Apple Seedlings worked on *Malus sikkimensis*

Family	No. of trees	Third year				Fourth year			
		Per cent flowering	Per cent fruiting	Av. No. per tree		Per cent flowering	Per cent fruiting	Av. No. per tree	
				Flower clusters	Fruits			Flower clusters	Fruits
Newton Wonder × Emneth Early	88	23	6	4	7	57	25	17	18
Newton Wonder × Woolbrook Pippin	86	5	2	6	1	45	37	32	7
Newton Wonder × Mr. Prothero	34	20	19	4	2	38	29	41	

Cactus Virus in the United States

Since the first report by Molisch[1] of the presence of proteinaceous spindles in the cells of certain cacti, a series of researches has been made demonstrating the association of virus with the spindles and with amorphous inclusions[2].

The immediate source material for these investigations has been exclusively from European greenhouses and botanical gardens. We can now report the presence of virus in cacti cultivated in the United States.

Characteristic cigar-shaped spindles, usually one, but occasionally two to the cell, have been observed, mainly in the hypodermal cells of free-hand sections of pads of *Opuntia monacantha f. variegata* and of four other kinds of flat-padded opuntias cultivated in Montana and California. We examined one field sample of *O. lindheimeri* shortly after it was collected in Texas. No inclusions associated with virus were

found. Such inclusions were reported previously to be present in a cultivated sample of this species[2]. No spindles have been found in pads of twenty cactus species examined shortly after field collection in Arizona, California and Montana.

In all cases, virus transmission was successful, as judged by the development of spindles, when sap from spindle-containing specimens was injected into or rubbed on the previously spindle-free pads of *Opuntia* species growing in the Montana State University greenhouse and the University of California at Los Angeles Botanical Garden.

No external symptoms appeared when representatives from the families Leguminosae, Solanaceae, Chenopodiaceae, Cruciferae, Tropaeolaceae or Cucurbitaceae were inoculated. Electron micrographs made from spindle-containing pads by the quick-dip method[3] showed two groups of elongated particles, with one length peak at 515 mμ (similar to cactus virus 1 (ref. 4)) and another at 300 mμ.

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Antimicrobial Substances from Ferns

It has been almost twenty years since Osborn[1] reported his now classical work on antimicrobial substances from green plants. Since that time the literature accumulated on this subject has been voluminous[2]. The vascular plants tested, however, have been essentially spermatophytes, with little attention to the pteridophytes. This work is concerned with the extraction of antimicrobial substances from thirty ferns collected at the Brooklyn Botanical Gardens. The specimens were selected at random, and the cut fronds were allowed to dry in air for at least one week before testing. Four additional dried ferns were obtained from other sources and likewise tested.

Extracts of the plants were prepared in the following manner: 15 gm. of pulverized material were added to 100 ml. of methanol and macerated in a Waring blendor for 3 min. and filtered. Filter-paper disks (6·35 mm. diam.) were saturated with the extract and allowed to dry for 3 hr. The surface of nutrient agar dishes was seeded with 0·5 ml. of a 48 hr. bacterial broth culture while 0·5 ml. of a one-week-old fungal culture was used to seed Sabauraud maltose agar dishes. The prepared disks were placed on the surface of the seeded dishes and incubated. All micro-organisms were incubated for 48 hr., the bacteria at 37° C., the fungi and *Erwinia caratovora* at 22° C. The zones of inhibition were measured from the disk edge to the zone edge and recorded in mm.

In Table 1 is listed the ferns and their zones of inhibition against 8 bacteria. No zones of inhibition were produced against *Aspergillus niger* ATCC 6277, *Candida albicans* ATCC 10231, *Gibberella fugikuroi*

Table 1. Antibacterial Properties of Ferns

	11766	8061	10692	9637	9491	9372	8245	9592*
Cyatheaceae								
Alsophila cooperi	+	−	+	−	−	−	−	−
Cibotium glaucum	+	−	+	−	−	+	−	−
Cibotium menziesii	+	+	+	+	+	+	−	−
Cibotium schiedei	+	+	+	+	+	+	+	+
Marrattiaceae								
Angiopteris evicta	+	−	+	+	+	+	+	−
Polypodiaceae								
Acrostichum aureum	−	−	−	−	−	−	−	−
Adiantum capillus-veneris	+	+	−	−	−	+	−	+
Adiantum trapeziforme	+	−	+	+	−	−	−	−
Asplenium nidus	+	−	+	+	−	+	−	+
Blechnum spicant	+	−	+	−	−	+	−	−
Cyrtomium falcatum	+	−	+	−	−	−	−	−
Davallia pentaphylla	−	+	+	−	−	−	−	+
Dennstaedtia punctilobula	+	−	+	+	−	+	+	−
Doodia media	+	−	+	−	−	−	−	−
Dryopteris dentata	+	−	−	−	+	+	+	−
Dryopteris filix-mas†	+ + +	−	+ +	−	+ +	+ −	+ +	+
Microlepia strigosa	+	+	+	−	−	−	−	−
Nephrolepis ensifolia	+	−	+	+	+	−	−	−
Nephrolepis exaltata, a variety	+	−	−	−	−	−	−	−
Polypodium aureus	+	−	−	−	−	+	−	−
Polypodium Meyenianum	+	−	−	−	−	+	−	−
Polypodium punctatum	+	−	+	+	+	+	−	−
Polypodium quercifolia	+	−	+	−	−	−	−	−
Polystichum tsus-simense	+	−	−	−	+	−	−	−
Pteridium aquilinum	−	+	−	−	−	−	−	−
Pteridium aquilinum†	−	+	−	−	−	−	−	−
Pteris tremula	−	+	+	−	+	+	+	−
Pteris vittata	+	−	+	−	+	−	−	−
Pyrrosia lingua	+	−	−	−	−	−	−	−
Stenochlaena tenuifolia	+	−	−	−	−	−	−	−
Tectaria cicutaria	+	−	+	−	+	−	−	−
Tectaria incisa	+	−	+	−	−	−	−	−
Thelyperis setigeria	+	+	−	−	+	−	−	−
Schizaeaceae								
Lygodium japonicum	+	−	+	−	+	+	+	−

* Bacterial test organisms: *Xanthomonas phaseoli* var. *sojensis* ATCC 11766, *Erwinia caratovora* ATCC 8061, *Pseudomonas solonacearum* ATCC 10692, *Escherichia coli* ATCC 9637, *Staphylococcus aureus* ATCC 9491, *Bacillus subtilis* var. *niger* ATCC 9372, *Bacillus megaterium* ATCC 8245, *Bacillus cereus* ATCC 9592.
† Rhizones and roots.
+, Zones of inhibition 1–5 mm.; + +, zones 6–10 mm.; + + +, zones 11–15 mm.; −, zone of inhibition absent.
Each extract was tested at least in triplicate.

NRRL 2284, and *Helminthosporium trucicum* ATCC 11535. The results indicate that antibacterial substances were extracted in the methanol-soluble fraction from 33 of the 34 specimens tested and that plant pathogenic bacteria are more susceptible than human pathogens. This may perhaps explain the relative resistance of ferns to bacterial invaders. Additional extracts are being prepared in this Laboratory and will be the subject of future reports.

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Introduction of the Potato into Western and Central Europe

The botanist Clusius, who prepared one of the first descriptions of the potato plant[1], indicated not only the time (the beginning of 1588) of his receiving from Philippe de Sivry (Prefect of the City of Mons, Belgium) two potato tubers and a berry, but also when Philippe de Sivry himself obtained the tubers. Clusius wrote that Philippe de Sivry had received it in the preceding year from a certain friend of the Papal Legate in Belgium under the name of 'Taratouffli'. ("Is a familiari quodam Legati Pontifici in Belgio se