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THREE CENTURIES OF BOTANY • PAGE 1

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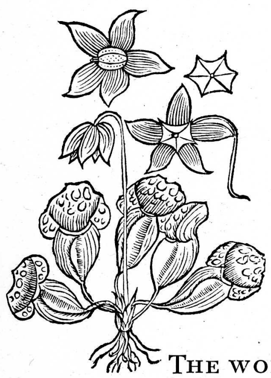
BRITISH GARDENS AND NORTH AMERICAN FLORA



BY SIR GEORGE TAYLOR

THE WORLD OF ART HAS BEEN SLOW to acknowledge its debt to the world of botany. When we recall the beauty of Brunfels or Fuchs, Besler, Ehret, Jacquin, Redouté, or Fitch, the thing to be wondered at is not so much that these splendors should now arouse the cupidity of collectors, but rather that they should have been held in such low esteem for so long. It is also worth remembering that the best of botanical illustrations have acquired their present value through their own intrinsic merit, and not simply as rare surviving examples of a dead art. For the art of botanical illustration is by no means dead, and as present Editor of the *Botanical Magazine,* now in its 179th year, I would even venture to say that the quality of its drawings and paintings compares very favorably, in technique and artistic merit, with the best work of the past, although perhaps — since the plates in the Magazine are no longer hand-colored — a good deal is lost in the process of reproduction. Indeed, the modern botanical artist, more acutely aware of the needs of science than his predecessor, may honestly claim that there has been progressive refinement and improvement in this specialized department of art.

The same may be said of photography, the successor to, but not the supplanter of, the pen, pencil, and brush. Within its limits, a photograph can be just as admirably sensitive as a painting or drawing, or, for that matter, just as depressing. There is this distinction, that, whereas natural indolence or modesty inhibits the extensive production and display of amateur paintings and drawings, there are unfortunately few who do not fancy their hand at photography, and many who are only too ready to exhibit their skill, or want of it, at some length, given the least encouragement. In all fairness, I should add that the world of botany has been just as slow in acknowledging its debt to the world of art and in exploiting to the full all that the world of art — which includes photography — can offer to our science. How many hours are spent annually in the elaboration of the private language of taxonomy, in drawing up and printing minute — and often unread — descriptions, when a line-drawing or a painting or a photograph, or a combination of all three, would convey immediately and precisely all that comes vaguely through the fog of inadequate terminology.

The shortcomings of language were recognized by the early fathers of taxonomy when they employed the best available artists and engravers to illustrate their herbals, and when, in default of what is imagined to be exact scientific terminology, they were

SIR GEORGE TAYLOR is Director of the Royal Botanic Gardens at Kew, England, and Editor of the two-centuries-old Botanical Magazine. *This article is adapted from an address which he delivered at the opening of an exhibit of fifty historically and scientifically significant books that are classics of "Three Centuries of Botany in North America." Dr. Frans A. Stafleu, Secretary of the International Bureau for Plant Taxonomy at Utrecht, Holland, also spoke on the occasion which celebrated the publication of the first volume of* Wild Flowers of The United States. *In the foreword of the catalogue describing the exhibit, President Bronk said: "The publication of* Wild Flowers of The United States *by Harold William Rickett is a landmark in the history of botany." The book is sponsored by The New York Botanical Garden under the general editorship of the Garden's Director, William C. Steere; it is dedicated "To David and Peggy Rockefeller, without whose enthusiasm and generosity these books could not have been written, illustrated, or published." "It is fitting," Dr. Bronk said, "that this last, most complete and beautiful of many books describing our precious heritage of flowers should be seen in the company of notable predecessors. The faculty and trustees of The Rockefeller University are grateful to the owners of these treasured volumes for the privilege of exhibiting them on the campus of the University that Mr. and Mrs. Rockefeller have done so much to make beautiful. It is fitting too that these botanical and literary treasures should for the first time be shown together in the building that bears the name of Abby Aldrich Rockefeller who created on Mount Desert Island, Maine, one of the world's most lovely gardens, that is now cared for by 'David and Peggy Rockefeller.'" The collection of rare books was on public display throughout April.*

obliged to express themselves, as far as possible, in the everyday words of household prose. We honor the memory of Linnaeus and his immediate forerunners and successors, and acknowledge the magnitude of their achievements in reducing a mass of ill-assorted data and opinion to an accessible and ordered codex of scientific information. But even the stoutest defender of Linnaean and post-Linnaean tradition of taxonomy must admit that a great deal of our professional literature is arid and uninformative, and that the ascendancy of Latin protologue and heavily Latinized prose over illustration and non-technical description has discouraged many a potential naturalist and greatly restricted public interest in our activities. I am hopeful that works like *Wild Flowers of The United States* may restore the study of plants to more general popularity.

Flower-books and floras, however artistic, exist to be used, to instruct as well as to be admired. Those of you who have all the floral wealth of the United States at your doorstep will have ample opportunity to put the work of your botanical colleagues to the test. I am sure *Wild Flowers of The United States* will be repeatedly tried, tested, and examined; its imperfections, if it has any, will be pounced upon with that critical glee which serves to sharpen the taxonomic intellect. This is because the life of the taxonomist is one long debate, with, I suspect, the charming prospect of the ultimate conclusion and the final vote being indefinitely postponed. Those of us who are separated from the American flora by the vast emptiness of the Atlantic will use this handsome new work primarily to see how the North American flora compares with the British, and to see how great has been the influence upon our respective floras of three hundred and fifty years of communication. First and foremost, the British botanist, unacquainted with North America, will be astonished at the very large number of British and western European plants which have made themselves at home on the American side of the Atlantic, and which are now considered established and permanent elements in the American flora. I do not know how many such plants are currently accepted as fully naturalized in the United States, but the total must be considerable indeed. It is interesting to read that many were already thoroughly established well over two hundred years ago, for John Bartram, in a most informative appendix to a letter written in 1759 to his correspondent Philip Miller (or possibly to his great friend Peter Collinson), mentions ten or more European annual and perennial weeds in the fields of eastern Pennsylvania, two of them — *Linaria vulgaris* (butter-and-eggs) and *Hypericum perforatum* (common St.-John's-wort) — so common as to be pernicious nuisances there. His account of the means whereby the Scotch thistle (by which I suspect he intends our common thistle, *Cirsium vulgare*) was introduced is so entertaining that I really must quote:

> A Scotch minister brought with him a bed stuffed with thistledown in which was contained some seed. The inhabitants, having plenty of feathers, soon turned out the down, and filled the bed with feathers. The seed coming up filled that part of the country with thistles.

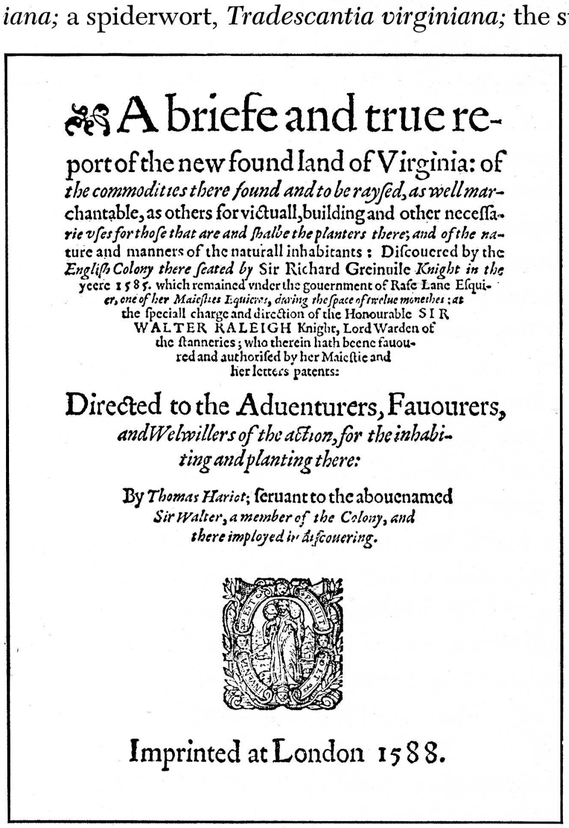
Naturalized Plants

Against the very large number of British and European plants now naturalized in the United States must be set the surprisingly small total of North American plants naturalized in Britain. It is true that the most recent check-list of British flowering plants includes the seemingly large number of 75 such species, but, on analysis, it will be found that this figure is not quite so significant as it would appear. Indeed only five species can be looked upon as thoroughly and widely established. These are *Impatiens capensis,* well named jewelweed; the showy *Mimulus guttatus,* or spotted monkey flower; *Epilobium adenocaulon,* now almost the commonest of willow-herbs in southern England; *Conyza* (or *Erigeron* in the United States) *canadensis,* the horseweed; and *Elodea canadensis* (Canadian waterweed), which spread in alarming quantity and at alarming speed soon after its introduction in 1836, but which has now settled down as an inoffensive and quietly respectable member of British plant society. I should perhaps include the pineappleweed, the rayless chamomile *Matricaria matricarioides,* among the thoroughly naturalized Anglo-Americans, but there is such obscurity as to its place of origin, whether America or Asia, that I must pass it by. Of the remaining species, a few, including the lupines *Lupinus arboreus* and *Lupinus nootkatensis;* the slender rush, *Juncus tenuis;* Spanish lettuce, *Montia perfoliata; Amelanchier confusa* (to quote its latest name), known variously in the United States as shadbush or serviceberry; an aromatic evergreen, *Gaultheria shallon,* salal; a brome grass, *Bromus carinatus,* and the taxonomically intractable asters and solidagos (goldenrods) are evidently on the increase, and may soon qualify for general acceptance as established members of our flora. Another small group, including a snowberry, *Symphoricarpos rivularis;* trailing mahonia, *Mahonia (Berberis) aquifolium;* red-flowering currant, *Ribes sanguineum;* and *Spiraea douglasii, Thelycrania (Cornus) sericea,* and *Populus gileadensis* (balm-of-Gilead), persist as garden relicts or garden outcasts, tenacious of the ground they occupy, but showing few signs of spontaneously extending their range. Here I must mention the rather unexpected success of the pitcher-plant, *Sarracenia purpurea,* which was deliberately introduced some sixty years ago into bogs in Roscommon and Westmeath, in Ireland. There it persisted and spread with astonishing vigor. Strangely enough, an earlier attempt at naturalization in the neighboring county of Leix was unsuccessful, and it is worth noting that three species were originally planted in Roscommon, of which only *Sarracenia purpurea* succeeded.

Let me turn now from the relatively limited contribution of North America to our wild flora, to the much more significant and lasting effects on British gardens. As Director of the Royal Botanic Gardens, I should like to be able to boast that Kew was in from the beginning, and the first to show such treasures as the tulip-tree, the bull bay (evergreen magnolia), and the false acacia (locust) to European gardeners and botanists. Alas, history says otherwise. Choice imported exotics were certainly grown by Queen Caroline (wife of King George II) in the grounds of Richmond Lodge, but Kew is not generally reckoned to begin its botanical existence before 1759, when Princess Augusta, widow of Frederick, Prince of Wales, appointed William Aiton as head gardener with supervision of her small private collection. Long before this date, a great many species had found their way into British gardens: The white-cedar or arbor-vitae, *Thuja occidentalis,* was already known before the end of the 16th century and, if tradition is to be accepted, the false acacia, *Robinia pseudoacacia,* was first imported into France in 1601, and thence into England. The tulip-tree, *Liriodendron tulipifera,* was another early introduction, possibly imported by John Tradescant the Younger, for Peter Collinson (of whom more later) writes thus in 1761:

In 1756, the famous Tulip tree in Lord Peterborough's Garden at Parson's Green, near Fulham, died; it was the tallest tree in the grove, above seventy feet high, and perhaps a hundred years old, being the first tree of its kind that was raised in England, and had for many years the visitation of the curious to see its flowers and admire its beauty, for it was as straight as an arrow, and died of age by gentle decay.

It is generally agreed that at least 150 North American ornamentals had been introduced into British gardens by the close of the seventeenth century, and the list would include, in addition to those already mentioned, such celebrities as the western sycamore, *Platanus occidentalis;* a bald-cypress, *Taxodium distichum;* the common persimmon, *Diospyros virginiana;* a spiderwort, *Tradescantia virginiana;* the stag-



A briefe and true report of the new found land of Virginia: of *the commodities there found and to be raysed, as well mar*chantable, as others for victuall, building and other necessa*rie vses for those that are and shalbe the planters there; and of the na*ture and manners of the naturall inhabitants: Discouered by the *English Colony there seated by* Sir Richard Greinuile *Knight in the* yeere 1585. which remained vnder the gouernment of Rafe Lane Esqui*er, one of her Maiesties Equieres, during the space of twelue monethes:* at the speciall charge and direction of the Honourable SIR WALTER RALEIGH Knight, Lord Warden of the stanneries; who therein hath beene fauoured and authorised by her Maiestie and her letters patents:

Directed to the Aduenturers, Fauourers, *and Welwillers of the action, for the inhabiting and planting there:*

By *Thomas Hariot;* seruant to the abouenamed *Sir Walter, a member of the Colony, and there imployed in discouering.*

Imprinted at London 1588.

Title page of the first edition of Thomas Hariot's A briefe and true report of the new found land of Virginia *London, 1588.*

At the opening of the exhibit "Three Centuries of Botany in North America" in Abby Aldrich Rockefeller Hall on March 20, Mrs. David Rockefeller discusses the book "Wild Flowers of The United States" with, LEFT TO RIGHT, *President Bronk, Dr. Frans A. Stafleu, Diarmuid C. Russell, Sir George Taylor, and Dr. Harold William Rickett.*

horn sumac, *Rhus typhina;* the red maple, *Acer rubrum;* the Virginia creeper, *Parthenocissus quinquefolia;* the trumpet-creeper, *Campsis radicans;* the cardinal flower, *Lobelia cardinalis;* the winter grape, *Vitis vulpina;* the sweet gum, *Liquidambar styraciflua;* and the shooting star, *Dodecatheon meadia.* Where all these novelties were grown is not always very clear, but certainly the two John Tradescants must have had many of them in their Lambeth garden or in the palace grounds at Oatlands, and it is known that Bishop Compton kept a rich variety of exotics at Fulham Palace, while others may have been grown by John Parkinson and John Evelyn. That such a fine collection should have been in existence so long ago speaks highly for the intelligence and hardihood of those early American settlers, and for the skill of 17th-century mariners and gardeners. One delightful species known to have been grown by Bishop Compton at Fulham was the small magnolia, *Magnolia virginiana,* which I have admired growing in its swampy native habitat and also, showing commendable tolerance, in the vastly different, poor, hungry, alluvial gravel of Kew. I must confess that this is one of my favorite plants and I much prefer it to the more flamboyant species from Asia.

Certainly the introduction of American plants was well under way before the end of the sixteen hundreds, but the full flood was to burst in the following century, and in a great measure it was in consequence of the exertions of two very active, and sometimes delightfully amusing, Quaker botanists – John Bartram of Philadelphia and Peter Collinson of London. Collinson, a prosperous draper, first started to grow rare plants with uncommon success in the then "Pretty

Village" of Peckham, now one of the less decorative portions of greater London. In 1749, thanks largely to matrimonial foresight, he fell heir to an extensive property at Mill Hill, on the northern outskirts of London, and there, at Ridgeway House, he developed a garden so rich in novelties of all kinds that it attracted the attention of the accomplished and curious inquirers of the period, and brought him a somewhat embarrassing wealth of botanical visitors and correspondents. He counted Philip Miller, Johann Dillenius, Sir Hans Sloan, Benjamin Franklin, Mark Catesby, Georg Dionysius Ehret, John Fothergill, Lord Petre, the Earl of Bute, and the Dukes of Argyll and Richmond among his friends. He was visited by Linnaeus, who went to England in 1736. He entertained Linnaeus's pupil, Peter Kalm, who was about to set off for North America in 1747. Collinson acted as botanical adviser and general liaison officer between all the Colonial American naturalists. He wrote to Breintnall, Witt, Bartram, Clayton, Colden, Mitchell, and Garden; distributed literature and seeds of European plants; cemented friendships; raised funds for collecting expeditions; and dispensed a vast amount of shrewd and judicious advice, sometimes in quaintly astringent terms, on the widest and oddest possible variety of topics. He was modest of his own botanical attainments, and said in a letter written to Linnaeus in 1756:

> You must remember I am a merchant, a man of great business, with many affairs in my head and on my hands. I can never pretend to publish a catalogue of my garden, unless I had one of your ingenious pupils to digest or methodize it for me.

One feels, nonetheless, that Collinson, like many an enthusiastic botanist before and since, was not the sort of man who would have allowed the demands of commerce to stand too seriously in the way of his favorite science. His close friendship with the Earl of Bute had fortunate consequences for Kew, for the Earl, an accomplished botanist although a detested prime minister, was Princess Augusta's close favorite, and became the first director or superintendent of her newly planned garden at Kew. A contemporary said of Bute that he was totally unsuited to be prime minister for three reasons: firstly, because he was a friend of the King; secondly, he was an honest man; thirdly – and this is where I feel the real sting – he was a Scot! No doubt through Collinson came many of the first rare American accessions to Kew, and it was certainly Bute who arranged for the transfer to Kew, in 1762, of the many rare trees and shrubs previously grown on the Duke of Argyll's estate at Whitton. An ancient *Robinia,* alive but tortured by age, still stands in the gardens to commemorate this historic removal. With Bute's supervision, Aiton's skill, and Collinson's enthusiasm, the collections at Kew rapidly became famous – so much so that, as early as 1766, just seven years after the foundation of the garden, Collinson was able to write to his friend John Bartram:

> The *Stuartia* flowered for the first time in the Princess of Wales' Garden, at Kew, which is the paradise of the world, where all plants are found that money or interest can provide. When I am there, I am transported with the novelty and variety, and don't know which to admire first or most.

Allowing for some forgivable measure of exaggeration, it is clear that a garden which, in 1766, could boast a flowering *Stuartia* – a genus named, incidentally, after the same Earl of Bute – was no ordinary one, and we may assume that it was already furnished with most of the American rarities then known to science. The extent of the period's knowledge, thanks largely to the untiring efforts of Bartram, Clayton, and others, was by no means negligible, and the catalogue of Collinson's garden, overlooked until 1809 and not printed until 1843, comprises 58 closely printed pages, most of them crowded with American novelties ranging from such horticultural aristocrats as *Cypripedium reginae* (showy lady's-slipper), *Lilium superbum* (Turk's-cap lily), and *Magnolia tripetala* (umbrella-tree), to the rather less aristocratic *Ambrosia trifida* (great ragweed). It is difficult to say just how many North American plants were first introduced and cultivated by Collinson, but it certainly exceeded one hundred, and included such popular favorites as *Monarda didyma* (Oswego-tea), *Physostegia virginiana* (false dragonhead), and *Liatris pycnostachya* (a blazing-star), as well as that most astonishing vegetable creation, the Venus'-flytrap. In fact it can be said that by the time of Collinson's death in 1768 most, if not all, the eastern North American flowers still cultivated in our British gardens had already been introduced.

The evening primrose, circa 1775, is one of seven original drawings by Simon Taylor, from the collection of the Royal Botanic Gardens.

Thereafter follows a lull in British-American horticultural and botanical relations, a period overcast by the struggle for American independence and by the European convulsions following the French revolution. Americans had asserted their political independence, and were well on the way to obtaining independence in scientific studies, too, so that it was no longer necessary for them to consult a Dillenius or a Linnaeus for instruction and information. British botanists and gardeners were temporarily agog with Masson's South African discoveries or with the Australasian marvels newly brought back by Banks and Solander. For the moment North American botany was of secondary interest.

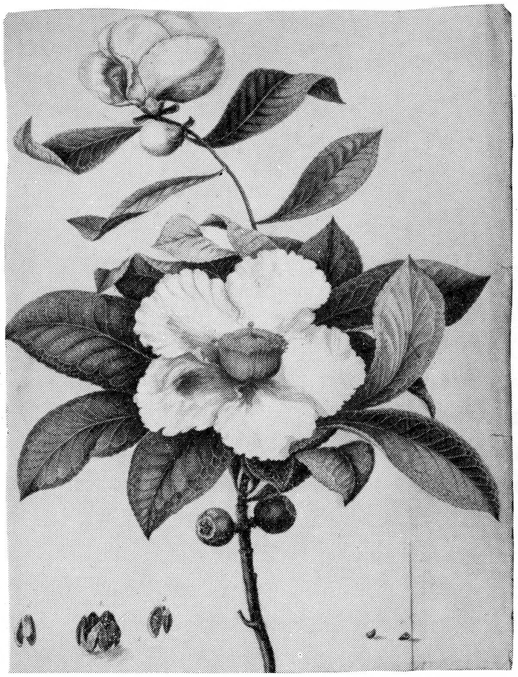
Linnaean Sunset

But the lull was of short duration: with the termination of the Napoleonic struggle at Waterloo and with the first penetration of the American West, a new chapter in the history of botanical and horticultural collecting was opened, with consequences more significant than all that had gone before. In Britain the sun was setting on the Linnaean scene: Collinson, Fothergill, Miller, William Aiton, and the Earl of Bute were all dead, and the last surviving stalwarts of the old regime, Sir Joseph Banks and Sir James Edward Smith, were soon to follow. In botany, the illustrious Robert Brown and his younger rival William Jackson Hooker were the dominant personalities. In horticulture, the recently formed Horticultural Society, presided over by Thomas Andrew Knight and Joseph Sabine, was forging ahead with grandiose and extravagant schemes. The first rapture for South African and Australian plants was already beginning to wane, and that thirst for something new, which afflicts Athenians and scientists alike, was demanding gratification. Since China and Japan were still effectively barred to the foreigner, and since tropical Africa was still impenetrable, the hinterland of America, and more particularly the unknown regions of the Rockies and the Pacific Coast, offered the most promising outlet for pent-up enthusiasm. Moreover, the small collections already made by Meriwether Lewis and William Clark, coupled with the reports and specimens brought to Europe by Archibald Menzies, confirmed the highest hopes of the seekers after novelty.

The task of botanical exploration fell principally upon the shoulders of two very able collectors — Thomas Drummond, who worked first in the North-

"I never saw any of these [acacia] trees but
at one place near the Apalachian [sic] *mountains,*
where Buffalo had left their dung;"
The Natural History of Carolina, *Mark Catesby, 1771.*

Original drawing by William Bartram
of the flower, Franklinia, *named for Benjamin Franklin;*
one of about fifty drawings commissioned by Dr. John Fothergill
during the period 1766-1776;
from the collection of the British Museum.



The plates for
François Michaux's Histoire des Chênes, *1801,*
were based on drawings by Pierre Joseph Redouté,
"the most famous illustrator of flowers
in the history of botany."
This india ink drawing is a detail of the white oak.

west and later in Texas and the extreme South, and David Douglas, unquestionably the virtuoso of plant collectors in western America, whose most rewarding labors were in the Northwest Pacific area and in California. Both had been protégés of William Jackson Hooker while he was Regius Professor of Botany at Glasgow; both were young men when they began their collecting careers in the mid 1820's; and both were dead by the middle of the succeeding decade. The scientific outcome of their brief and often highly perilous labors is enshrined in the twelve parts of the *Flora Boreali-Americana,* written and illustrated by William Hooker, in Hooker and Arnott's *Botany of Captain Beecher's Voyage,* and in countless contributions to botanical journals. But — as with Sir Christopher Wren — *Si monumentum requiris circumspice,* for there is hardly a garden which is not brightened by some memento of their work. Drummond's name at once recalls the gay brilliance of *Phlox drummondii;* Douglas is commemorated everywhere — in the Douglas-fir, the Monterey pine, and Sitka spruce, the musk which lost its scent, the flowering currant, the California poppy, the clarkia, and the border lupine — to mention only a few of the plants which everywhere adorn our gardens, parks, and forests. It is questionable if any other single collector made a greater or more lasting contribution to our gardens, or imported more popular and widely grown plants. With the completion of his mission, the heyday of American plant introduction was over. Of course, much remained to be done, and no doubt still remains to be done, but never again will a collector of American plants create such a general stir in Europe by the extent, the novelty, and the variety of his discoveries. The anticipations of Hooker and the Horticultural Society were exceeded; of some two hundred plants introduced through his agency into British gardens, thirty or more have stood the test of time and are still very generally grown.

The Hooker Epoch

William Jackson Hooker, by then Sir William Hooker, became director of Kew in 1841 and was succeeded as director, in 1865, by his son, Joseph Dalton Hooker. The two Hookers, father and son, presided over the fortunes of Kew for a span of 44 years, maintaining close and friendly connections with botanists and gardeners in all parts of the world. Sir William never visited any part of America, but in the summer of 1877 Sir Joseph, an experienced traveller, spent some memorable months in Colorado, Utah, Nevada, and California with an old friend and correspondent, Professor Asa Gray. To tell you of their adventures would be alien to my purpose, for in the forty-three years that had elapsed since the tragic death of David Douglas, objectives in botany and horticulture had changed no less in England than in the United States. The botanical riches of Asia and the Old World tropics were pouring into our herbaria, and those gardeners who had once paid high prices for Douglas-firs and western yellow pines were now bidding just as eagerly for Himalayan rhododendrons and Chinese or Japanese magnolias. The pioneering work of Robert Fortune in China and Joseph Hooker in Sikkim and Bhutan had initiated a new epoch in the history of British gardens.

American Flora Yield to Asiatic

What has been the general impact of the North American flora upon our British gardens? To satisfy my curiosity, I recently counted the number of North American trees, shrubs, and woody climbers listed in the catalogue of a very well-known English nursery.* The grand total came to no fewer than 307 species, a surprisingly high figure. Then I noted the number of species commonly planted, which one might expect to see without going to Kew or to some similar establishment deliberately maintaining large and varied collections. The total — even making liberal allowance for horticultural initiative — does not exceed twenty, and of these fully a quarter had been introduced in the seventeenth century and another quarter before the end of the eighteenth century. I know we are a conservative people, but the discrepancy between the total available and the total generally planted calls for some less facile and facetious explanation. It is true that the extensive planting of Sitka spruce, Douglas-fir, and other American conifers has transformed and is still transforming our forest landscapes; but in our gardens the taste for the Asiatic still rules supreme. Certainly the Asiatic magnolias have, for instance, generally ousted their American counterparts. Only *Magnolia grandiflora* is to be seen at all frequently in British

*Messrs. Hilliers, Winchester

gardens, and then often as a venerable specimen, a relic of cultivation from the days before the Asiatic species were known or grown. The list of parallel examples is easily extended: Asiatic rhododendrons have largely supplanted American ones, and American species of *Malus, Prunus, Betula, Spiraea,* and *Virburnum* have been largely replaced by their Asiatic counterparts. *Cotoneaster* is grown instead of species of the United States hawthorn, *Crataegus,* and *Weigela* instead of the bush-honeysuckle of North America, *Diervilla.* In most cases, but not in all, it must be admitted that the Asiatic species are more colorful, although sometimes less dignified, than their American cousins; it is also true that many American trees and shrubs are disappointing under British skies, resenting equally the overcast equability of our cool, uncertain summers and our cool, uncertain winters: *Chionanthus virginicus,* or old man's beard, the glory of many American gardens, rarely flowers or fruits freely with us, and is generally less satisfactory than the Chinese *Chionanthus retusus.* The dogwoods, so highly praised by American writers, will, with us, give a moderate display only after an exceptional summer, and the American oaks and maples, which flame so grandly in their native woodlands, are more often than not damp squibs in our autumnal gardens. However much we may covet the Californian teabush, *Ceanothus;* the bush-poppy, *Dendromecon;* and the flannel-bush, *Fremontia;* or cherish the glorious *Stuartia;* the loblolly bay, *Gordonia;* and the *Franklinia,* they must, for the most part, remain plants for the favored few, flourishing only in gardens where the exceptional mildness of winter comes to the aid of constitutions undermined by want of sunshine and warmth in the summer.

American Herbs Still Flourish

The picture is very different when we turn to the herbaceous department and survey the American contribution; here American annuals and perennials still fill our summer borders and beds with unrivalled gaiety, and our summers, dreary though they may be, are unfailingly made more bearable by *Clarkia, Godetia, Eschscholzia* (California-poppy), *Coreopsis, Nemophila,* and *Gilia;* while our herbaceous borders, bereft of *Aster* and *Erigeron* (fleabane), *Helianthus* (sunflower), *Monarda* (horsemint), *Lupinus,* and *Penstemon,* would be but sorry shadows of their former selves. Yet it cannot be pretended that the summer scene has changed much since Douglas sent his last collectings to the Horticultural Society. As I glance through the pages of *Wild Flowers of The United States* I feel that a little more enterprise might be shown by our gardeners and perhaps a little more salesmanship by yours, for many American annuals and perennials never seen in Britain, or at most seen only in botanic gardens or in the private collections of a few connoisseurs, are deserving of wider publicity and cultivation. Perhaps I have been carried away by the illustrations, and have succumbed to the magic of the color-plate, which every seedsman knows so well how to exploit. But to judge from the contents of the first two parts of *Wild Flowers of The United States,* surely in *Iris, Phlox, Erythronium, Viola, Trillium, Asclepias,* and *Penstemon,* and in the families *Orchidaceae, Liliaceae, Malvaceae, Gentianaceae,* and *Compositae,* there must be many species worth trying in our gardens — and many others, already tried — whose beauty would warrant repeated and persistent attention in a wider range of gardens.

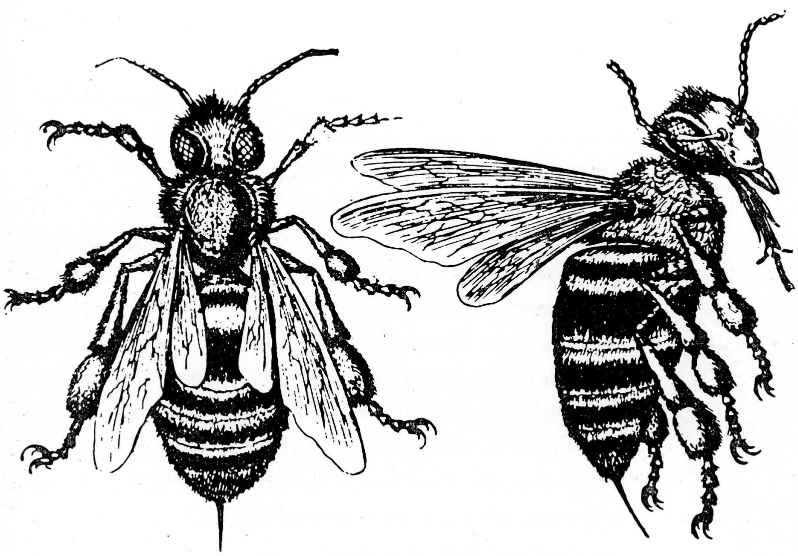
Conservation Vigilance

I am not for a moment suggesting that *Wild Flowers of The United States* is the product of some secret association of botanists, nurserymen, and seedsmen or that it was published to boost the sales of American plants, but even were it so, I would forgive the collusion, for I can think of no flora, wild or cultivated, that has been given such a charming and enticing advertisement. Not that I would ever suggest indiscriminate collecting from the wild. I am sure that you have the same conservation problems in your country as we have in our small one. Threats to beautiful and rare plants caused by overcollection or more usually by developments for commerce or demands of the armed forces — require constant vigilance. It is good to know that in both our countries informed opinion is able to submit balanced and reasoned cases for protection of species and habitats and that the conservationists' proposals are most carefully weighed, although not always accepted.

These, then, are my final words, and I merely hope that I have struck a more or less sensible balance in our mutual wild flower interests, which have for both of us a very special relationship.

CELL BIOLOGY

PAST AND PRESENT



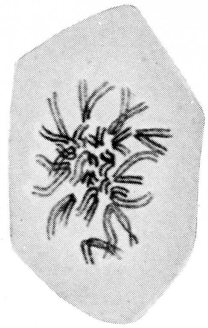
These bees were originally engraved by Francesco Stelluti for the Academy of the Lynx, of which he was a member. Later he re-engraved them for an Italian translation of the Latin poems of Persius, published in Rome in 1630. The figures here are from the latter. Of this study, Stelluti wrote: "I have used the Microscope to examine bees and all their parts. I have also figured separately all members thus discovered by me, to my no less joy than marvel, since they are unknown to Aristotle and to every other naturalist."

BY GEORGE E. PALADE

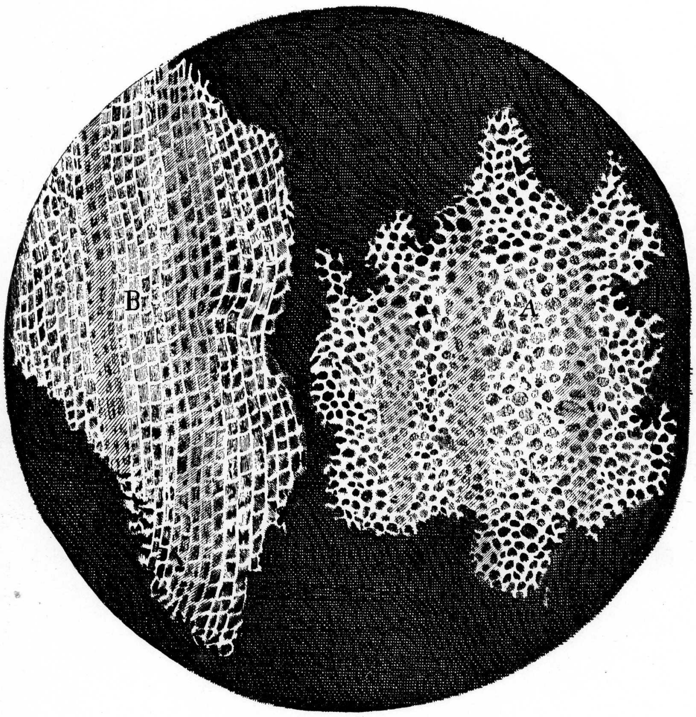
Last fall, Dr. Palade received both the Albert Lasker Basic Research Award and the T. Duckett Jones Memorial Award of the Helen Hay Whitney Foundation – two of the highest honors granted for biological research. The citation for the Lasker award said, in part: "The fundamental discoveries of Dr. Palade have extended [earlier concepts of cellular organization] to previously unimagined levels of detail . . . To Dr. Palade, a scientific leader with imagination and technical ability, who travelled into a new land and became its chief geographer, this . . . Award is given." This article is based on Dr. Palade's remarks when he received the Duckett Jones Award at the Princeton Inn on November 26.

SCIENTISTS, like most human beings, appreciate recognition. Since there is in any scientist more of a curious child than of a detached saint (among many other ingredients), recognition with tangible awards *in vivo*, not *in paradiso* or in the calendar, is enjoyed without reservations or apologies, the basic attitude being that the sooner it comes, the better. It is evident that I have been favored in this respect. Hence, I can use my happy and safe position to advance the suggestion that the age limit for awards and prizes be lowered. It has been rising of late among winners. To begin with, the ability of a recipient to enjoy his recognition may become blunted by too many years of work, or just too many years of living; and to end with, there is little society can expect in return in terms of rekindled interest or more work, if it waits too long.

The natural inclination of a scientist in my position is to deliver a scientific paper dressed for the occasion with some reminiscing, and suffused — if possible — with a reasonable amount of philosophical considerations. It hardly works in twenty minutes or even in a whole hour. Hence, I will avoid this formula,



Many of Walther Flemming's observations of mitosis, which he made from the eighteen seventies until his death in 1905, remain valid today. This lithograph of a Salamandra *cell nucleus shows "simultaneously longitudinal fission of the threads." This fission is, of course, the separation of chromatids.*



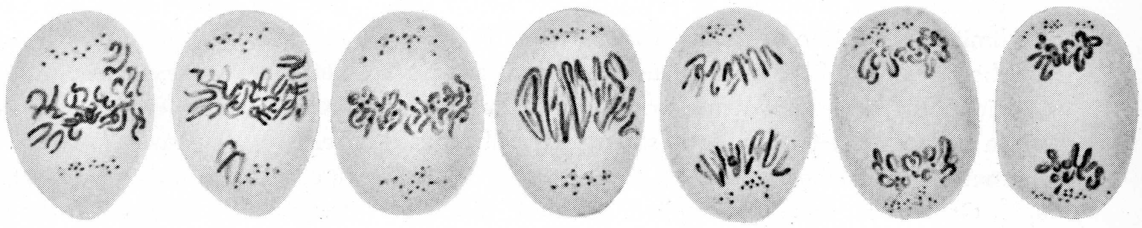
Robert Hooke's drawing of cork, as it appeared in the first edition of his Micrographia, *was published by the Royal Society in 1665. In describing his technique, Hooke says: "I with the same sharp Pen-knife, cut off from the former smooth surface an exceeding thin piece . . . and . . . could exceeding plainly perceive it to be all perforated and porous, much like a Honeycomb, but that the pores of it were not regular . . . these pores, or cells, were not very deep. . . ." This was the first time the word cell was used in a biological context. He went on to say, "it seems very probable, that Nature has in these passages, as well as in those of Animal bodies, very many appropriated Instruments and contrivances, whereby to bring her designs and end to pass, which 'tis not improbable, but that some diligent Observer, if help'd with better Microscopes, may in time detect."*

and I shall try, instead, to reconstruct for you, in condensed form, the development of my field of activity over the years. In this context, the worth of my work, now distinguished by the T. Duckett Jones Award, could be more easily assessed.

For the simple reason that living matter is generally organized on a minute scale, scientific work aiming in the direction of cell research became possible only after microscopes were invented — that is, in the seventeenth century. From its beginning and throughout its entire history, the field has remained strictly dependent on improvements in the resolving power of magnifying instruments. The beginnings were slow and the facts and concepts handled were so few and so disparate that for more than two centuries microscopy remained a hobby of cultured men rather than a recognized field of science.

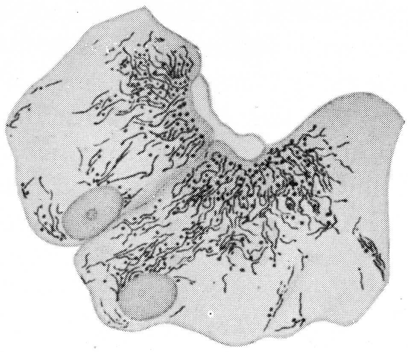
It may amuse you to learn that the first micrograph in the literature was a five-times-enlarged image of a honey bee, published in Rome in 1625 by the Italian Academy of the Lynx. It was the work of Francesco Stelluti, a literatus turned amateur microscopist, who had chosen the bee as his first specimen because the president of the Academy was interested in apiculture. Stelluti must have liked that micrograph, for a few years later he republished it as an incidental illustration in his translation of the poems of the Latin poet, Persius Flaccus. Toward the end of the century, the pace of microscopy quickened — with Hooke and Leeuwenhoek — but the approach did not radically change. After that the field became rather stagnant, primarily because of lack of preparative procedures. The productive vanguard of the time was made up primarily of botanists, who had the signal advantage of being able to cut thin, freehand sections from hard plant tissues. The number of published papers increased, and finally the painful question of how to keep abreast of the literature emerged at the beginning of the nineteenth century. A new paper in plant anatomy — or phytotomy, in the language of the times — was appearing almost every year, and some people were wondering if there was enough time to digest properly information coming in at that great speed.

At the beginning of the last century, work on lens corrections started in earnest, images improved, and systematic comparative histology of plant and animal tissues became possible. One of the first outcomes was the celebrated cell theory proposed around 1840 by Matthias Schleiden and Theodore Schwann. It was based in good part on wrong premises, but it was reaching toward correct conclusions, at least concerning the idea that the fully developed cell is the structural and functional unit of living matter. Stagnation set in again until the next period of lens improvement, which occurred in the late 1870's. Most of the progress was due to a remarkable man, Ernst Abbe, who worked out a satisfactory theory of image formation and designed lenses so effectively corrected that their limit of resolution was equal, or nearly equal, to the theoretical limit in visible light. It was a spectacular step forward which set the basis for modern light microscopy, and over which little has been improved in the last eighty years of work in light optics. The repercussions in cell research were equally spectacular. In the following twenty to twenty-five years, preparations techniques were diversified and refined, and chromosomes, centrioles, mitochondria, the Golgi apparatus, the ergastoplasm, and the sarcoplasmic reticulum were discovered or redefined. That was indeed the golden era of light microscopy, studded with the names of the great discoverers Flemming, Altmann, Ranvier, Golgi, Garnier, Cajal, which were still filling the pages of the cytology and histology books forty to fifty years later when I entered medical school. Yet, there was an element of frustration in the entire development: all one really knew about those subcellular components was that they existed in many cells and that they underwent certain structural modulations while the cell went through this or that functional cycle. The only meaningful modulations were those undertaken by chromosomes in cell division. The rest was confusing and seemingly unfathomable, but not void; it was filled with theories, hypotheses, assumptions, and names — many, many names — huge, imaginative constructions based on little or no evidence. I still remember how uncomfortable I felt through my years of histology and cytology courses, which I digested with great difficulty, and how often I thought that the great era had produced knowledge that led nowhere. The only exception was the discovery of chromosomes, and chromosome behavior in mitosis and meiosis, which later on was so successfully used in cytogenetics.



These figures are from Flemming's observations of cell division in living seminal epithelium of the Salamandra.

In the middle 1920's, experiments in electron optics were started by Busch in Germany, and in the late 1930's the first commercial electron microscopes became available. They brought with them the promise of a large increase in resolving power — by a factor of about 100 — but also severe limitations in specimen preparation: only fixed and extremely thin objects could be examined in the new machines. This situation led to a repetition of the process through which preparatory techniques had been developed for light microscopy about a century before. The first specimens for electron microscopy were obtained by mechanical disruption of various tissues and contained only tough structures, like collagen fibrils and myofibrils, able to survive the treatment. Attempts were made to cut thin sections from conventionally prepared tissues, but the results proved disappointing: they showed little gain in information over what was already known from light microscopy. The only re-



In 1890, Richard Altmann developed a staining procedure which he thought was specific for certain cell granules, later recognized as mitochondria. This figure, from Altmann's Elementarorganismen, is a section of liver tissue from Rana esculenta "fixed with deosmium mixture."

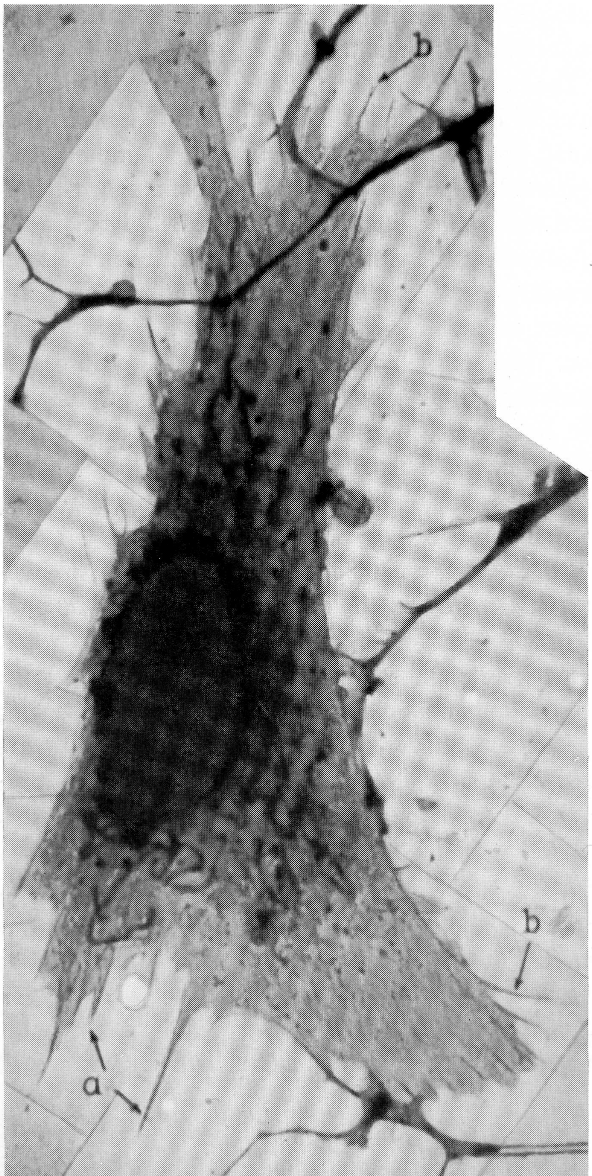
warding approach, as far as cell research was concerned, was that followed in the middle 1940's by Albert Claude, Keith Porter, and their collaborators, who decided to use thinly spread cultured cells as specimens for electron microscopy. The approach was limited in its applicability, and yielded only a partial view of cellular organization, but it produced the first clear indication of cell structure below the limit of resolution of the light microscope. It led to the discovery of the endoplasmic reticulum and, incidentally, to the first demonstration of viral particles in cells cultured from Rous sarcomata and mouse mammary carcinomata.

General pressure was applied, however, in a different direction — to develop techniques comparable to those already available in light microscopy; that is, to reduce specimen thickness by microtomy and thereby to make accessible to electron microscopy any type of cell in its natural habitat, which, in the case of metazoon cells, meant in the intimacy of animal tissues. In the late 1940's and early 1950's, about fifteen years ago, a series of improvements in preparative techniques bearing on embedding, fixation, and microtomy finally made possible this kind of universal approach, and opened for electron microscopical investigation a whole new stratum of biological organization stretching from ~2500 Å — the limit of resolution of the light microscope — down to the limit of resolution of the electron microscope, which at that time was somewhere between 50 and 20 Å. Since then it has been progressively reduced to 5 Å or less. To be sure, our techniques of the early fifties were not the final answer: they have been repeatedly and substantially improved since then. And the opened layer was not as thick as the figures of the resolution limits would indicate. The full resolving power of the electron microscope could not be used, and still cannot be used, in biological specimens because of lack of adequate contrast. Yet, with all these reservations, we had a spectacular break-through, primarily because the newly opened layer proved to be much richer than had been expected in resolvable structures.

The task of the electron microscopists that started the exploration of these new territories was rather simple: to ascertain the existence of new structures; to translate in three dimensions the essentially two-dimensional information obtained from thin sections; to look out for meaningful relationships and modulations; and to find out how widely spread or how restricted in their distribution were these new structures. Notwithstanding the simplicity of the approach, arguments and conflicts were rather frequent. The atmosphere of the field was slightly reminiscent of the California gold rush and each of the new forty-niners was rather touchy about his nugget or nuggets. Yet, the images of the new nuggets were so clear that even the most promising controversies did not succeed in living more than a few years. In retrospect, what is most impressive is the speed at which the exploration was carried through; the rapidity with which the findings were extended to the generality of cells; and the ease with which quasi-unanimity was reached, at least as far as strictly structural interpretations are concerned.

Each pioneering group brought to this enterprise its skills and its drive, as well as its past and prejudices. The French, led by W. Bernhard and C. Oberling, stressed the points of continuity with the great era of light microscope cytology, and pointed out that many of the new structures were rediscoveries of old findings, sometimes discredited or forgotten. The Swedish group, led by F. Sjöstrand, stressed high resolution and precise measurements aimed at detecting general principles of organization in the so-called "double membranes," and attempted, perhaps sooner than possible, a molecular interpretation of structural patterns observed. Our group — at that time Keith Porter and I — moved in a different direction. We tried to find out how widespread was the occurrence of the new subcellular components, as a first indication of their importance. We stressed the extensive compartmentation of the cytoplasm and the interrelations of these compartments with one another; we looked for functionally meaningful modulations; and we concentrated on the most elaborate of these new compartments — the endoplasmic reticulum. Others, like H. Huxley and H. Fernández-Morán, joined the field to work, at the beginning at least, on special topics like myofibril organization and myelin sheaths, which they had studied before by other means. In due time, each group was enlarged and diversified by many interested newcomers. The work of those years is now part of our common patrimony, and words like ribosomes, endoplasmic reticulum, cisternae, and cristae are so much a part of our current vocabulary that it seems hardly necessary to define them or retrace their history.

In the middle 1950's, the activity in the field continued in an atmosphere of great excitement and high expectations. People spoke of a true renaissance in morphological sciences, and they were right; but a discerning eye already could perceive, through the rosy mist, that the layer was approaching exhaustion and that the whole movement was running the risk of a repeat performance of the post-Abbe period in light microscopy. An unusually fortunate coincidence made the difference: almost concurrently with the introduction of electron microscopy in cell research, techniques were developed — primarily by Albert Claude — for the mass isolation of subcellular components via differential centrifugation. In fact, the first piece of work I did in the late 1940's, when I joined Claude's group at The Rockefeller Institute, was in cell fractionation, not in electron microscopy. In one of those minor but useful laboratory rebellions, in which "the boys" try to do better than their master, George Hogeboom, Walter Schneider, and I devised a technique for isolating mitochondria that retained *in vitro* the form and staining affinities they have in the intact cell. The basic premise was simple: to use morphological criteria systematically for working out cell fractionation procedures. That was a good introduction and a well-learned lesson, which led me in the middle fifties to join forces with Philip Siekevitz and to start a long series of integrated structural and functional (or biochemical) studies of subcellular components. The general approach we followed was to isolate in mass, by various centrifugal procedures, morphologically recognizable old or new subcellular components, using electron microscopy to check the results of the fractionation; to establish the gross chemistry of each fraction; and to assay its enzymatic and biosynthetic properties in order to find out the function of the corresponding component in the intact cell. Sometimes the order had to be reversed because cell fractions of unknown cytological significance, like Claude's microsomes, were already in the books. One way or another the work led to the identification of microsomes as fragments of the endoplasmic reticulum and to the identification of the



This first electron micrograph of a cell was taken by Keith R. Porter, Albert Claude, and Ernest F. Fullam. It appeared in a paper titled "A Study of Tissue Culture Cells by Electron Microscopy," published in 1945 in The Journal of Experimental Medicine. *It is "a fibroblast-like cell . . . from chick embryo tissue." Magnification is x 1600. The authors said "the adequacy of the electron micrograph technique for the demonstration of the structural features . . . is beyond question."*

small cytoplasmic particles I had found in 1953 as ribonucleoprotein particles. As is well known, under the name of ribosomes these particles have made a prodigious career in cellular and molecular biology. By the time Jack Kirsch, Philip Siekevitz, and I succeeded in demonstrating that such particles isolated from liver are capable of incorporating labeled amino acids into proteins *in vitro,* we were already in a large, active, and distinguished company. Similar results had been obtained with ribosomes from a variety of bacterial, plant, and animal sources.

Being primarily interested in the functional role of the entire complex of cell structures, we chose the exocrine cell of the mammalian pancreas, a convenient cell type in which we could study a series of problems such as the role of attached and free ribosomes, the role of the endoplasmic reticulum; that of the various elements of the Golgi complex; and that of secretion granules.

In addition to electron microscopy and cell fractionation procedures, from time to time the new orientation required new tools, and this led to the adaptation of autoradiography to electron microscopy by Lucien Caro, and to work with pancreatic slices and microsomes *in vitro* carried out with James Jamieson and Colvin Redman, respectively. Step by step, the important events in the secretory cycle of the pancreatic exocrine cell were unraveled and the functions, or at least some of the functions, of the subcellular components already mentioned were demonstrated. In the process, the pancreatic exocrine cell became one of the best-understood cells in terms of structural-functional correlates and, as a result, what we learned about it has been frequently used as a model in interpreting findings made on other cell types less extensively studied.

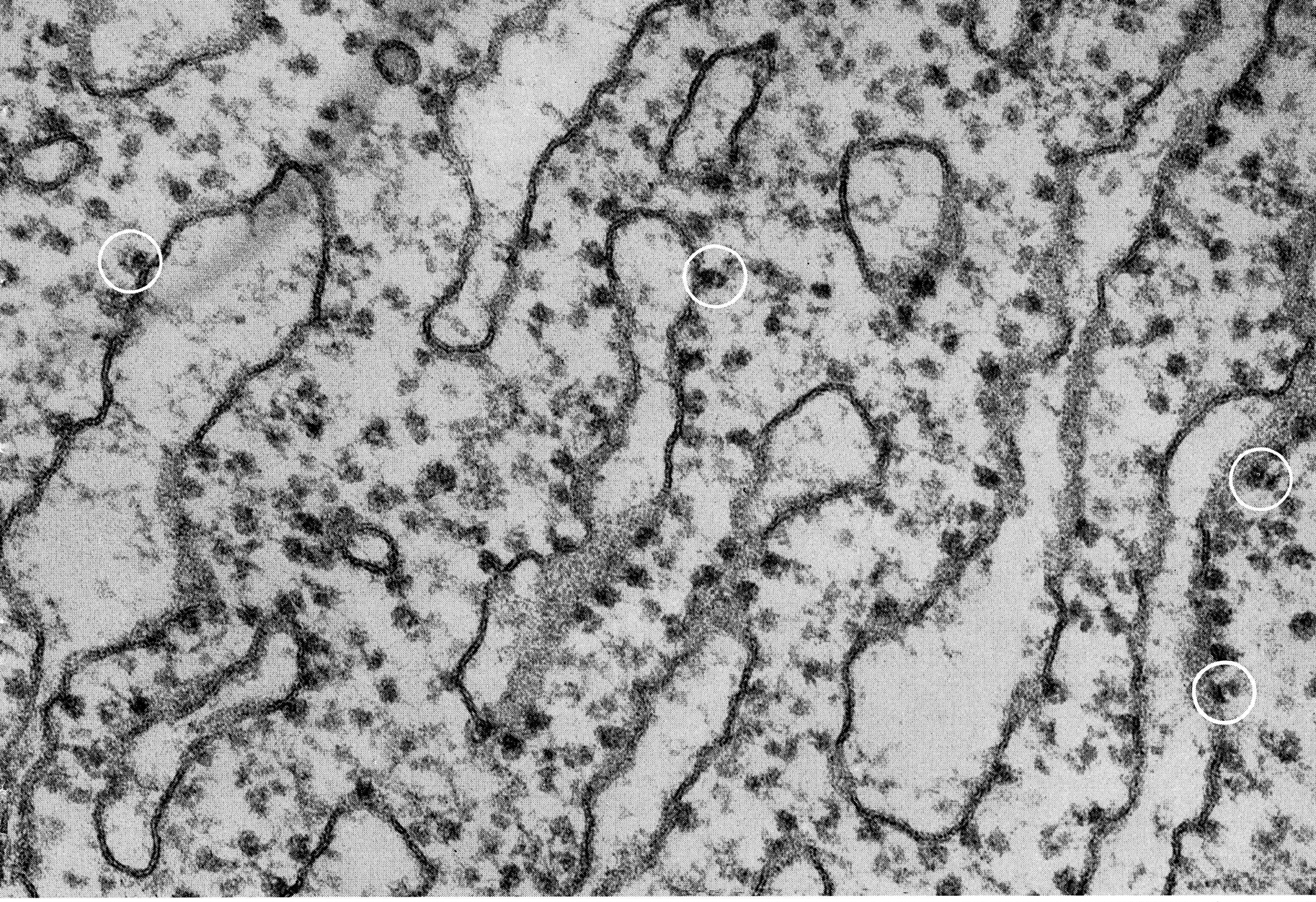
By the early 1960's, work following this integrated or convergent approach was already going on in a number of laboratories on a variety of topics such as mitochondria, lysosomes, nuclei, striated muscle, striated borders of the intestinal epithelium, and blood capillaries. It is difficult to say who led and who followed. Integration was in the air; it was finally possible; and men working in many fields independently saw the opportunity and seized it. A kind of broad, all-encompassing science was developing with remarkable vigor, submerging old boundaries and forging a new basic biology, a cell biology, from parts that once belonged to microscopical anatomy, biochemistry, and biophysics. The by-products were a journal and a society. It was finally clear that the "renaissance," initially brought about by the increased resolving power of the electron microscope, was developing in a way quite different from that of its predecessor, the post-Abbe period in light microscopy. It was producing reasonably good science.

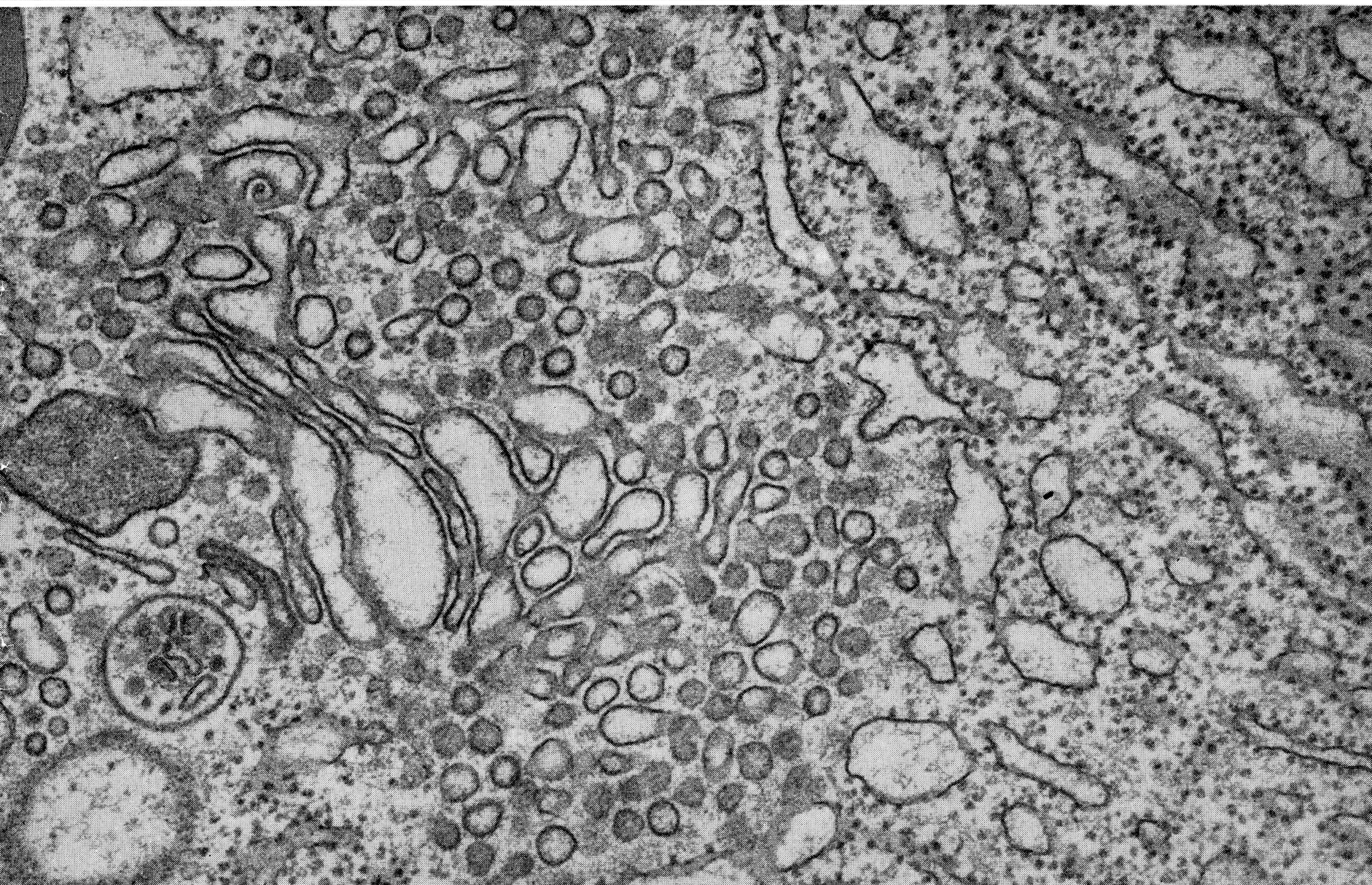
We have reasons, therefore, to be happy about the immediate past and even the present; but is the future of this field equally promising? Frankly not, because the famous stratum is now rapidly approaching exhaustion, and because even a widespread application of integrated approaches has the chance of strengthening the flanks rather than of advancing the front of the movement.

The last unknown and probably the most difficult layer of biological organization to analyze still lies ahead, barely scratched. It is the layer of immediately supramolecular organization and concerns patterns used and forces involved in the assembly of molecules and macromolecules into such elementary structures as various membranes, ribosomes, chromosomes, filaments, fibrils, and practically everything else. What is really frustrating is that the necessary resolving power is available, at least in good measure, but cannot be used because of lack of contrast, which means that our techniques and our instrumentation again require extensive adaptation and refinement.

Ten or twelve years ago the main task in cell biology was to uncover the functional role of a whole set of newly discovered or already known cell organs. Now, with part of this task accomplished, we must explore and understand the molecular architecture of elementary biological structures, for, in ultimate analysis, this architecture determines and controls the function of every cell organ and of the cell itself.

Electron micrographs by the author. FACING PAGE, TOP: *Basal region of acinar cell of rat pancreas showing endoplasmic reticulum with attached ribosomes. Circled ribosomes show the groove separating the large from the small subunit.* x 144,000
BOTTOM: *Golgi complex in acinar cell of rat pancreas.* x 56,000





THE ROCKEFELLER UNIVERSITY

NEWS

National Academy of Sciences

MOSES KUNITZ AND HENRY G. KUNKEL were elected Members of the National Academy of Sciences, in recognition of their distinguished and continuing achievements in original research, at the 104th Annual Meeting of the Academy on April 24. Election to the Academy is considered one of the highest honors that can be accorded an American scientist.

Dr. Moses Kunitz has been with the Rockefeller since he became Technical Assistant to Jacques Loeb 54 years ago. He is a world authority on the purification and crystallization of enzymes. Although he retired officially in 1953, Dr. Kunitz's "continuing achievements in original research" are active and productive. His extensive work in purifying and crystallizing ribonuclease and deoxyribonuclease from beef pancreas, as well as pyrophosphatase from baker's yeast, provides the starting point for contemporary biochemical researches with these enzymes going on in laboratories throughout the world. In 1957 Dr. Kunitz was named Carl Neuberg Medalist by the American Society of European Chemists and Pharmacists.

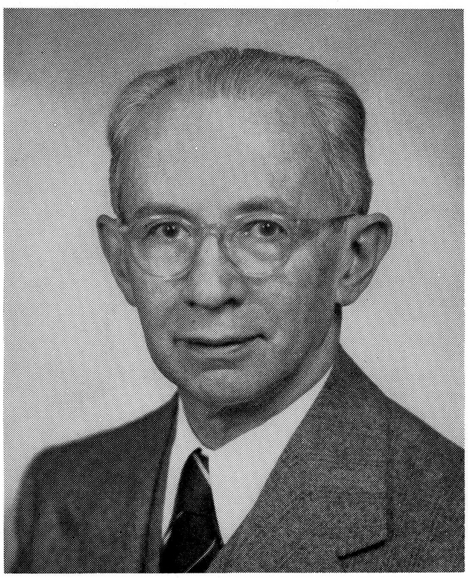
Dr. Henry G. Kunkel, Professor and a Senior Physician of the University Hospital, is widely credited with observations on immunological mechanisms in disease which are the basis for much of what is said on this subject in textbooks today. His work with myeloma proteins and other γ globulins is particularly well known, and he has made significant contributions to the development of zone electrophoresis. Dr. Kunkel's more recent studies have helped pioneer understanding of the character and genetic relationships of the immunoglobulins and antibodies.

Dr. Frederick Seitz of our Board of Trustees presided at all sessions as President of the Academy, President Bronk delivered a memorial tribute to H. P. Robertson, Foreign Secretary of the Academy 1958-61, and Dr. Peyton Rous was the commentator at the conclusion of the symposium on RNA viruses and neoplasia.

Environmental Influences on Behavior

BY DAVID C. GLASS

ON APRIL 21 AND 22 the third in a series of conferences on Biology and Behavior was held in Caspary Auditorium under the joint sponsorship of The Rockefeller University and Russell Sage Foundation. This third conference was concerned with Environmental



MOSES KUNITZ

HENRY G. KUNKEL

Influences on Behavior. The first two dealt, respectively, with Neurophysiology and Emotion [*Review*, Nov.-Dec. 1965] and Genetics and Behavior [*Review*, Nov.-Dec. 1966]. The conference series was designed to strengthen the dialogue between the biological and social sciences, and to stimulate a rapprochement between the two disciplines in order that future work in each field might be undertaken in fuller recognition of the other.

There is a marked and growing concern among social scientists about the effects of environmental factors on biological mechanisms of behavior. One example is the recent work with small mammals on environmental stress and adrenal and gonadal functioning. Correspondingly, many biological scientists call attention to the fact that a comprehensive human biology cannot omit one of man's more striking characteristics, namely, his social nature. Although the interdependence of the organism and his environment has long been recognized, the systematic study of environmental effects on biological functioning and its behavioral consequences has received less attention than it deserves. It was to this issue that the most recent conference on Biology and Behavior was addressed.

The principal paper of the conference was delivered on the evening of April 21 by Professor René Dubos, who noted that "... the human genetic pool remains essentially the same from one generation to the next, [but] its phenotypic expression varies greatly and rapidly in response to changes in the ways of life and the total environment." But later in his talk he said:

> Man's evolutionary past naturally imposes constraints on his life in the modern world. In fact, the frontiers of technology and sociology are determined by biological limitations built in man's fundamental genetic make-up, which has remained much the same since the late Paleolithic times, and which will not change significantly in the foreseeable future.

Dr. Dubos devoted the major part of his paper to a detailed consideration of the consequences for human biology and behavior of some of the environmental forces which are most characteristic of the modern world.

The morning session of the first day of the conference was concerned with early nutritional deficiencies and later mental performance. It was concluded that malnutrition is one of the contributing factors to poor social background, poor physical growth, and inadequate mental functioning. A number of empirical studies suggest that children with a history of early malnutrition are educational risks. Normal adaptive functioning requires a normal environment, adequate nutrition, and a normal genetic constitution.

The second session considered early social deprivation in nonhuman primates and its implications for human behavior. The papers uniformly emphasized a comparative perspective, underlining the view that an understanding of human behavior and development can be aided by systematic examination of primate behavioral development. It became increasingly clear that environmental and social events during the first few weeks of life are vital to the development of the infant. It is almost impossible to overcome opportunities for learning lost during this period, and this indeed may be a critical period for psychological development.

On the second day, the effects of social isolation on human learning and performance in social situations were discussed. Data were presented on the relationship of the presence and absence of others to learning and performance. Social interaction, i.e., from the presence of other children, had a facilitative effect on performance, whereas social isolation had an inhibitory effect. But this finding needs qualification, for there is other evidence showing that humans tend to isolate themselves from further stimulation after a high degree of social interaction. Additional social contact may actually lower rather than raise performance level. It would appear that organisms seek an optimal level of arousal that varies from environment to environment and from species to species.

The final session of the conference was addressed to research on cultural deprivation and its effects on higher mental functioning. Distinct differences in behavior and mental organization as between middle and lower class children do not emerge clearly until after two years of age. Data suggest that every child requires a set of schema to interpret experience, distinctive events to promote the development of such schema, perception of a model whom the child views as possessing attributes he values, a set of goals promoted by people the child admires, and, finally, some degree of certainty about the occurrences of each day. Some children are deprived of all or most of these ingredients, and it is this group that has customarily been termed "culturally deprived."

It was concluded that neither the social nor biological determinants of behavior can be emphasized to the relative exclusion of the other. As Dr. Dubos noted in his evening address,

> Whether physical or mental, human potentialities can become expressed only to the extent that circumstances are favorable to their existential manifestation. Society thus plays a large role in the unfolding and development of man's nature.

Robbins Plant Science Building

ON MARCH 18, the William J. Robbins Plant Science Building was dedicated at The Fairchild Tropical Garden in Miami, Florida. Dr. Robbins, a Trustee Emeritus of The Rockefeller University, has been closely associated with the Garden as a member of its Board of Trustees and, since 1962, as its President.

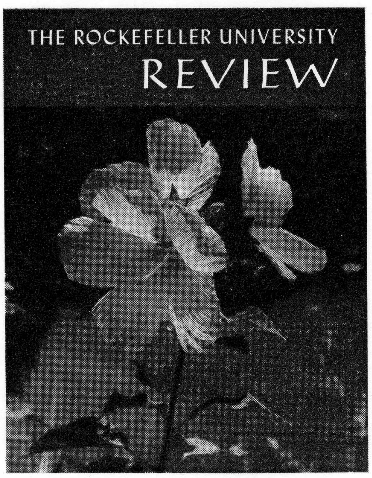
The building contains laboratories for plant anatomy, taxonomy, cytology, and physiology, a library, a herbarium, a seminar room, offices, and a photography section. The eight-acre site was provided by the Montgomery Foundation and the funds for the structure by the National Science Foundation.

The Garden includes the finest and largest collections of palms, cycads, and tripsacums in the United States.

¶ This spring, President Bronk was made an honorary citizen of West Virginia by Governor Smith and received an honorary Doctorate of Science when he dedicated the first scientific laboratory to be constructed under the Federal Appalachian Program.

¶ On April 15, the University was host to the members of the Torrey Botanical Club, the oldest botanical society in the United States. Professor Armin C. Braun presided at the scientific meeting in Caspary Auditorium where Doctors Reddi, Robbins, Voeller, and Wood discussed their research activities. This was followed by visits to the botany exhibit and to University laboratories engaged in botanical research. The meeting honored the Club's centennial year.

¶ Professor A. Pais paid tribute to J. Robert Oppenheimer — his former associate at the Institute for Advanced Study — in an address, "The Princeton Period," presented at the J. R. Oppenheimer Memorial Session of the American Physical Society on April 24, in Washington, D. C.



THE COVER shows the rose-mallow, *Hibiscus palustris* — with a freshwater pond at Southold, Long Island, in the background—from *Wild Flowers of The United States,* Volume 1, page 145 [*story on page* 1]. Picture by the eminent photographer of flowers, Samuel H. Gottscho.

ACKNOWLEDGMENTS: COVER photograph courtesy of The New York Botanical Garden and Samuel H. Gottscho. PAGE 1 wood engraving "Hollow Leav'd Lavender," from Josselyn's *New Englands Rarities Discovered,* London, 1672. PAGE 2 photograph by Nancy Palmer Photo Agency. PAGE 4 title page of Hariot's *A briefe and true report* . . . reproduced by permission of The Clements Library Associates from their facsimile edition. PAGE 5 photograph by The Rockefeller University Illustration Service. PAGE 7 courtesy of the Royal Botanic Gardens, Kew, England. PAGE 8 Catesby engraving courtesy of The New York Botanical Garden; Bartram drawing courtesy of the British Museum; Redouté drawing courtesy of the Royal Botanic Gardens. PAGE 11 bee drawings from *Persio,* Rome, 1630. PAGES 12 AND 13 cork drawing from *Micrographia,* Robert Hooke, first edition, London, 1665, The Rockefeller University Library collection; *Salamandra* lithographs from "Beiträge zur Kenntniss der Zelle und ihrer Lebenserscheinungen," Volume II, in *Archiv für Mikroskopische Anatomie,* Volume 18, by Walther Flemming, Germany, 1880. PAGE 14 drawing of frog liver tissue from *Elementarorganismen* by Richard Altmann, Germany, 1890. PAGE 15 electron micrograph, *Journal of Experimental Medicine,* Volume 81, 1945. PAGE 17 electron micrographs by George E. Palade. PAGE 18 photographs by The Rockefeller University Illustration Service.