flowers which were easily visited by thousands of insects of all kinds.

There is quite a little group of shrubs which occur on the banks of rivers (and often in beds of streamlets) that overflow. These shrubs are submerged often and are not hurt. These *fluviatile* shrubs have a certain facies, very difficult to describe. There must be thirty or forty species of them in the Yunnan river valleys. These shrubs do not occur elsewhere than on banks or in the beds of streams. The last one I have found is a very fine species of *Ficus*. This class of shrub would be a nice enough problem for some one to work out.

I hope you will try and get a young Cambridge or Oxford botanist to come to this part of the world, do some naturalist work, and collect seeds and live plants for cultivation. China is a very easy country to travel in, and expenses of travelling are not heavy. The mountainous regions of Yunnan and Szechwan are very healthy besides.

TECHNICAL INSTITUTIONS IN ENGLAND.

THE current number of the *Record* of Technical and Secondary Education contains some encouraging statistics with regard to the establishment, extension, and adaptation of permanent technical schools and institutions in England since the passing of the Technical Instruction Act, 1889. The primary object of the inquiry (the results of which are now published) was to ascertain the amount of money sunk in buildings for technical education by local authorities, but some valuable information regarding certain details of organisation was obtained at the same time, and has been incorporated in the article. The statistics do not take into consideration either higher grade schools or schools governed by schemes under the Endowed Schools Acts and other secondary schools; but they refer to all the various types of permanent technical institutions, and, consequently, there are included domestic economy schools, agricultural and horticultural schools and colleges, farm schools, and dairy schools. It was intended to take in university colleges so far as they included technical or agricultural departments, but it is stated that as these institutions are largely non-local in character, supplying certain educational requirements in large areas by reason of the financial assistance of local authorities, they have been excluded. The following summary, given by the *Record*, shows the developments which have taken place, but, as has been mentioned, it only partly represents the progress made since 1889, as it does not take into consideration secondary schools serving the purpose of technical institutes.

The figures which appear under the head of "counties" refer to those institutions which have been directly established, and are being exclusively maintained, by County Councils.

(1) NUMBER OF MUNICIPAL SCHOOLS EXISTING OR IN COURSE OF ESTABLISHMENT:—

	Schools.
(*a*) In 47 county boroughs	71
(*b*) In 130 non-county boroughs and urban districts	132
(*c*) In 30 counties	36
Total number of municipal schools in England	239

This number does not include—(1) those voluntary technical schools which will probably become municipal institutions in the near future, viz. the schools in three county boroughs and three non-county boroughs and urban districts; (2) the municipal classes, held in rented premises, in 29 non-county boroughs and urban districts.

(2) INCREASE IN ANNUAL LOCAL CONTRIBUTIONS FROM THE RATES:—

	Amount voted in 1895-6	Amount voted in 1897-8	Increase in Rate-aid.
	£	£	£
(*a*) In 15 county boroughs	7,488	17,429	9,941
(*b*) In 70 non-county boroughs and urban districts	6,791	15,960	9,169
In 85 localities	£14,279	£33,389	£19,110

These figures are exclusive of—(1) those relating to Sheffield, where an additional sum of 1000*l.* will be raised by rate during the current year; (2) a total sum of 29,777*l.*, which has been voted from the general rate funds of urban authorities, and applied entirely to *capital* purposes.

(3) TECHNICAL SCHOOLS ESTABLISHED, EXTENDED, ADAPTED, &c., SINCE 1889:—

	County Boroughs.	Non-County Boroughs, &c.	Counties.	Totals.
Number of schools established...	42	89	32	163
,, ,, in course of establishment	12	56	4	72
,, ,, extended or adapted ...	14	46	—	60
,, ,, transferred, purchased, or presented...	29	43	—	72

(4) PROVISION OF SITES FOR TECHNICAL SCHOOLS:—

	County Boroughs.	Non-County Boroughs, &c.	Totals.
(*a*) Sites *purchased* by the local authority ...	20	44	64
(*b*) Sites *given* by the local authority	8	17	25
(*c*) Sites *presented* by private individuals or Trustees ...	7	28	35
(*d*) Sums *involved* in the acquisition of sites: in 23 county boroughs ...			£122,528
in 66 non-county boroughs and urban districts ...			55,214
Total for 89 localities			£177,742

(5) CAPITAL EXPENDITURE UPON TECHNICAL SCHOOLS SINCE 1889:—

	Total sum involved.	No. of localities.	No. of buildings
	£		
(*a*) County boroughs ...	1,351,193	50	69
(*b*) Non-county boroughs and urban districts	826,376	166	172
(*c*) Counties	112,853	22	26
Totals	2,290,422	238	267

To this sum an amount of 50,229*l.* should be added as representing the value of sites for technical schools presented by local authorities, Trustees, and private individuals in 18 localities, and included under section (4) of this summary; an aggregate amount of 2,340,651*l.* is thus shown as having been absorbed by the establishment of technical institutions in England from the year 1889. It should, however, be pointed out that the figures under (*c*) do not include the sums spent by the County Councils of Cambridgeshire, Lancashire, Warwickshire, and the East, North, and West Ridings of Yorkshire upon their municipal institutions.

Of the funds dealt with above, it is only possible to give the derivation of a sum of 1,854,036*l.*, which is apportioned among the different authorities as follows:—

	County Boroughs.	Non-County Boroughs, &c.	Counties.	Totals.
	£	£	£	£
Loans	657,183	259,047	27,350	943,580
Donations and subscriptions, and Trust funds ...	309,716	178,436	13,567	501,719
Residue grant ...	167,642	92,366	71,936	331,944
Science and Art Department's grants	11,101	35,915	—	47,016
Lump sums from rate fund	18,036	11,741	—	29,777
	£1,163,678	577,505	112,853	1,854,036

In order the more easily to grasp the significance of these figures and to facilitate comparison, it may be well to present the following table of percentages:—

	County Boroughs. Per cent.	Non-County Boroughs, &c. Per cent.	Counties. Per cent.
Loans	56½	45	24¼
Donations and subscriptions and Trust funds ...	26¾	31	12
Residue grant	14¼	16	63¾
Science and Art Department's grants and lump sums from rate fund ...	2½	8	—
Per cent.	100	100	100

From this table it will be seen that, while the largest proportion of capital expenditure in the county and non-county boroughs, &c., is met by loans, the main source of supply of the County Councils is still the Residue grant. The extent of the assistance rendered by voluntary effort is also clearly indicated, as well as that given by the Science and Art Department; the smaller urban districts appear to have received the largest contributions from these two sources.

THE BRITISH ASSOCIATION.

BRISTOL MEETING.

SECTION K (BOTANY).

OPENING ADDRESS BY PROF. F. O. BOWER, SC. D., F.R.S., PRESIDENT OF THE SECTION.

SHORTLY before we met last year in the hospitable Dominion of Canada, two biologists, whose work relates to the questions I propose to discuss to-day, passed away. In both cases their services to science had received honourable recognition in this country. Johannes Japetus Smith Steenstrup, who had been for more than thirty years a foreign member of the Royal Society, died June 20, 1897, at the advanced age of eighty-four; Julius von Sachs, also a foreign member of the Royal Society, died May 29, 1897, aged sixty-five.

The former of these, a zoologist, was probably best known in this country for his work on "Alternation of Generations," a translation of which was published by the Ray Society in 1845. The title-page describes the phenomenon as "a peculiar form of fostering the young in the lower classes of animals." Botanists should remember that this term "alternation," which they often use in a sense peculiarly their own, was originally applied to the course of development in certain animals, by Chamisso in 1819. The first general statement of the subject from the zoological side was by Steenstrup in the work already named; even there no mention is made of such phenomena in plants, until the concluding paragraph, where there is an allusion in very general terms to the course of events in the life of seed-bearing plants. But when we remember that it was only in 1848 that Suminski discovered the antheridia and archegonia borne upon the prothallus of a Fern, we see plainly that Steenstrup could not have used the term "alternation" in the sense in which it is now generally applied to plants. The interest for us as botanists will therefore be that Steenstrup suggested in his work on alternation in animals how in the life of plants successive phases exist, and that these are comparable to those which he described in many animals.

The work of Sachs, on the other hand, has influenced every one of us. Some, including myself, have had the great advantage of his direct personal guidance; all must have derived pleasure as well as profit from his writings. I shall not here attempt any general summary of the achievements of this great man, for that has been done efficiently by the scientific press at large. I shall merely allude to one feature of his work, viz. the style of its presentment to the reader. He was always clear, usually concise. He was, in addition to his power as an investigator, a master with the pencil, as well as with the pen. It was this combination of qualities which made him the great text-book writer of his time. Never perhaps has a volume more fairly reflected the position of a science at the moment of its publication than did that of Sachs. It resembles the work of a snap-shot camera, and, like any instantaneous photograph of life in motion, it has fixed and perpetuated awkward positions. The morphological system of the time was stiff and unpromising; the text-book accurately depicted this, but it did not suggest or anticipate future developments; it did not bear the softened image of a longer exposure; it presents to us the angular attitude of a moment.

The powers of Sachs as a writer found their best scope in his "History of Botany," a work which will always retain its value as a masterly exposition of the results of very wide reading, arranged with a literary skill which is unfortunately rare among scientific men. I lay stress upon this power of Sachs as a writer, apart from his record as an investigator, because he was strong where so many of us are weak. The truth is that little effort is made by men of science to use a concise and transparent style; for the most part we write by the aid of such instincts as nature has given us; few cultivate composition. But it should, I think, be impressed upon the young aspirant that, when he writes, it is one of his first duties to consider his readers' convenience; he must use all endeavours to convey forcibly the result of his inquiry, but to make the least possible demand upon the patience of his readers. I should like to see certain papers selected as models of construction, to be studied as such by all candidates for our higher degrees; we should naturally include in the list those of the best masters of style in foreign languages, and among them would rank the late Julius von Sachs.

THREE PHASES OF MORPHOLOGICAL STUDY.

It will be in your memory that the Address of last year's Sectional President was largely devoted to branches of our science which touch the material and economic interests of man. It was pointed out to us how certain fungal diseases diminish agricultural profits to an extent which may be estimated in millions of pounds yearly. Beneficent microbes were also mentioned, such as those which govern the aroma and maturing of butter and cheese; these and many others, the study of which lies properly within the province of botany, affect not only the health, but, at the most varied points, the comfort and prosperity of mankind.

It is unnecessary for me to dwell further upon these matters, or to urge again the utilitarian argument for the proper support of botany. I propose, on the other hand, to invite your attention this morning to the Morphology of Plants. This is a department of science pure and simple. The results which it brings have not, and cannot be expected to have, any money value in the markets of the world. The present time is one of unusual bustle and change in morphology, consequent upon the discovery of new facts and the introduction of new methods. The development of the study may be divided into three periods, we ourselves standing upon the threshold of the third. The earliest phase was that of description and delineation of what might be observed of the mature form of plants; this includes the work of the herbalists and of the earlier systematists, who thus furnished the basis for classification. It is true that the mere description was enriched at times by comparisons made, but these often took a capricious form, as is shown by the many curious allusions which still survive in the nomenclature. Erasmus Darwin satirised the imaginative comparisons indulged in by early writers in his "Loves of the Plants"; an instance of this is seen in his lines referring to the legendary organism, half animal, half plant, suggested by the peculiar form of *Dicksonia* (*Cibotium*) *Barometz*:—

> "Cradled in snow and fann'd by arctic air
> Shines, gentle Barometz, thy golden hair.
> Rooted in earth each cloven hoof descends,
> And round and round her flexile neck she bends;
> Crops the gray coral moss, and hoary thyme,
> Or laps with rosy tongue the melting rime.
> Eyes with mute tenderness her distant dam,
> Or seems to bleat, a *Vegetable Lamb*."

The tendency to comparison thus already perceptible asserted itself strongly in the next phase of our study, to which it gave its character. And now the need arose for observing development; this was initiated by Schleiden, and carried to a triumphant climax by Hofmeister. Passing from the hands of these pre-Darwinian to those of post-Darwinian writers, the comparisons, while remaining virtually the same, received a new significance. Observers now pushed their inquiries into the details of anatomical structure and development, and in many cases attached an importance beyond what is justifiable to minute similarities or differences of cell-cleavage. Thus what might be called "cellular morphology" became a feature of the period. It has, however, been in a measure discredited by the excessive zeal of some of its votaries, who drew large conclusions from slight facts; a salient example of this is furnished by studies concerning segmentation of the ovum. But we must not assume that because it has been pursued indiscreetly, the study of segmentation is effete; there is still scope for valuable observation, which will bear a reasonable burden of argument; though conclusions from such a source must be compared with those derived from other data, and a due estimate of them must be made accordingly.

Morphology has lately passed to a third stage—that of experiment—with a view to ascertaining the effect of external agencies in determining form, and the limits of variability under varied circumstances. Development of itself shows only how a part originates; it does not demonstrate what it is, nor what it may become under special conditions. This new and growing phase of experimental morphology, together with comparison