especially by Perrin's work, so that much of the basis of this difficulty may be fairly considered as now removed.

Quite analogous to the reduction from the normal of the moisture held by a semi-permeable medium brought about by the addition of salt to the water, is the reduction in the vapor pressure arising from the presence of a salt in the water. The vapor pressure is likewise increased by the application of hydrostatic pressure, which may be effected by means of an inert gas. In both cases the hydrostatic pressure which must be applied to bring back to normality is equal to that which the added salt would exert if it were in the state of vapor or, in other words, the osmotic pressure.

The two cases are really very similar. In both there is equal molecular transfer backwards and forwards across the bounding surface. In the one a transfer from that solution to the semi-permeable medium and back from it into the solution. In the other a transfer from the solution into the superambient vapor and back from it into the solution.

The processes are very similar, namely, equal molecular transfer to and fro across the respective surfaces of separation.

Thus we may in the case of osmotic equilibrium attribute the phenomenon with Callender to evaporation, but not evaporation in its restricted sense, from a free surface of liquid, but as we have seen from a saturated colloidal surface into the solution. This process might perhaps be better referred to as molecular emigration, the term migration being already a familiar one in connection with liquid phenomena.

F. T. Trouton

THE SPIRIT OF A UNIVERSITY

A decade ago in the United States of America, in a university rated among the first in numbers of students, the professor of astronomy was summoned before the president and the governing board and asked whether he believed the nebular hypothesis which he discussed in a text-book issued under his name. An answer in the affirmative was promised to cost him his teaching position. He answered in the negative, and to prove his sincerity assented to calling in his books and having them burned in public. A less number of years ago a university president whom we to-day honor as a first citizen found it well, or shall we say necessary, to step out of his chosen field of work because he held the minority view among his associates that the word democracy does not mean a political party only. Some months ago a professor of philosophy, teaching its principles as he saw them and under a freedom apparently guaranteed him by charter, alleges his resignation is requested because such teaching in the mind of his president is incompatible with the doctrinal views of an avowedly religious organization operating in some state or states of our Union.

Again, the members of a faculty wake to their accustomed labors and over the coffee and in the newspaper receive first word that their places have over night been declared vacant; a university president demands that his faculty vote Yes or No as an expression of their confidence in him; a faculty member backed by brains and fearlessness rises to condemn most of those time-sanctified institutions of boards of control and university presidents.

It is well to emphasize that these illustrations do not represent hand-picked rarities, but are typical of a class of problems which in greater or less degree arise periodically to clog the machinery of university education. Neither can it be said that a correct solution is not usually found for them. The only question of importance is why the delay in so doing and why so much

of heart burning in the process. The perspective of time answers ever the same—some of those involved, and they may be trustees, presidents, faculty members, or the public at large, have never learned or have temporarily forgotten what constitutes a university.

And what does constitute a university? Time again writes: *It is a collection of men at work solving the problems that our universe presents and standing ready to teach to others the methods of such analysis.*

This definition will doubtless strike many a reader as strangely incomplete. As a first omission will be felt the ignoring of its legal status which in our modern day plays so large a part in the constitution of the university. To understand properly the national, state or municipal aspects of a university we must go back to the original charters granted the original institutions, when we will see in them nothing but the sovereign guarantee of special protection to the workers which constitute the university. The reasons for the necessity of such special protection we shall discuss shortly; but here it is well to ponder for a moment the mere fact. It can hardly be said that such protection of the men of our faculties in America has ever made itself apparent. There are plenty of illustrations to the contrary. Would we find any virtue in the legalization of our privately or publicly controlled universities, we may say that this guarantees a certain protection to the tools with which our faculties work and legal supervision of the custodianship of such things of value which private citizens have at times given to the university to improve the tools of the faculty.

It is well to understand of what such tools consist. They are the records of past workers and the material necessities of the present—among the first, books and such other evidences of its labors as a bygone generation may have seen fit to leave behind; among the second, our buildings and their contents from penwipers and kitchen chairs to tubes of rare gases and janitors. It is entirely in keeping with America's veneration of property rights that legal supervision of the university should be most evident in the protecting hand which it spreads over her material aspects. Some day perhaps our country will attain the standard of the middle ages and extend an equal protection to the men that constitute the university, for, after all, the carpenter's chest is not the carpenter, and while the workman may make him new implements, the rarest tools need hands and minds to guide them.

It is evident from these simple considerations that the sine qua non of a university ever has been and ever must be a group of clear thinking individuals possessed of expert knowledge gotten at first hand. The wobbly logician is useless from the start. Neither does mere possession of much or even expert knowledge make the university type. Teachers in primary grades and the high school are supposed to have as much, and certainly the teaching staff of a technical school. The university man is more than a mere animated manual of useful information in captivity. What we expect of him is not instruction in facts but instruction in methods, and how can he teach others to analyze world problems who has not learned himself?

Let it not be assumed that this obvious point of view so glibly and generally assented to in spirit is as readily adopted in the specific university problem. There is ever a deal of cry for the "practical" man in university instruction who will give our sons and daughters the immediately applicable formulæ for curing headache, shoeing horses, freezing ice cream and raising hay. I am by no means opposed to such

things, only let us not forget what their real place is, and by over-emphasizing them as ends in themselves create in our universities an atmosphere in which a thinking doctor, an engineer who knows principles, a real physiologist or a real agriculturalist can never be made. John M. Coulter has summed it up well: "We are interested in the practical application of knowledge rather than in practical work without knowledge."

It does no harm to try to visualize the university as we have defined it. Its beginnings go back to before the days when the word was born. The shepherd who first distinguished the wanderers from the fixed among the stars breathed its spirit. Socrates and Galileo were good-sized universities in themselves. The academies of the middle ages were the beginnings of the modern, more formal conception of the university. They were collections of men who thought for themselves of matters universal, and taught others how to think. There are some universities in Germany. The name is no guide to them in America. A change in name hardly makes a college, a finishing school or a state-controlled chicken ranch into a university. No doubt degrees may be acquired, and the ambition "to make friends that will be useful in after life," to dress simply and yet expensively, to gain the assurance necessary to live off father's farm, may all be satisfied in many of these places, but is this a university education? With what mixed feelings one reads the autobiography of a Darwin! After two years in Edinburgh and after three in Cambridge he writes, wasted. Only his open holidays stand out when he walked the fields with Henslow and in him found the university. And what shall we say of the institutions usurping the name which for a quarter century allowed Darwin to work at their doors, to achieve that which brought a new salvation, to attain universal recognition, before they themselves invited him in? Must every generation learn anew that a university is not a neat package of fixed ideas, but a place offering sanctuary to unshackled thinking?

A faculty does not, however, constitute the whole university in the minds of the average public. There are boards of trustees, presidents, and we might add, deans, to be considered. Few institutions in the flesh have given rise to bitterer discussion. To understand the why of this and the merits of such discussion we need but recall the history of their development and interpret their acts in the light of what constitutes the spirit of a university.

The best universities, perhaps the only universities known, and the spirit of which every country is busy copying, have no boards of trustees whatsoever, and no presidents. The faculties in them elect each year a dean, and since there is but one of him he might be called a president. But he is not chosen because of his ability to get money for a hard-up institution, to collect or dismiss a faculty, to meet the legislators in the lobby or the well-to-do in their homes, but as an acknowledgment on the part of his confrères of his contributions to the thought of his day. His influence over his faculty is the silent influence of leadership, not the noisy one of accidental power. For trustees in these universities there is no need, for auditing clerks are sufficient to visé bills, the amounts of which may not exceed appropriations originally settled upon when the professor assumed charge. A department is judged by results and not by the neatness of its correspondence files and signed bills.

There was something of this same spirit in the original American universities. There were boards of trustees, but originally

all, and even to a late date many members of such were members of the faculty. The boards had, in other words, delegated to them administrative powers and duties which they could do better than the faculty—clearly a step forward in the terms of efficiency. With time, however, faculty representation in the board became less conspicuous. Originally, the reasons for this were also not bad. A university is the embodiment of certain educational ideals, and it was, of course, to be expected that many not directly connected with a faculty, but interested in the progress of education, should seek opportunity to labor for it. And why should not such labor receive acknowledgment in a position of administrative trust on a university board?

There must have been much of mutual help in a meeting in which men of the outside world brought to cloistered students their practical suggestions, while those within aided the outsiders to catch the ideals of the universities, all presided over by a president chosen for his first-hand knowledge of educational problems. Had things remained so it would have been well for all concerned. But exactly as the past decades found more to admire in the investment banker than in the builder of the road, and more in the squirter of water than in the engineer, so the superintendents and employers of the faculty came to mean more than the output of the university itself.

Excessive attention to the machinery of the university has served to blind us to the obvious fact that it is but a tool and that what we want is more product. There is a law of diminishing returns in the administration of universities as in other forms of activity. In too many spots in our country the administrative tail has wagged and wags the dog. I know the dominant member of a university board who habitually refers to the teaching staff as the hired help. It seems no accident that the strong men of this faculty have found more congenial fields of labor elsewhere. Even national bodies dedicated to the advancement of university education get stung by the efficiency bee. A member of such once classified the engineering branches of our universities on the basis of money spent per student hour. Weaker than the report were the backs of many university attachés which bent under the weight of its fearful authority; nor did stiffness flow back into them until President Maclaurin killed the hundred-and-thirty-page Goliath with a two-page pebble in which he pointed out, what might have been recognized before, that the efficiency of a university is not to be reported on in the same way as the efficiency of "a glue factory or soap works."

It has been urged in extenuation of the gradual acquisition of all administrative powers by trustees and president that such has been made necessary by the weakness of our faculties. Relatively speaking, they have hardly been weaker than many of the superimposed administrators, but in the absolute we have not been so strong as we might. And the reasons for this too are not far to seek. Being so largely ignorant of what really constitutes the spirit of a university, it is but natural that we should have pursued and still pursue a course which keeps a chronically weak-kneed faculty in professorial chairs. In expressing to a friend one day the opinion that the Chinese would one day become a world power, he retorted that he did not think so, because for several hundred years they had not given birth to a new idea. This would, I confess, seal their fate in my eyes were it not for the fact that for these same centuries the Manchus holding sway over them have discouraged all original thinking by the chopping off of heads.

There are a lot of Manchus in our American universities. One of the worst of these is the insecurity of the teaching position held by the professor. It is a tremendous element in the development and supremacy of the German university that her professors are appointed for life and are, to all intents and purposes, not removable for anything short of murder. Big men enlist for such prizes, but not for jobs which terminate automatically every academic year or at the pleasure of a new president or new board of trustees. It will be answered to this that men inadequate for professorial positions must be gotten rid of for the benefit of the university. True, but the way out of the difficulty lies not in the dismissal of professors. The men concerned should never have been appointed to professorships, for assumption of their chairs could hardly be expected to change them much.

But as certainly as our professors should not be subject to dismissal except under the most exceptional circumstances and then only when judged by their peers, equally certainly should there be a quiet burying-ground for the walking dead. The conquest of our universe is the advance of an army, into which many have entered and all should be allowed to, but of which only the picked may live to take final command.

The recruiting of our university faculties begins to-day in the positions for graduate students, fellows and assistants. They form good starting-points and should be as numerous as possible in order to give all those who are called or think themselves called, an opportunity. Of the numerous starters, merit should in due season bring reward to the better ones, and these be made instructors, assistant professors, or, if you please, associate professors. It is in this ascent of the hill that the weak should drop out and under. If properly supervised they might be pushed out and under. It should be understood at all times that a university is not a hospital for the infirm.

Hastily viewed, our present system seems to offer just such opportunities, but in practise an almost opposite result is obtained. It can hardly be said that every one may enter the lists for a university career. On the other hand, once in, the purest bone with long life and robust health may attain a top place. Everything encourages this. If short in virility and long in servility any one may mount in the course of several years from four hundred to a thousand or fifteen hundred. Non-objection to domestic service tempts him into matrimony, and pity for the young couple encourages the raise to eighteen hundred. The third reel tells the story of the rest of this university man's life. He is acknowledged no good, he has not the desire or nerve to quit, and he is not pushed out because he is married. Our universities are full of such men. They are the food of caricaturists and satirists and yet our universities themselves make them. Nor will they become of historical interest only until we stop filling up our teaching bodies with men whose first virtue is their cheapness. The day must come when we will frankly draw a monetary dead line at the point where a man can just live alone and bid him die there unless the character of his work is such that he is accepted into the fold of university-sized men and thereby at once assured decent compensation for a family and life tenure of office. There should be no stepping-stones across this gulf. However agreeable to the chief the placid acceptance of his ideas by the subordinate, however admirable length of service, such do not make the university professor, and university rewards should not be his.

There should, however, be opportunity for the capable university man who has

still to gain the coveted upper place, to work and teach without subserviency. It is unfortunately true that, being human, even great men find virtue in the merely faithful dog, and under the prevailing system of appointment in America, where to stand in with a powerful professor or to be the graduate of the right school means more than accomplishment, such can not help but prosper. And yet it is the less agreeable young worker who thinks independently and differently that we really wish to develop. The situation brings vividly to the front the necessity of lower pitched university positions for which any man may qualify and in which he may enjoy independence and opportunity for individual thinking while receiving as compensation a fixed salary from the university administration or from the students whom he attracts. A university is not alone a collection of clear and new thinking men, but a nursery for such. As one surveys our American institutions as now constituted one wonders how, should they appear, there would fare in them a Voltaire writing "Oedipe" at twenty-two, a Michelangelo carving the young St. John at twenty, a Galileo discovering the isochronism of the pendulum at nineteen.

The American has been accused of being racially without individuality. All the men tighten or bag their clothes in the same season and all the women replace, if so able, felt with straw on Easter day. These things mean in toto a desire to stand with the majority, and it is but natural that to so stand should be considered right, for such view receives constant encouragement in a land where the voice of the many is the voice that rules. It is this view carried into our universities that has done so much to keep us well in the rear. Neglecting for the moment its mischievous consequences from the standpoint of material support and development, for it is not easy to impress the ideals of higher education on a grammar-school mind, this majority view has blinded trustees, presidents, faculty members, and the public at large to the real purposes of a university by demanding that they of it constantly exhale this. But to be of university size its men have very decidedly to voice a *minority* point of view. To believe in and teach the circulation of the blood in 1914 does not make or require a university man. The time for this passed about 1628. Nor will our universities reach a higher level before we have accustomed ourselves as a nation to expect heterodoxy in them and have learned to like it so well that we encourage it. Sovereigns, men of power and of wealth, governments even, have for centuries known this, and spread their protecting hands over the men of their universities to the point even of putting them above the law. It is the blighting influence of the majority demanding that its view be taught in all its schools which has so long made our state and municipal universities lag behind the privately endowed. Democracy owes the latter an unpayable debt in the examples they have given of how to breed and develop that minority point of view which time makes a majority one.

How to encourage this one thing for which our universities exist is well illustrated by those of Germany. Our colleagues there enjoy complete freedom of teaching. It is not expected of them that each shall teach the same thing and in exactly the same way. With us there must be so many hours of this and so many hours of that, all neatly divided according to rules and regulations laid down by the latest college conference. Why not as many hours as possible of that which the man knows best and then another man or another institution for another phase of the same or a

different subject? How can a new point of view come into being or be developed except as we let those whom we have assumed to be able to foster such alone, to spread the new belief with all the power in them? When this day comes men will again call themselves the products of men and not, as now, the products of teaching factories.

But the undertow of interference with freedom of teaching actually goes deeper than this formalism. In Germany even a docent teaches as and what he pleases, and this in spite of all our notions regarding restriction of expression of opinion under European flags. With all our extravagant claims of free press and free speech, our universities are forever debating whether this or that may be discussed in a class room and this or that speaker may use our platforms. Presentation of any living issue, especially if it involves politics, religion or the social sciences, seems tabooed from the start. And yet if subjects with a little less perspective than that given by four hundred years are not the true raw material upon which our universities are to work, what are? Must we forever in practise admit the truth of the father's view in Shaw's play who sends Fannie to Cambridge because he knows that there, if anywhere, will be found alive the atmosphere of the eighteenth century?

We can not leave to anyone's censorship the matter of who and what may or may not be heard in the forum of our universities. We have learned to honor a Luther because he preached the bars down in matters religious; a Jefferson because he preached them down in matters political; a Humboldt because he preached them down in matters educational. The university preaches the bars down for the discussion of all subjects. Those who visit her do not come to be taught a gospel but to use judgment in selecting the best from the gospels presented.

It remains to justify this special protection, this, to some, reckless use of material wealth in support of those who constitute a university. But what need we say of those who have proved themselves the greatest single force for the increase, distribution and maintenance of the one universally desired and valuable commodity—happiness? Can we express in comprehensible values the freedom given the mind by a Newton, a Herschel, a Laplace? Has the public ever paid too much for the blows to superstition of Vesalius, Servetus, Agassiz? Do we remember that for the dynamo and motor and their thousand delightful consequences England never paid Faraday more than twenty-two hundred dollars a year? Was a docent's income too high a price for the Hertzian waves and wireless? Has any one counted up the hours of pain that ether and chloroform have forever abolished? Do we walk daily through pestilence and remember to bend the knee to Pasteur? Shall we detail the millions which a Liebig has added to agriculture? Have we gained anything when the desert brings forth fruits and the swamp something besides death? Will Smith, Laveran, Ross and Reed be even thought of when the boats of a hundred nations push their way through the Panama ditch which the work of these men alone made possible?

If we would further replace intolerance by tolerance, superstition by knowledge, hunger and famine by food, sickness by health and death by life, if we would see happiness where there are tears and blood, the way is clear. A university is not a luxury for the favored of fate. From her cup drink alike and are satisfied sovereigns by the grace of God, aristocrats, bourgeois and proletariat. If gratitude is a

thing of the human heart all classes owe her allegiance. In her the rarest individualist and the broadest communist find common ground. Individuals have freed the many, which, would they remain so, must nourish the fields from which their liberty has sprung. When democracies forget, the individual may rise to do what the many should. A Vilas, a Carnegie, a Rockefeller puts governments to shame. To discover among us the pioneers of thought and to set them at the world's work is university business, and he who does this, be he philanthropist, trustee, president, or faculty member, is a university man.

However uneven the progress of the university, however in innocence or by intent those momentarily in command may chasten her spirit, the need for her will keep her alive. The ever-new problems of an ever-changing universe guarantee this. In the history of our world that religion has always been best which has been newest, because the newest takes greatest cognizance of and tries best to meet the problems of the age in which it is born. Religion invites defeat because it attempts to do more than this by prescribing for all the future which no age and no spokesman for an age can foresee. For the same reason political constitutions ultimately meet amendment or pass out entirely. Our forefathers could hardly draft laws to meet the problems of steam transportation, of telegraphic monopoly, of meat trusts and the thousand other things that our own age has discovered. Only science, which on new evidence will change all her laws over night, is as secure to-morrow as she is to-day. Her spirit is the spirit of the university to which alone the strong will and the weak must forever bow.

MARTIN H. FISCHER

APPROPRIATIONS FOR THE DEPARTMENT OF AGRICULTURE[1]

WITH the continued enlargement and extension of the functions of the United States Department of Agriculture, the annual appropriation act providing for its support has become more and more a measure of much public interest. The latest of these acts, signed by President Wilson June 30, 1914, and carrying appropriations for the fiscal year commencing with the following day, is no exception in this respect, again establishing as it does the principle of federal aid to agriculture in the broadest use of the term, providing for the maintenance and development of its manifold activities to a larger extent than ever before, and opening the way to an increased efficiency through a reorganization of its work.

The total amount carried by the act is $19,865,832. This is an increase of $1,878,887, or over 11 per cent. over the previous year, and of $804,500 over the estimates submitted by the department. The increased allotments are distributed throughout the entire department, and while many are designed to provide more adequately for its administrative and regulatory functions, which now absorb nearly two thirds of the total appropriations, opportunity is also afforded for the extension of most of its lines of research, and especially for the development of its various forms of demonstration work.

In its general make-up, the law conforms closely to its immediate predecessor, and in fact is somewhat more rigidly confined to the routine work of the department. There are, however, a number of items of new legislation. Thus, the Secretary of Agriculture is directed to prepare a plan for "reorganizing, redirecting and systematizing the work of the Department of Agriculture as the interests of economical and efficient administration may require." This plan is to be submitted to Congress with the estimates of expenditures for the fiscal year 1915–16, these estimates being arranged on the basis of its provisions. A special object of the proposed reorganization is the elimination of the possibility of duplication, and the securing

[1] From the *Experiment Station Record.*