seems to me to be the duty thereto of the astronomer in the quarter century which is before us. The non-Euclidean geometries of Bolyai, Lobatchevski or Riemann are beautiful mathematical structures; they are internally self-consistent and logical. Provided only we assume a mighty enough "curvature," any of these systems can be made to "fit" our physical universe. It has been suggested, though doubtless not very seriously, that the reality and the inevitableness of such non-Euclidean systems could be proved if we could show that the sun of the angles of the triangle formed between our sun and two very distant stars is very slightly different from two right angles. Like the systems named, the theory of relativity is beautiful, internally self-consistent and logical. It would be as futile to argue against it by deducing peculiar consequences or apparent paradoxes in it as it would be to argue against non-Euclidean geometry. Many relativity frameworks are doubtless possible, and any one of these may conceivably be inevitable and necessary, though, following Poincaré, we shall generally choose that system which is simplest. Science, and some would say even government, ethics and religion, is pragmatic. There is but one test of a system; does the system "fit," and can the "fit" be explained only by the system and no other? The line of action thus laid down for us by the theory of relativity is accordingly very simple and direct. We must test the three proofs adduced from astronomical evidence in every possible way. Our criteria will be, first, is the evidence valid, and, secondly, is it impossible to explain it in some apparently simpler way by what we term classical mechanics.

As a by-product of the Allegheny solar wavelength program, Burns and Meggers, by methods which can detect a shift ten times smaller than that predicted by the Einstein theory, find that the shift of the solar lines to the red is far different from the simple and uniform shift postulated by the theory of relativity. They find that amount of shift to the red is a function of the intensity of the solar spectrum line, the finest and sharpest lines being shifted not at all. It seems impossible to find support for the theory of relativity in these results. Others are attacking the same problem, and doubtless programs of investigation are even now under way with regard to the two other proofs, namely, the anomalous motion of the perihelion of Mercury and the observed deflections in star positions photographed near the sun at total solar eclipses. The duty lies upon us of exhaustive investigation of these astronomical apparent evidences. The predicted shift of the spectrum lines to the red is apparently non-existent as a direct result of the theory of relativity; only if future work fails to find explanation for all three proofs shall we need to regard Einstein's theory as both necessary and inevitable. Our course of action seems thus clearly and definitely marked out for us; we must do the work leaving, perhaps, the final summing up and the definite decision as to the validity of this important theory to the astronomer and the physicist at the equinox of 1950.0.

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RESEARCH IN COLLEGES

WE will start with some self-evident propositions, which apply to the colleges.

(1) The *first* function of a college is to teach its students.

(2) Through its faculty, the college has responsibilities to the community, as in making books, public lectures, assisting civic organizations, industries and in religious work.

(3) The college also has a duty to extend the bounds of human knowledge.

These three overlap, for research should be of benefit to teaching and it *is* teaching when students are taught research, and simply the sight of research going on is educational. Moreover, through research we meet our most important obligation to the community.

Is research not better left to industry or to the universities? The object of business is to make money, while the object of our schools of learning is to obtain the truth, which we must have if we are to teach. Research is, therefore, a primary function of our colleges. The university and the college can not be distinguished on the basis of interest in the truth. Formerly the search for the truth was a function of the church, but it has handed it over to the colleges. Colleges past the pioneer stage can have no reason for evading their responsibility in finding out the truth. Since the churches have given over the search for truth, it is all the more important that the colleges, many of them denominational schools, should carry on in order to pay back the debt which they owe to the church from which they draw support; woe to the church which forever remains content with the truth which is now accepted and acceptable!

In no institution will all the faculty be engaged in productive research, still less in scientific research. Some will be primarily teachers and executives, geniuses in committee work; others will "build their homes by the side of the road" and inspire young men with their great personalities, without adding anything to the sum total of human knowledge; still others will find greatest chance for service in making

books or public addresses and in great public leadership. All these types are valuable and necessary. But each of us should contribute something.

Our colleges are founded and perpetuated on the ideal of service and if a man in our faculty can not subscribe to that ideal, he ought to withdraw or be withdrawn.

If now there are some who subscribe to the lofty ideals of the college, yet feel that they can serve best by doing none of the above things, but by doing productive research, then the college should try to provide aid and encouragement for them as it would for those doing any of the other things mentioned.

There are several misconceptions in regard to research. An effort to simply find out how sauerkraut is made, I would hardly call a research, even though the information were new to me. As I understand it, the word research signifies a *diligent protracted investigation, especially for the purpose of adding to human knowledge.* No protracted investigation would be required to find out how sauerkraut is made in the Lehigh Valley and the knowledge when found would hardly be novel.

The protracted character of research makes it appear necessary to have an unusual amount of leisure, and those of us in colleges know that we have little or no leisure. Leisure may be desirable for research, but as most people would define the term, it is hardly indispensable, for some of the best research in the world has been done by busy teachers in small colleges. I note that many lament their lack of leisure in a way which assures me that they are really boasting of the fact that their time is well filled. There is no one whose time is not filled up with something. Fair health and will power are all that are necessary. Much can be done in the time between when dinner is called and when dinner is served, according to Ostwald. Then there are our nights, to say nothing of summer.

With only a high-school education, Thomas Mixesell carried on the most complete, extensive and accurate phenological observations ever made, in conjunction with his regular farm operations and with no idea that his records would prove invaluable. In addition to records of rainfall and temperature, he kept records for 150 species of plants for 30 years, recording every phase of plant growth from the time the buds started until the plant was divested of leaves and scarcely a single observation was missing. Similar records were kept of the times of migration, dates of nesting and other life incidents for a large variety of birds. Mixesell was strongly opposed in his work by his wife, who thought it a waste of time. A large portion of his work was destroyed, an irreparable loss! Mixesell's wife typifies the community at large, which is always asking "Of what use is it?" to which the proper answer is that of Benjamin Franklin, who asked, "Of what use is a newborn babe?"

There is need, then, for encouragement of research work. Library facilities, apparatus, leisure and opportunities for publication are the rewards the investigator craves. Simply because our country has the greatest wealth of any in the world, and that certain research organizations are liberally endowed is no proof that civilization will not repeat the stupid blunders of allowing Carl W. Scheele to perish of cold in his miserable little laboratory, or Mosely to be shot at Gallipoli or Lavoisier to be beheaded at Paris. "It took but a moment to cut off that head, but two centuries have not produced another like it," some one has remarked regarding Lavoisier.

What, then, is the function of research in the college? In the words of President Richards, research should be coordinate with teaching. I do not need to add that this has not been the case in the past. Was it not yesterday that the frugal old wives around us exclaimed at the waste of time involved in the investigation of bisparaaminodiorthohydroxyarsenobenzene, unmindful of the fact that this very substance under the simpler name of arsphenamine is ushering in a new day in medicine.

Somewhat like guilty boys who go behind the barn to smoke their first cigarette, those doing research still need to work very quietly to avoid suspicion of neglecting their classes or of subverting established institutions of some sort. This ought not so to be.

Dr. W. R. Whitney remarked to the speaker that the work of Sir William Ramsay on the rare gases has benefited the General Electric Company to the extent of over a million dollars and yet neither he nor University College has directly benefited from that fact. This work was carried on with no idea that it would benefit this or any other company. There are numberless researches which can not be carried out by a single industry with any expectation that the industry will be directly benefited. If the individual *industries* can not take the risk involved in their prosecution, should we expect *individuals* who are enthused with the research spirit to take all the risk? No, I think the colleges should carry on fundamental researches, collecting from the industries or the state the money necessary for the prosecution of the work, in the way of buildings, apparatus and salaries. Such research institutes have already proven a great success, notably the Carnegie Institution, the Rockefeller Institute and the Mellon Institute; and others more definitely affiliated with colleges could be named.

"He who makes two blades of grass grow where one grew before is a public benefactor." This encomium of praise to the farmer who is more indus-

trious than his fellows may be deserved. If he ruined his health and thereby became a charge on his fellows the truth would be less obvious, and we suspect that this proverb, like most proverbs, is only a half-truth. But what shall we say of the chemist Liebig who found that those two blades could be made to grow with no additional sweat of the brow, both this year and next, both on his own farm and every other farm, by merely spreading on the soil a little potash or niter or phosphate from a neighboring farm? Pasteur by his own researches saved France enough to enable her to pay off the Franco-Prussian war debt, according to Huxley. So we may assume that our colleges, which assume this research obligation to society, will eventually be amply repaid for their trouble. Conquest by war made men rich by making weaker peoples poor, but the conquests of science make us all rich, the many enjoying the luxuries of food, raiment and education formerly afforded by the few.

Lastly now as to that philosophical inquiry of Bertrand Russell, as to whether all this wealth and leisure made possible by our mastery of nature is making the race better or worse. Undoubtedly he is right in saying that the biological equilibrium of man is being disturbed, which may produce profound changes in him. Believing in evolution, this is the same as saying that the world is even now passing through one of those cataclysms which in the past caused the destruction of many species, but always caused the emergence of higher forms better suited to the new environment.

I make the plea, therefore, not for scientific research alone, but for the unshackling of knowledge as a whole. Research in language and religion, for example, has to too great an extent been devoted to the dead past instead of to the vibrant present and the pregnant future. Research along the line of eugenics is necessary if the race is to improve.

Mind has not in the past been a conscious directing force in evolution, but there can be no doubt that much can be accomplished in just this thing and the universities and colleges must lead in formulating our ideal and the method of approximating it. In the end it will appear that the aims of science and religion are one. "The Kingdom of Heaven is within you. You shall know the truth, and the truth shall make you free."

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LAFAYETTE COLLEGE

DISMISSAL OF DR. HENRY FOX FROM THE FACULTY OF MERCER UNIVERSITY

"PITILESS publicity" is often the only remedy for educational as well as for governmental ills, and this is equally true whether these ills are recognized as such or are defended in the name of religion or patriotism. The latest instance of the wave of religious intolerance that has been sweeping through certain colleges in this country is the dismissal of Dr. Henry Fox from the faculty of Mercer University, Macon, Georgia—ostensibly not because of anything he has taught or done but because his private theological opinions are not as positive and clear-cut as those of "a majority of the Baptists of the State of Georgia."

Dr. Fox holds the degrees of B.S., M.A., and Ph.D. from the University of Pennsylvania. He has been instructor in biology in the University of Wisconsin, professor of biology in Temple University, professor of biology in Ursinus College and since 1918 professor of biology in Mercer University. From 1907 to 1912 he was field investigator for the U. S. Bureau of Entomology and he has continued to serve in that capacity during the summers since that time. He is the author of numerous research papers and is a member of several national biological societies; he was president of the Georgia Society of Biologists for 1923, and has been secretary of the Georgia Academy of Sciences since 1922. These items are mentioned to show that Dr. Fox is a scientist of recognized ability.

That he was a hard-working and inspiring teacher and an unselfish and helpful colleague is shown by the high esteem in which he was held by the students and faculty of Mercer University. On learning that he was to be dismissed the students passed resolutions (*Mercer Cluster*, Oct. 17) protesting against his removal and commending him for his high Christian character and loyalty to truth, to Mercer University, and to religion; they state that he never taught evolution as a fact but as a theory, that in matters of religion he always showed a reverent, sympathetic and constructive spirit, that "he always advised students to maintain their religious faith and ideals, stating that there is no conflict between true science and true religion; and finally that the great development of the science department at Mercer University had come through his efforts." Students preparing for the ministry who had taken Dr. Fox's work were particularly strong in their commendation of him and in their condemnation of the proposed dismissal.

President Weaver, in an article published in *The Christian Index*, the organ and property of the Baptists of Georgia, after the dismissal of Dr. Fox said of him: "Dr. Fox is a member of one of our Macon Baptist churches in good and regular standing, one of its most constant attendants, a generous contributor to the 'Seventy-five Million Campaign,' and a man whose daily life commands the admiration of all who