While classical vaccine therapy and serum therapy were justly proud of their few spectacular victories, they were humiliated by wholly illogical and much more numerous clinical failures. To post-Ehrlich immunology, test-tube "mutants" are not necessarily specific immunizing agents against corresponding infections, nor are serum "antibodies" in the horse necessarily directed against the antigenic "determinants," pathogenic for man.

Recent studies have shown that pathogenic microorganisms not only multiply in the corresponding specific immune serum but often multiply much more rapidly than in control tubes with normal serum.[33] A specific growth-stimulating bacterial retention product in convalescent animals is no paradox to modern theorists.

Recent tests have shown that tuberculous animals are not only resistant to superinfection with tubercle bacilli, but are apparently equally resistant to influenza, anthrax, streptococci and diphtheria toxin.[34] If in time it should be shown that there is no appreciable specific protective factor in tuberculosis, that the increased resistance to superinfection is largely nonspecific, it will be no surprise to current theorists.

Classical immunology is to-day puzzled by the apparently spontaneous appearance of diphtheria immunity in adolescent Eskimo children in an environment demonstrably free from diphtheria bacilli.[35] Post-Ehrlich immunology is prepared to consider a phylogenetic recapitulation of ancestral immunity not necessitating personal contact with specific infections.[36]

SUMMARY

Future bacteriologists can not assume without convincing experimental evidence that any pathogenic microorganism is necessarily static in its biochemical specificity, but must consider the possibility that immunochemical specificity varies with test-tube conditions, animal species, organ or tissue infected and stage of infection.

Future serologists can not assume without convincing experimental evidence that any specific serum component or property is necessarily a specific "antibody" or "defensive hormone"; but must consider the possibility of a wide range of "ongrafted," "induced" or "mutant" specificities, with no preconception as to their probable immunological rôle.

Future immunologists can not assume that the formation or "induction" of new protein specificities is the only important adaptive factor in specific immunization; but must emphasize the relative importance of collateral hypertrophies of non-specific enzymic, hormonal and genetic factors.

Finally, future clinicians must be cautious in endorsing any infectious theory which assumes or implies that the animal body is static in its biochemical specificity; but must be receptive of the accumulating evidence that specificity varies in different tissues, organs and body fluids, and at different stages of anatomical and physiological growth.

OBITUARY

DAVID STARR JORDAN

DAVID STARR JORDAN was born on a farm near Gainesville, Wyoming County, New York, on January 19, 1851. He died at his home, Serra House, on the campus, Stanford University, California, at 9:45 o'clock on Saturday morning, September 19, 1931, at the ripe age of 80 years and eight months.

On July 3, 1929, Dr. Jordan became very seriously ill, due in large part to the unusual extreme heat which prevailed during the first few days of that month at Stanford. For some time he was confined to his bed and his life was despaired of, but, in spite of renewed attacks, he recovered from each to some extent, but never quite fully; each relapse left him a little weaker than before. During these periods of partial recovery he was able to be taken in a wheelchair out into his flower garden, where he would remain some time each day in comfort in the pleasant surroundings. On one or two occasions he was taken to the quadrangle and to various places about the campus so familiar to him during his long connection with the university. The last of these little visits to old familiar scenes was only a few days before the end came.

Until toward the last he retained his interest in world affairs, and in certain ichthyological studies upon which he was engaged when first stricken. His last considerable contribution to ichthyological literature is a "Check-List of the Fishes of North and Middle America," a volume of 670 pages, the manuscript of which was finished only shortly before what he jokingly referred to as his "unceremonious collapse." He was pleased when the "Check-List" appeared in print (February 8, 1930), and he autographed three copies on March 27.

I first met Dr. Jordan in the spring of 1877 at

[32] A. Besredka, "Le choc anaphylactique," Masson et Cie, Paris, 1930, Chap. 7, p. 263, *et seq.*

[33] M. Nocolle and E. Cesari, *Annal. d. Inst. Pasteur*, 40, 43, 1926.

[34] T. Hirayama, *Ztschr. f. Immunitätsforsch.*, 68, 218, 1930.

[35] Bay-Smith, *Klin. Wochenschr.*, 21, 947, 1929.

[36] Editorial, *J. A. M. A.*, 96, 950, 1931.

Butler University, where he then was professor of biology. The next year I was one of a dozen students led by Professor Jordan on a walking trip of 550 miles through the South—from Somerset, Kentucky, across Kentucky, Tennessee and North Carolina, into northern Georgia. This was, in fact, a traveling school. Dr. Jordan had been through that country before and, being quite familiar with it, he gave us at least one lecture each day on the geology, natural history or political history of the region through which we were passing.

That tramp through the South with Dr. Jordan was the most important influence that ever came into my life. I came to know him intimately and from many angles, and my admiration for his scholarly attainments and for him as a man grew day by day. I then and there determined to continue as a student of his so that I might get as much from his inspiring teaching as possible. That I did, and the association and the personal friendship begun then continued without interruption and without a single jar to the end, I always as his humble and enthusiastic helper, proud of his friendship and grateful for his patience and encouragement.

Dr. Jordan was, first of all, a naturalist. His intimate knowledge of many species of animals and plants, gained through observation and study in the field of many individual animals and plants themselves, was marvelous. In the making of a naturalist and the study of systematic zoology and botany, he regarded books as of value but as of only secondary importance. He often said (quoting Agassiz) "when one studies Nature from books alone, he will not know her when he meets her in the woods or fields." He was amused by the discussion of evolution and the origin of species, in the papers at the time of the Scopes trial. He felt that the only way in which species can be studied understandingly is through a careful examination and comparison of numerous specimens of different and related species. Reading books about animals and plants can not alone give any clear conception of what a species is. And one can not very clearly understand what is meant by the organic evolution of species unless he compares many specimens of closely related species. Books about animals can not lead; a study of the animals themselves must come first. Dr. Jordan was a real naturalist. He knew the animals and plants of the old farm on which he was brought up, and those of every region in which he later lived; not only the fishes (his first and abiding interest), but the birds, mammals, reptiles, amphibians, mollusks, crustaceans, lichens and the algae not only of the fresh waters and damp places but of the sea as well.

Dr. Jordan was a great teacher; great, whether the subject be geology, botany, entomology, invertebrate marine zoology, ornithology, ichthyology, general biology or evolution; or the languages, as German, French or Norwegian; for he, at times, had classes in every one of these subjects—and I was in most of them. In the laboratory, after a few general directions, he usually left the student to his own resources, only asking him a few questions now and then, and checking up on his work. He would very early assign some particular problem to the student. If the student showed any special ability, Dr. Jordan would suggest that he prepare a paper on the subject for publication. Frequently he would ask the student to join him in the study of some group of fishes or collection of fishes upon which he (Dr. Jordan) was engaged. He would frequently ask the student to be junior author with him of the paper. Dr. Jordan has thus had associated with him more young men and women as junior author than any other writer whose name I now recall. He thoroughly believed in the dictum of the late Colonel Francis W. Parker, that "we learn to do by doing. If you wish to learn to write reports of your researches, try your hand at it." Dr. Jordan was an inspiring teacher. The subjects he taught were usually elective, but the number of students that elected work with him was a good proportion of the whole. In the graduating class at Indiana University in 1886 there were twenty-one members (Iowa University was small in those days), but of these twenty-one, five mastered in zoology; four of the five in ichthyology, and four of the five became professional zoologists. One of the best ways to measure the greatness of a teacher is to consider what becomes of his special students.

As an educator Dr. Jordan was no less great. His influence upon educational theory and practice has been profound. Even while yet at Butler College he had begun to advocate the giving of greater freedom to the student in the selection of the subjects that should be required for graduation. When he went to Indiana University in 1879 he continued to speak for greater elasticity in the curriculum. When he became president of Indiana University in 1885, he at once began to put the elective system into effect. He believed that the natural and physical sciences and modern languages are no less valuable than mathematics and the dead languages for mind development and training, and that their cultural value should be recognized. Under this system the student's major professor becomes his counselor and guide. With the opening of Stanford University in 1891 with Dr. Jordan as its first president, then the really great opportunity came and Dr. Jordan embraced it with all his wonderful power and enthusiasm. With a faculty of his own selection of able young men with un-

bounded enthusiasm and an institution unhampered by tradition, the time was auspicious for a great adventure in higher education. It was made; and what was largely educational heresy then is now accepted throughout America. Under Dr. Jordan's influence the natural sciences became respectable parts of the college curriculum.

Although Dr. Jordan was deeply interested in all branches of natural history, his special field was ichthyology. His first paper, however, appears to have been botanical, on "The Colors of Vegetation," published in 1873, and his next, published the same year, was on "Hoof-rot in Sheep," both no doubt resulting from his observations on the old farm where he was born and reared. In 1874 he published in the *American Naturalist* two botanical papers, and the next year he published, also in the *American Naturalist,* his first contribution to ichthyological literature, "The Sisco of Lake Tippecanoe." He described the sisco as a new species under the name of *Argyrosomus Sisco* Jordan. This was the first new species of fish ever described by Dr. Jordan. Since that year Dr. Jordan collected fishes in many waters in many parts of the world, and he described and named nearly a thousand new species and about five hundred new genera of fishes. For more than twenty years he was the most active ichthyologist in the world, and for more than thirty years he was the most distinguished student of fishes in the world.

In his study of fishes Dr. Jordan was interested in finding out what different kinds or species are found in different waters, and the relationship between those of one stream to those of other streams. To interpret the problems of geographic distribution it is necessary to know the species involved; hence careful comparison, study of differences and resemblances, is necessary; in short, to understand the origin of species it is necessary to know what the species are. Dr. Jordan did not limit his study of species of fishes to an examination of research collections; he was one of the keenest, most observing of field naturalists; he "knew fishes when he met them in their native waters" and was interested in their ecological relations.

A complete bibliography of Dr. Jordan's papers and books on fishes is not at hand, but it contains more than 450 titles. These contributions varied in size from a few pages to one of 3,528 pages and 392 plates.

Dr. Jordan once said: "I have lived three more or less independent lives: first, and for the love of it, that of naturalist and explorer; second, also for the love of it, that of teacher; and third, from a sense of duty, that of minor prophet of Democracy." And he adds that "if he had his days to live over, he would again choose all of the three." And each of these lives, filled with life's enthusiasms and faith in the final triumph of truth and righteousness in the world, he lived joyously.

For David Starr Jordan was a man who enjoyed life and who gloried in the opportunities that came to him to use his tremendous mental and physical strength for the good of his fellow man. His power of memory was astounding, his knowledge profound. He was an inspiring teacher, kind, sympathetic, utterly unselfish, and always ready to give encouragement to any student who seemed to need it.

Dr. Jordan was very unassuming and of marked simplicity; to his intimate associates, he seemed always a big brother, a big overgrown boy, big in body and in mind, but, withal, a boy. We were not always sure whether to take him seriously. I rarely or never saw him "lose his head," or become openly angry. In spite of frequent display of wit and humor, he was always dignified and in a big way; we never "slapped him on the back," nor called him by his first name. His humorous and witty expressions and his pithy aphorisms were wonderfully helpful in his teaching. On one occasion a bright but convivial young man applied for a certain position with which Dr. Jordan was concerned. Dr. Jordan, in telling us about it, said: "The job is too big for a boozer. We can't run our plant on cocktail power and cigarette smoke."

I can do no better than to close this notice with the felicitous words written by President Herbert Hoover as the dedication to David Starr Jordan of "The Stanford Quad" for the collegiate year 1929–30:

> First president of our beloved university, creator of its oldest traditions, scientist of unquenchable thirst for truth and of unalterable integrity in its search, teacher of sympathy and imagination, friend of youth, wise counselor, believer in the inviolable sanctity and worth of the individual human soul, exemplar of the moral virtues, inspirer to the spiritual life, apostle and prophet of peace, this book is dedicated with veneration, devotion, and affection.

BARTON WARREN EVERMANN

MEMORIALS

THE suggestion has been made that a statue of the late Dr. Stephen Moulton Babcock be erected in recognition of his generosity in giving his test for butter fat in milk to the public as well as of the many other contributions to dairy science which he made. It is felt that a fund of approximately $30,000 should be raised to insure a statue and setting worthy of the purpose and the donors. The Babcock statue fund will serve as a token of appreciation from those of his generation who contribute to it and as an incentive