most always surpass the males in longevity and general health improvement. It is to be hoped that someone can offer an explanation of this retrogression.

The apparent sudden break in the differences in death rates at age 70 for this decade is a little disconcerting and is probably due to inaccuracy in the statistical data. When, however, we consider that the death rates given above are computed practically independent of each other it is more surprising perhaps that more "breaks" are not encountered.

The record of the males is also very unusual. Although the death rates decreased at ages 40 and below and increased at higher ages in the decade from 1900 to 1910, as was found in the earlier investigation, the death rates for the decade from 1910 to 1920 not only decreased at every age but decreased the most by far at the very ages at which there has always been a retrogression before; moreover, the decrease is much greater at those ages than in the case of the females. The improvement is so great at the advanced ages that the writer investigated the mortality statistics of 1919 and found them in substantial agreement. It should be stated parenthetically that since the population statistics are collected but once in a decade the mortality tables could be constructed only for the years considered without the employment of an undesirable scheme of interpolation for the population statistics.

The table of expectations of life is as follows:

EXPECTATIONS OF LIFE

AGES	1900	DIFF.	1910	DIFF.	1920
		FEMALES			
10	50.8	+1.9	52.7	+ .2	52.9
20	43.0	+1.5	44.5	+ .1	44.6
30	35.7	+ .8	36.5	+ .4	36.9
40	28.6	+ .3	28.9	+ .4	29.3
50	21.5	0	21.5	+ .3	21.8
60	15.0	— .2	14.8	+ .1	14.9
70	9.6	— .2	9.4	+ .1	9.5
80	5.6	— .1	5.5	0	5.5
		MALES			
10	49.7	+ .7	50.4	+1.9	52.3
20	41.8	+ .4	42.2	+1.8	44.0
30	34.5	— .1	34.4	+1.7	36.1
40	27.5	— .5	27.0	+1.4	28.4
50	20.6	— .5	20.1	+ .9	21.0
60	14.2	— .3	13.9	+ .4	14.3
70	9.0	— .1	8.9	+ .1	9.0
80	5.2	0	5.2	0	5.2

The values of the expectations of life afford little further information and serve mainly to show the total effect of changes in death rates at certain ages upon the prospect of earlier ages. Thus, although both sexes show an increase in the expectation of life at earlier ages and a decrease at the advanced ages with the females far in the advance as to general improvement in the decade from 1900 to 1910 the order in improvement is completely changed in the decade from 1910 to 1920. The males increase their expectation of life by almost two years at age 10 and since the expectation of life is approximately the same in all mortality tables at the age of birth and age 10 we have here a good estimate in the increase in the whole span of life. The increase in the expectation of life at the successive ages is also very substantial. In the case of the females there is an increase in the expectation of life at all ages but the increase is almost negligible. It is important, however, that there is no period of retrogression at all and it is evident that the increase would have been really significant if it had not been for the unexpected and unusual retrogression in death rates in the neighborhood of ages 20 and 30.

The writer gladly passes on to others the problem of explaining the great improvement at the advanced ages for both males and females or the "set back" at the earlier ages of the females in the last decade. Some claim that an unusually large number of the physically unfit (tubercular, etc.) was eliminated during the period of the war and this might well explain the improvement at the advanced ages. It would be interesting to know how much credit is due to agencies—like the Life Extension Institute, the Y. M. C. A., etc.—which are definitely devoted to the task of improving the health of the mature individual. Some will give much credit to prohibition and there may be considerable justification but it should be recalled in that connection that the last amendment did not go into anything like complete effect until some time after the first of the year (1920) whose mortality statistics form the basis of the results we are just considering.

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THE OKLAHOMA-TEXAS BOUNDARY SUIT

THE Oklahoma-Texas boundary suit, in which a decision has recently been rendered by the Supreme Court of the United States, was of more than ordinary interest by reason of the large property values involved, the considerable

cost of the litigation, and the extent to which scientific investigations were utilized. The value of the property, particularly the small part of it known to be oil bearing, can be estimated only in millions of dollars. The testimony in this case as submitted to the Supreme Court, exclusive of the attorney's briefs and arguments, amounted to more than five thousand printed pages. This testimony was accompanied by about five hundred photographs and more than one hundred original maps and charts, prepared especially for this case. The cost of printing the testimony exclusive of maps and engravings was in excess of twenty-five thousand dollars. The total cost of the suit to the litigants probably exceeded one half million dollars.

In its historic setting, this case dates back to a treaty made between this country and Spain, in 1821, approximately one hundred years ago, which was intended to define the boundary line between the United States and the Spanish possessions. The boundary established by this treaty, reaffirmed by succeeding governments, ultimately became the boundary on the Red River between the States of Oklahoma and Texas. The exact place of this boundary line on the river having been called into question, suit was brought in 1919 by the State of Oklahoma against Texas to which the United States became intervener. The evidence presented consists of scientific and lay testimony. Geologic and ecologic investigations for the United States and Oklahoma were made by L. C. Glenn, Isaiah Bowman, H. C. Cowles and L. L. Janes, and for the State of Texas by E. H. Sellards, R. T. Hill and B. C. Tharp. The topographic surveys and maps incident and necessary to these investigations were made for Texas under direction of Arthur A. Stiles, state reclamation engineer, and for the United States under direction of Robert Livingston. After testimony as to soil conditions had been presented by Texas, certain members of the United States Bureau of soils were called into the case by the United States, including H. H. Bennett and others. Chemical analyses incidental to Texas investigations were made under the direction of E. P. Schoch. In all a total of twenty-eight men appeared in this suit as expert and scientific witnesses.[1]

A previous decision of the Supreme Court rendered in 1921, following an earlier decision made in 1896, placed the boundary between Texas and Oklahoma as on the south bank of the river. However, it remained to be determined what constituted the south bank of the river, where on that bank the boundary line should be drawn, and in what way, and to what extent the river had changed its course in the one hundred years since the treaty was made.

Much of the scientific testimony was concerned with the habits of the river, particularly in building its valley lands. Witnesses for the United States and Oklahoma concluded from their investigations that the valley land in the upper part of the river with a few exceptions was not in existence in its present form one hundred years ago when this treaty was made. It was also held by these scientists that the method of building this valley land in the upper Red River is by a process called "island building" and not by the more common processes known on other rivers. According to this theory the valley land is built up through the formation of a succession of islands, followed by the abrupt transfer of the water of the river around such islands, this process being described by them as avulsion. The reworking and rebuilding of the valley lands by this method is assumed by these scientists or some of them to have progressed at such rate as to have completely reworked and rebuilt all valleys in the upper reaches of the river, with few exceptions, within the past one hundred years.

The force of these contentions will be appreciated when it is remembered that it is a well established principle of law recognized by both parties to this suit that when a river forming a boundary line changes its course by the usual process known as erosion and accretion, that is, by the more or less gradual washing of the banks at one place and the deposi-

[1]The evidence in full in this case appears in the records of the Supreme Court of the United States, No. 23 original, 1920, and No. 20 original, October, 1921, Volumes I to IX, 5,513 pages.

tion of the washed material at another, the boundary line continues to follow the river and changes with it. On the other hand when a river owing to either natural or artificial causes abruptly leaves its channel and makes for itself a new channel the intervening land between the old and new channel remaining undisturbed, as in the case of ox-bow cut-offs, a change known as avulsion, the boundary line in such instances does not go with the river to its new channel but continues to follow the former channel. The theories advanced, if sustained, would have resulted in placing the state boundary line at or near the foot of the Texas bluff, thus throwing practically all of the river valley land of the upper part of the river into the State of Oklahoma. That is, under this interpretation Texas constantly loses by the shifting of the river, but never gains by deposition of sediments, the rate of loss progressing with such rapidity that practically the whole of the valley land in the upper stretches of this river has been lost to Texas within an interval of one century.

The investigations centered on, but were not confined to one particular valley in Wichita County known locally as the Big Bend into which the oil fields extend. Scientists representing the United States and Oklahoma maintained that one hundred years ago when this treaty was made, this valley, or such parts of it as may then have been in existence, was separated from the mainland by a channel of the river flowing at or near the Texas bluff. Trees in this valley in excess of one hundred years of age were said by the ecologists representing the United States to have had their inception on islands. These contentions, if sustained, would have placed this, as well as other Texas valleys, in the State of Oklahoma.

The State of Texas on the other hand maintained that neither the Red River channel, nor the sand stretch which borders the channel, nor any part of the channel or sand stretch lay adjacent to the Texas bluff in the Big Bend Area so recently as within the past one hundred years. With regard to changes in the course of the river, it was contended that in this river, as in other rivers, the change throughout the entire course of the river occurs in some instances by erosion and accretion and in some instances by avulsion, and that normally in this river where the land is being built up, as has been done in the past ages in the Big Bend Area, the change of the course of the river is by erosion and accretion. The larger valleys are regarded as in general exceeding one hundred years in age, at least in their older lands. Around the original nucleus of the valleys, in most instances, newer lands have been added from time to time, the controlling building process being by accretion. Ecologic studies indicate that the older portions of the Big Bend and other larger valleys have reached the climax stage of plant development, in this respect agreeing with the adjacent terraces and uplands. Under this interpretation the valley lands on the south side of the river belong wholly to the State of Texas throughout the entire course of the river where it forms the boundary.

The evidence presented in this suit may be classed as: (1) Physiographic, including discussion of the physical features of the valleys, such as sand dunes, their age and habits of building and shifting, sand bars, back valley streams, marginal fans, old stream channels and inter-dune depressions; (2) geologic, including discussion of sedimentation of river valleys in general, and such evidence as was available from fossils, particularly the more or less well mineralized bones of the buffalo and other animals formerly living in the valleys; (3) agrogeologic, including thickness, method of accumulation, age indications, alteration and succession of soils; and (4) ecologic, including relation of the vegetation of the valleys to that of the upland, as well as the age indication of the timber, shrubs and herbaceous vegetation of the valleys.

By the decision of the Supreme Court, now rendered, Texas retains the valley land up to the margin of the sand bed of the river, throughout the entire territory under controversy. In addition to the valley lands, counsel for Texas maintained that rights inherent in the treaty gave Texas possession to the waters edge, thus in places crossing more or less of the sand stretch which borders the river channel. This last named contention was not sustained in the majority opinion of the court although it is sustained in the dissenting opinion of Justice Mc. Reynolds.

The conclusions of the judges of the Supreme

Court based on the evidence relating to the age of the valley and the methods of building the valley land is indicated in the following extracts from the decision rendered.

EXTRACTS FROM THE DECISION OF THE SUPREME COURT OF THE UNITED STATES IN THE CASE OF OKLAHOMA VS. TEXAS, UNITED STATES INTERVENER. PP. 12-14.

Common experience suggests that there probably have been changes in this stretch of the Red River since 1821, but they cannot be merely conjectured. The party asserting material changes should carry the burden of proving them, whether they be recent or old. Some changes are shown here and conceded. Others are asserted on one side and denied on the other. A controverted one is ascribed to the so-called Big Bend Area, which is within the oil field. That area is now on the south side of the river and connected with the bluffs on that side. Oklahoma and the United States assert that in 1821 a channel of the river ran between it and the bluffs and that the river has since abandoned that channel. Texas denies this and insists that the situation in 1821 was practically as now. . . . It (the testimony of the experts) is so voluminous that it does not admit of extended statement or discussion here. We can only refer to important features and give our conclusions.

It (the Big Bend) is larger now than sixty years ago, but how much is uncertain. The enlargement is the result of intervening accretions. The habit of the river is to erode the outer bank of a bend and to accrete to the opposite bank. . . . On the outer part are physical evidences of the formation being comparatively recent. On the inner part are like evidences of the formation being old, among them being the presence of living trees more than a century old. One of the trees, a pecan, attained an age of 170 years. . . . To overcome the inference arising from the presence of the old trees, which were well scattered, testimony was presented to show that in 1821 these trees were all on islands, which afterwards were consolidated amongst themselves and with the land on the south side. We think this testimony is essentially speculative and not a proper basis for judgment. In this area, as elsewhere in the valley, a succession of depressions is found at the foot of the bluffs, and some testimony was produced to show that in 1821 the river, or a part of it, flowed there. It may be that the river was there long ago, but the testimony that it was there in 1821 is far from convincing. . . . Our conclusion is that the claim that the river, or any part of it, ran south of this area in 1821 is not sustained. So the boundary follows the cut bank around the northerly limit of the area.

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CHAUNCEY WILLIAM WAGGONER[1]

IT is fitting that the faculty of West Virginia University in general session assembled should pay appropriate tribute to the memory of Chauncey William Waggoner, head of the department of physics in the university, whose life and work have been so abruptly and tragically ended.

Professor Waggoner had leave of absence from the university for a year and was engaged in following up certain scientific investigations in the interest of a large industrial corporation. In pursuit of this work he was visiting Shreveport, Louisiana, where he met with the unfortunate accident that caused his death. He was thrown from a horse on October 24 and died on October 26.

Chauncey William Waggoner was born at Rock Bridge, Ohio, February 23, 1881. He was graduated from Ohio University at Athens, Ohio, with the degree of B. S., in 1904, and from Cornell University with the degree of A. M. in 1905. For five years he was student and instructor in Cornell University. He specialized in physics and won his doctorate in 1909. In the same year he was chosen professor of physics and head of the department of physics in West Virginia University and took up his work at once.

The thirteen years that followed were years of unusual growth and expansion in the university, especially in the departments of science, and Professor Waggoner, in sympathy with this development, reorganized the department of physics adequately to meet the growing demands upon it. He was always anxious that his department should be well equipped and able to do efficient work, and that the standards of science teaching and scientific research in the university should be uniformly high. Toward these ideals he worked with splendid enthusiasm.

[1] Resolutions adopted by the Faculty of West Virginia University.